Exhibit 1
Report and Declaration of Andrew Afflerbach For the Smart Communities Siting Coalition

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C.

STREAMLINING DEPLOYMENT OF SMALL CELL INFRASTRUCTURE BY IMPROVING WIRELESS FACILITIES SITING POLICIES; MOBILITIE, LLC PETITION FOR DECLARATORY RULING	))))))))	WT Docket No. 16-421

REPORT AND DECLARATION OF ANDREW AFFLERBACH
FOR THE SMART COMMUNITIES SITING COALITION

Contents

1. Summary

This document describes small cell and DAS wireless deployments, discusses local permitting and oversight process, and suggests strategies to maximize public-private collaboration to facilitate mobile wireless construction. As I explain below, "small cell" refers to the wireless antennas' coverage areas, not the size of the antennas themselves; because of the large scale of some small cell deployments, the installed equipment may approach the scale of typical macrocells.

The observations in this report are based on my experience over two decades of observing and overseeing build-out of communications infrastructure across the United States and abroad.[1]

Accommodating permitting and other local government requirements in public rights-of-way is typically a relatively small part of the cost and time required for design and construction of outside plant for a communications network. In my experience, the fees charged by local governments in connection with broadband represent a small portion of the cost of wireless network deployment, and the process entailed in local oversight of wireless facilities siting represents a very modest portion of the process and timeline of building or upgrading a wireless network, assuming that the wireless company participates in the process.

Local permitting processes and fees have little impact on the decision to deploy broadband in urban versus rural areas. In fact, the permitting process and local government coordination can help and facilitate deployment. When it is done effectively, it protects the integrity of existing infrastructure and public safety, and provides certainty and predictability to wireless carriers and wireless infrastructure companies.

In my experience, the optimal way to facilitate and smooth the wireless siting process is for wireless companies to work with localities by filing complete, accurate, timely siting applications—and by collaborating with the localities in an efficient, mutually-beneficial process of pre-planning, specification development, and reasonable staging of the deployment.

Localities are highly motivated to facilitate and incentivize broadband build-out, and are willing to use permitting and other processes to enable and smooth the deployment process as much as possible. Numerous localities are currently involved in creative efforts to understand private sector needs and to develop ways to work collaboratively. The next generation of wireless broadband deployment can best be achieved if wireless companies undertake a similarly collaborative, constructive engagement with localities.

[1] CTC provides technology engineering and business planning consulting services for public sector and non-profit clients nationwide and abroad. Since 1983, CTC has assisted hundreds of public and non-profit entities to analyze technology needs and strategies; plan and design wired and wireless broadband networks; and work with the private sector to meet local broadband and technology needs.

2. Small cell and DAS facilities in the PROW are neither small nor insignificant in impact

The term "small cell" is used loosely within the industry to refer to a wide variety of installations that are designed to serve a smaller area than traditional "macrocells." A search of literature suggests that there is no agreed-upon definition that could easily distinguish "small cells" from "macrocells" other than that loose distinction. For purposes of this report, we will treat any radio unit designed to serve a relatively small area as a "small cell" or "small cell and DAS" regardless of its technical configuration. What is critical to this proceeding is that the classification of something as a "small cell" does not mean that the impacts and complexities associated with its installation and maintenance are small.

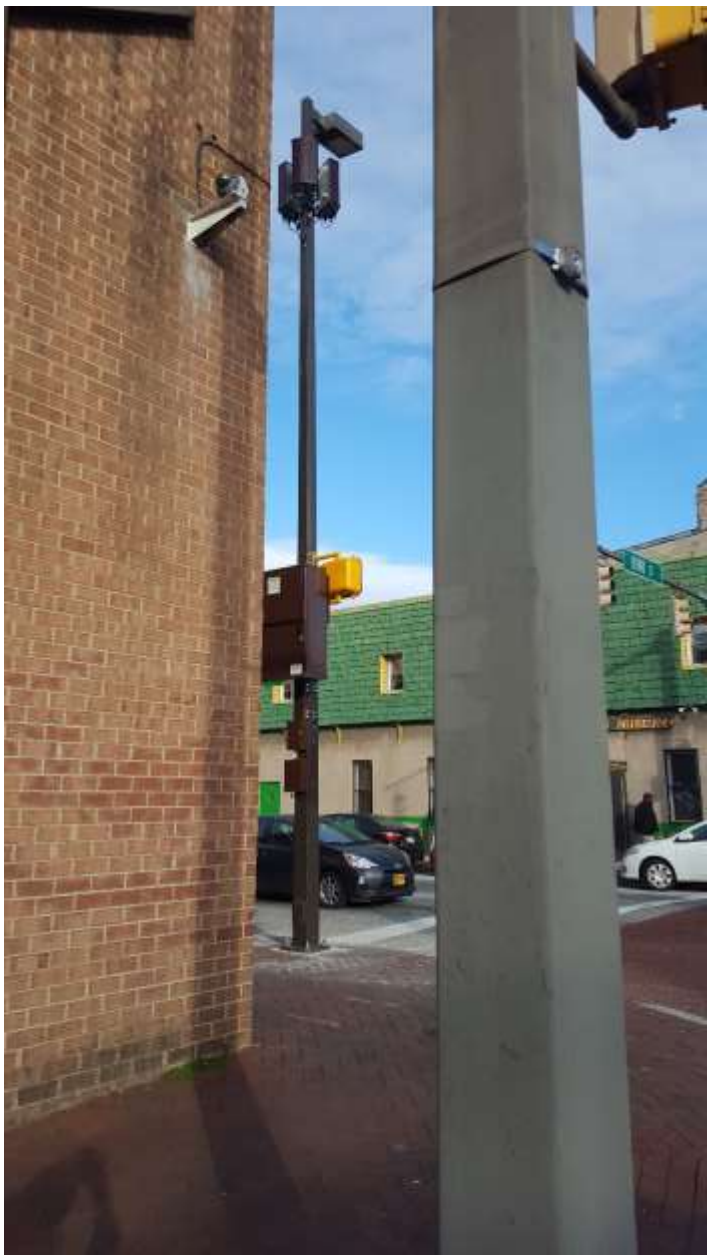
"Small" cell facilities can have significant profiles, including many components additive to the "small" cell antenna.

Over the past decade, service providers have begun to augment tall tower deployment with neighborhood wireless transmission facilities—such as DAS and small cells—that have smaller coverage footprints. In the new distributed wireless architecture, broadband users communicate with localized access points, typically mounted at elevations of 20 to 30 feet above ground level. These neighborhood access sites target service areas with a radius of 250 to 300 feet from the access site.

Small cell technologies vary in size and profile, depending on the functionality they are designed to provide.

A smaller antenna may be used to enhance mobile data capacity in an area that is already mostly served by a macrocell. At the small end is a system for a single band, using fiber optic connectivity to connect to the network. In this case the system might comprise a set of three panel antennas, each approximately 2 foot by 1 foot, attached 20 feet high on an existing light pole.

Figure 1 – Smaller Small Cell Pole with Fiber Optic Backhaul Connectivity



It would be accompanied by an electronics and power cabinet approximately 4 foot by 3 foot mounted between 8 and 12 feet off the ground, and by a power meter and load center five feet off the ground and by electric conduit up the entire length of the pole.

Because of the weight and wind loading of all the new attachments, existing light poles might not support them, and therefore placement of the small cell infrastructure often requires replacing the pole.

A larger system may be proposed in some cases. One reason may be that, instead of augmenting an existing macrocell network, a cluster of small cells or a multifrequency distributed antenna system (DAS) is being used in lieu of the macrocell, potentially because the terrain or aesthetics do not allow for a macrocell nearby. In this case, a provider will want a larger system that carries more spectrum bands. In a larger system that is being deployed instead of a macrocell, there may be a separate building, comparable to the hub building of a macro cell site (typically 25 feet by 50 feet), that manages and operates the cluster of DAS or small cell antennas. The system may require replacement of existing light or utility poles with taller ones, to enable the antennas to be mounted between 40 and 60 feet high. Antennas may be a combination of 2 foot by 1 foot panel antennas and 5 feet long whip antennas. Each pole may require multiple cabinets for the electronics, each approximately 3 foot by 2 feet. The cabinets may fill the entire area at the lower part of the pole. There is also significant cabling.

Figure 2 – Multifrequency DAS Structure with Multiple DAS Antennas

Figure 3– Multifrequency DAS Structure with Multiple DAS Antennas

Figure 4 – Base of DAS Installation With Multiple Cabinets for Radios, Backhaul, and Power

In addition to the physical components shown in these pictures, many "small cell" installations require a wireline connection to a central hub, and may also involve back-up power supplies, which may often be placed in ground cabinets of fairly significant size.

2.1 Some "small" cell facilities approach "macro" site facilities and electric transmission monopoles in size and weight

Because of the large scale of some "small" cell deployments, the deployments may approach the scale of typical macrocells.

In some small cell deployments, the technology does not use fiber or wired infrastructure to connect to the network. The network connectivity, known as "backhaul," is done wirelessly. In order for backhaul to work effectively using a wireless approach, there needs to be a strong signal between the small cell devices and one or more master backhaul antennas. Some providers are accomplishing this by making the master backhaul antenna especially tall, potentially 70 to 120 feet, which exceeds the height of many macrocells. Mobilitie is one company that uses this architecture and has filed many applications for poles of great height.

The figures below provide examples of exceptionally tall "small" cell deployments in the rights-of-way, including one with the radios placed above high voltage transmission lines. The only visual difference from a macro cell monopole, which is frequently of this height and placement, is the relatively skinnier antenna profile at the top.

Figure 5 – Small Cell Comparable in Height to Macrocell

Figure 6—Small Cell at Height of High Voltage Transmission Lines

2.2 Alternative technologies have smaller form factors

The photographs above reflect the equipment required for particular deployments by particular providers of wireless services or facilities used in the provision of wireless services. The facilities are primarily designed to make more efficient use of commercial cellular wireless spectrum and are designed to provide those services to commercial wireless users. There are, however, design alternatives that could serve the same ends, without the large form factors shown on some of the photographs. That is, to some degree, many of the same functions could be performed using different and potentially less intrusive technologies.

There are also other wireless technologies under development and deployment that have a smaller form factor and lighter equipment. For example, wireless equipment using very high frequencies in the submillimeter spectrum, also known as mmWave, is envisioned as part of the emerging 5G architecture. mmWave equipment typically uses spectrum above 10 GHz and uses much larger channels than the commercial wireless providers. This provides potentially much higher speeds. Examples of mmWave equipment are shown in the figures below. The white devices are mmWave equipment, and these provide intermediate connectivity to the Wi-Fi equipment (black panel antennas). The devices are relatively small, some measuring 12 by 6 inches and weighing a few pounds.

While mmWave equipment is not a full replacement for commercial cellular technology,[2] it may provide an alternative solution for parts of the cellular architecture, such as the backhaul network connection, and indicates that future generations of wireless equipment might not be as large and heavy as the current generation of small cells. For example, if it operates as a backhaul technology that connects a network to cellular or Wi-Fi equipment on a pole, it can be a lighter-weight and smaller profile alternative to the types of backhaul technologies that require 90- to 120-foot poles.

[2] mmWave does not support mobile use in its current form. It requires line of sight or near line of sight connections, mmWave user equipment is not yet mass produced at low prices. However, it can be part of a comprehensive wireless solution that does support mobile use.

Figure 7 – mmWave Antennas Providing Backhaul for Wi-Fi Network

Photo courtesy of Siklu Communications

Figure 8 – mmWave Antennas Providing Backhaul for Wi-Fi Network

Photo courtesy of Siklu Communications

Cable operators are also deploying Wi-Fi equipment in the rights-of-way, leveraging their cable attachments on utility poles and devices installed on customer premises. Like the mmWave equipment, the Wi-Fi equipment is smaller and lighter than the cellular small cells. It is powered through the cable system and does not require additional cabinets on the poles. Wi-Fi and future generations of unlicensed technology may be deployed on utility poles and customer premises and may also provide an alternate technology solution for the densification challenge that are currently being addressed by the small cells.

The sorts of deployments proposed by companies like Mobilitie are thus not necessarily critical to ubiquitous broadband, and local efforts to minimize impacts can be entirely consistent with rapid and efficient wireline and wireless deployment.

Figure 9 – Wi-Fi Antenna on Cable TV Attachment

3 Local review protects public safety and critical infrastructure

The recent round of wireless applications, including for the types of tall poles described above in residential neighborhoods, historic districts, or in areas where citizens have spent significant resources on redevelopment, has drawn the attention of the public itself—with large turnouts in public meetings, organized movements, and media stories. As a result, the review processes become more time consuming, but not without good reason. In fact, the review of applications for placement of small cells in the rights-of-way may be far more complex than the review of an application for placement on private land, a rooftop, or the side of a building.

A typical community reviewing an application for use of the rights-of-way considers:

- Effect on public safety communications
- Effect on public safety, including potential impact on pedestrians and vehicles; the likelihood that the object will be hit; and the possibility it will contribute to an accident, for example by blocking a view
- Effect on other public infrastructure, including, for example, storm water systems

- Effect on residents, neighbors, business owners, and customers
- Effect on ADA compliance and on members of the community with disabilities
- Congestion on sidewalk or roadway
- Aesthetics, including the compatibility with the surroundings, blockage of view
- Setback, including the risk of damage or injury if the object falls

These reviews, and the ongoing use of the wireless infrastructure are complicated by the fact that rights-of-way are constantly changing. Aboveground facilities may be moved underground pursuant to a development plan or in response to hazards created by the placement of structures. Sidewalks and roadways may need to be widened, or hazard-free-paths created for pedestrians or cyclists. The addition of occupants to the rights-of-way necessarily complicates the process of coordinating right-of-way uses.

3.1 Local review protects against interference with public safety communications

Applications that are in proximity to public safety communications antennas or collocated on the public safety antenna sites require extra scrutiny for interference. Usually this due diligence is performed by the applicant as a condition of use of those structures, but it requires additional review by the public safety communications staff. The siting review process is a way of ensuring that applications that may pose risk to public safety communications come to the attention of the public safety communication staff, and that the applicant has demonstrated it will not interfere.

3.2 Local review protects public safety and utility worker safety

A well-organized siting review process can systematically evaluate the risks to public safety and utility worker safety. By requiring a complete application, the process requires the applicant to do its homework and conduct all engineering and design in advance, and perform all the necessary evaluation of compliance with local code, land use and transportation corridor rules.

In the review process, a community can identify the clearances between the structure and the road and buildings. It can verify the RF emission and its compliance with FCC rules regarding emissions and signage. It can verify the placement of power meters and power shutoff. It can verify that structural engineering has been performed. It can verify that soil studies and drainage studies have been properly performed, both of which are critically important for structures on the scale of the new poles, especially the tallest, which are nearly four feet in diameter at the base. It can verify that the applicant has coordinated with the existing utilities. It can verify that landowners and community groups will be notified and where appropriate, provide their consent.

Cabinets at ground level or on poles can block traffic or obstruct views. The review process can verify if the placement will have an impact on traffic or the view in a way that can impact public safety or increase the likelihood of accidents. It can verify compliance with safety clear zones. It can verify compliance with DOT rules that allocate different spaces in the rights-of-way to different uses, or ensure that the DOT has an opportunity to perform the review.

3.3 Local review protects critical public infrastructure

One of the main purposes of the rights-of-way is the storm drainage from the road. The review process can verify that the design is in compliance with rules on drainage. Similarly, the review can verify that the design for the structure will not create problems for snow removal.

Placement cannot interfere with potential road widenings. A new structure needs to be placed so as not to interfere with known or potential road widenings, and there needs to be a procedure in place if road widening needs to happen—such as one in which the applicant moves or dismantles the structure.

3.4 Local review allows consideration of impact on ADA compliance

Communities are making large investments in ADA compliance in the rights-of-way. Examples include the placement of ramps at intersections, audio at crossing lights, and sufficient space on sidewalks for wheelchairs. A review process can ensure that a proposed structure is compliant with community rules about the sidewalks and does not reverse these efforts or make them more difficult to implement. Not only the pole needs to be compliant, but cabinets need to be placed such that they do not obstruct. The process also needs to take into account future modifications that may take place on the poles. Since many of these may be done by right, the initial review needs to take into account sufficient margin to accommodate modifications without becoming a risk to people with disabilities.

3.5 Current FCC rules for "minor" modifications increase risk regarding issues such as public safety by creating technical incentives to deploy in inefficient ways

The importance of review of these areas related to safety, ADA compliance, and existing utilities is compounded by the FCC's existing rules that allow certain increases in size of facilities by right. Indeed, permissive rules for expansion of existing wireless facilities as currently applied to facilities in the rights-of-way actually create more problems than they resolve because they allow for small form factors to be replaced by large form factors.

As a result, a proposed installation that is acceptable as initially installed could create public safety challenges at a future date. And the potential for growth discourages more efficient designs and technology choices that can deliver the same coverage and functionality without the size and complications of Mobilitie-type deployments.

In these ways, the FCC's current modification rules are incenting design inefficiency by the companies and are greatly complicating the local review process.

4 Small cell infrastructure may not enable 5G and IoT deployment

There is no 5G standard—at the moment, 5G is envisioned as a means to providing the next generations of mobile broadband applications, especially low-latency communications for machine-to-machine communications and the Internet of Things (IoT).[3] Researchers and industry experts differ on the extent to which this future will be an evolution of LTE and licensed frequencies, the use of mmWave technologies, and the use of unlicensed technologies using small radios at short range—or the degree to which 5G will be ubiquitous or simply for high-traffic corridors and specific applications. And there is no way of knowing, at this point, whether traditional licensed frequencies provide the best option for IoT or whether the IoT is more likely to depend on low-powered unlicensed wireless networks that can use networks of small sensors connected to a fiber backbone to provide real time information. And we do not know how the communications networks will function with are be integrated with wireless charging networks now being tested in the U.S. and elsewhere.

From an engineering standpoint, it may be that the things that companies like Mobilitie want now (large, 120-foot towers) do not provide the best model for the future, and that limited rights-of-way real estate is better dedicated to smaller profile, embedded devices that work in conjunction with fiber and larger wireless networks.

In other words, it is not necessary to clear the path for placement of small cells of any size and form for 5G or IoT – if anything, putting a thumb on the scale favoring Mobilitie's 120-foot deployments may simply interfere with creation of more efficient networks. The Commission's own struggles with LTE-U suggest why not every deployment is necessarily a deployment that will advance 5G or IoT.

5 It is more time-consuming to evaluate applications for facilities in the PROW than on private property

Given the potential impact on safety, the scarcity of space, and the competing needs for the rights-of-way, the review process in the rights-of-way needs to be very extensive. By contrast, on private property, the review process is more limited—does the structure fit into the surroundings, is it safe, have the right people been notified and approved? There is often no need to worry about traffic, drainage, ADA compliance, or existing utilities—or those issues may be more easily addressed.

[3] Wirelessly interconnecting electronic devices and machines over the internet.

5.1 Private property offers a workable alternative to rights-of-way for siting small cells and DAS

The public rights-of-way are not the only way "small cell" systems can be built. From a technical standpoint, the network can frequently be designed for similar coverage using private rather than public property. As an example, Mobilitie is requesting approval for a 75-foot structure in a crowded downtown area in suburban Washington, D.C. The proposed structure and its height are indicated by the red arrow. Near the proposed structure are several buildings where the rooftop and façade could be used. There are already macrocell antennas on two nearby rooftops, so clearly backhaul and power are readily available. Using those structures could eliminate the need for the new 75-foot structure. **The only advantage of using the rights-of-way is for Mobilitie to avoid paying rent to the building owners—but this "savings" comes at the expense of the public through the added risk, congestion, and disruption of placing a very large pole in a very busy sidewalk, very close to the road and buildings.**

Figure 10 – Site of Mobilitie Application for New 75-Foot Pole

6 Reducing local fees or processes will have marginal impact on rural broadband deployment

It is deeply misleading to suggest that "streamlining" processes for reviewing small cell deployments will lead to increased build-out in rural areas—because such processes and fees are limited or non-existent in those areas already, and the technology is not well-suited to rural areas.

6.1 Small cell and DAS are typically not deployed in rural areas because the technology is not suited to rural needs

Small cell technologies are best suited to add capacity to mobile wireless networks in areas that are congested and where demand for bandwidth outpaces supply, or where macro cell sites are not suitable for aesthetic or functional reasons.

Small cell networks are designed to maximize the use of spectrum by efficiently reusing the spectrum in many smaller coverage areas rather than across fewer, larger coverage areas (as macro cell sites do). That is, these networks are typically not being used to expand the area covered by existing macrocells; rather, they add capacity in existing coverage areas, or fill in spotty coverage gaps in very targeted areas within a carrier's current coverage area such as, for example, in valleys where the terrain blocks coverage from a macro cell.

For these reasons, these technologies are best suited for urban and suburban markets with high concentrations of users in relatively small areas, and for very limited deployment in high-value rural areas, such as alongside major roads in rugged terrain. They are not intended for most rural or low-density markets where density of users is lower and where fewer, larger macro sites are far more cost effective to deliver service than frequent micro sites.

The following photo illustrates a deployment of DAS in rural areas. This DAS is located alongside U.S. Route 6 in Clear Creek County, Colorado, where a macro site is not possible because of the terrain and the macro sites in the mountains above cannot provide coverage in the narrow canyon below.

Figure 11 – Distributed Antenna Installation on U.S. Route 6 in Clear Creek County, Colorado

6.2 Local process and charges have marginal impact on rural broadband deployment patterns

Based on my experience observing broadband investment patterns since the advent of the wireless and cable platforms in the late 1970s, nationally mandated changes to permitting fees, franchise or license fees, or fees for leasing public property or structures, or changes to local oversight of wireless siting are unlikely to change the return on investment calculus in a way that would result in advanced wireless services being deployed in rural or other underserved areas.

The fundamental dynamic of broadband investment is that network deployments and upgrades are capital-intensive—and capital flows to areas where projected returns are greatest because demand is most concentrated and per customer costs lowest. Shortening the Section 332(c)(7) review times, setting up a national regulatory system to review fees, or nationally regulating rents for use of public property would not change that fundamental dynamic. At best, national standards would mean industry costs would be reduced in rural and urban areas; such standards would not make it more likely that build-out would occur in those areas. In fact, it is my observation that carrier deployment investment decisions are made centrally and the companies' local representatives compete for investment allocations.

As a result, even where the economics of rural build-out could be marginally improved (through elimination or reduction of a cost of doing business), investment patterns do not change because the fundamental economics do not change. In decades of experience, we have never observed a build-out scenario where reduced marginal costs (such as local fees or public process) resulted in

funds that were allocated for build-out in more populous areas being diverted to a rural or underserved area.

Indeed, in most rural communities, local permitting processes and fees do not exist. It is in the most unserved and underserved rural areas where local fees and process are most minimal or non-existent, either because the locality does not see a need for them (for example, traffic control in these areas requires less coordination) or because as a matter of local or state policy, there exists little or no process or fee for permitting communications infrastructure.

In recent years, we have on numerous occasions worked with local government clients to approach carriers to request enhanced build-out and to inquire as to how the locality can facilitate and enable (or even subsidize) such build-out. But even where localities commit to eliminating regulation and fees, we have not seen carriers commit to new investment for which they did not otherwise have existing plans for a business case.

7 Localities exert themselves to attract and facilitate private investment in new or upgraded broadband facilities, including in wireless

Even though the effort does not always bear fruit, local governments are highly motivated to facilitate broadband deployment and attract broadband investment, both in wireline and wireless service. Over the past decade, we have observed countless communities seeking to build processes and incentives for private investment in broadband, and to simultaneously facilitate and smooth the way for private deployers.

We have observed this dynamic in both the wired and wireless areas. With regard to wireline broadband, for example, more than 1,100 cities and counties filed initial requests in response to Google's call to communities to compete for new broadband investment—and Google has been inundated by request and proposals from hundreds more communities in the years since. And those communities that Google Fiber selected for potential deployment undertook multi-year efforts to organize, streamline, facilitate, and enable Google's deployments,[4] even without any assurance that Google would eventually commit to building in their city.

Those and other cities also undertook similar efforts to recruit other companies, both incumbents (particularly AT&T and CenturyLink, who also availed themselves of public facilitation in response to the Google Fiber competitive threat[5]) and competitors (including a new class of smaller

[4] Derek Slater, Google Fiber Blog, "Behind the scenes with Google Fiber: Working with city governments," October 7, 2013, https://fiber.googleblog.com/2013/10/behind-scenes-with-google-fiber-working.html.

[5] In the research triangle area of North Carolina, for example, AT&T was granted significant process concessions and reduced fees by a consortium of cities working with local universities to encourage and facilitate broadband

wireline and fixed wireless ISPs that have emerged in the past few years with capital to build new networks in select cities).[6]

In the wireless area, both metro-area and rural communities work to fulfill public demands for better mobile connectivity—sometimes to no avail if the wireless industry does not prioritize the unserved or underserved areas.

We have observed considerable public sector effort to understand and address private sector investment imperatives in mobile wireless, and numerous county and town efforts to recruit mobile companies to improve services in underserved areas. In some cases, public enticements to the industry will begin with meetings and requests but can extend as far as offers to contribute assets, pay for deployment, or subsidize operations.

Summit County, Colorado, for example, offers a good example of how communities seek to facilitate private deployment. The County last year released an RFI "to convey its interest in partnering with a motivated, high-caliber partner to make wireless broadband service available in three underserved areas of Summit County over privately or publicly-constructed infrastructure."[7] The County is working energetically to create opportunity and incentive for wireless carriers to deploy in these rural areas, and has offered access to public assets as well as the potential for public contributions of capital to support the private deployment.[8]

A national set of rules that effectively forces local and state resources to be expended to comply with those rules will at best handicap such efforts, in our view.

7.1 Delays in review of applications are frequently created by insufficient or inaccurate applications by carriers

In many cases, delays in processing requests for placement submitted to localities are caused by the applicant's submission of incomplete or unverified engineering information, and subsequent delays in responding to requests for additional information. In my company's experience, there exists a pattern with some applicants of consistently filing inaccurate or incomplete applications and then criticizing the locality for not approving these insufficient applications.

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investment. North Carolina Next Generation Network (NCNGN) Blog, "NCNGN Selects AT&T," April 8, 2014, https://ncngn.org/.

[6] In Holly Springs, NC, for example, the Town leased fiber, streamlined permitting, and facilitated entry and construction by competitor Ting Internet. Ting Internet Blog, "Interview with Jeff Wilson, IT Director of Holly Springs" January 26, 2017, https://ting.com/blog/internet/hollysprings/interview-jeff-wilson-director-holly-springs/.

[7] Request for Information for Partnership for Deployment of Wireless Broadband to Three Underserved Areas in Summit County, November 21, 2016, http://www.co.summit.co.us/DocumentCenter/View/16781?bidId=169.

[8] Ibid., page 13.

For all of the public safety, public infrastructure, and ADA compliance reasons described above, localities cannot approve erroneous or incomplete applications – nor would they want to create incentive for the applicants to continue filing insufficient applications.

In contrast, many companies consistently file adequate, complete, professionally prepared documents, which enables expeditious review and resolution of the applications—to the benefit of both public and private sectors.

Challenges can also be created by filing of hundreds of permits at one time, or an unwillingness of carriers to work with the locality to stage applications and mutually determine a schedule that works for both parties. In contrast, if the applicants work with the city or county to plan to stage the filing of permit applications rather than filing hundreds at one time, the processing burden on the locality is spread over a reasonable period of time. In my experience, localities are very willing to work with deployers to establish timetables and processes for reasonable submission—and reasonable review—of permit applications. In a cooperative process, the parties can define a logical construction area for which all necessary applications can be submitted, and a timetable for review that balances applicant needs and competing demands on the locality's staff. In some cases, to accommodate bulk review, the locality must hire additional or outside staff, and the applicant agrees to pay those additional costs. What works depends on the community and on the project.

It is worth emphasizing that submission of applications in bulk does not necessarily reduce the time required to review applications. A bulk submission does allow a locality to understand the overall impacts and design of a network, and that is helpful in understanding the goals of the applicant, and in considering alternatives. However, many elements of a review, discussed above, are site-specific, and the time required may depend on the resources required. In our view, attempting to regulate what is now a cooperative process would not be helpful. In our experience, bulk applications, if only because they do require coordination across many sites, require more time to review than individual applications, particularly individual applications for use of private land. However, in our experience localities have been able to address the bulk review process within the parameters of the FCC's Section 332(c)(7) shot clock through agreements with the operator.

8 The optimal way to enable broadband deployment is to encourage local public-private collaboration

In my experience, the most successful and speediest broadband deployments are those in which public and private entities work collaboratively and willingly.[9]

This collaborative local process is not only a successful strategy for enabling private investment, but is also an efficient means by which to ensure that communications networks are built in efficient, thoughtful ways through comprehensive planning.

Network deployment is likely to be fastest and most efficient if the private deployer will work with the public sector to plan adequately and comprehensively for design, permitting, and staging of construction—and if all private entities will collaborate with each other and the public sector to plan ahead in ways that will make construction more efficient for all.

8.1 Collaborative process facilitates and speeds deployment, while minimizing conflict, both in wireless and wireline

Comprehensive development planning, with frequent collaboration and input from both public and private sectors in the pre-construction phase allow private providers and localities to understand and coordinate each other's plans and timelines. For example, this kind of cooperative planning enables a willing provider to stage permit and inspection requests rather than filing for an overwhelming number of permits at one time. It also allows the provider to strategically plan where it will deploy infrastructure.

An additional benefit of this approach is transparency: both parties are incented to share information to maximize the pre-construction planning and minimize likely points of conflict. Indeed, the need for transparency and communication is mutual: much as the locality should be open about its processes, the private deployer should do the same and should plan and stage its construction to maximize cooperation with the locality.

For example, a comprehensive process was undertaken in 2014 between the City of San Antonio and Verizon Wireless to support Verizon's small cell efforts. Through a collaborative process between the two parties that addressed a city-wide plan and accommodations for historic sites, San Antonio and Verizon Wireless agreed on a master license agreement for use of City rights-of-way for the installation of small cell equipment on utility and traffic light poles.[10] The process

[9] Speed of deployment, of course, also assumes that private sector processes such as make-ready on utility poles, proceed efficiently, and that private entities do not endeavor to slow down existing or potential competitors by obstructing such processes as make-ready. See, for example, Ibid.

[10] This agreement was adopted by the City Council by ordinance in June 2015. "Master License Agreement Between the City of San Antonio and San Antonio MTA, L.P. D/B/A Verizon Wireless for the Use of Public Rights-of-Way," June 2015, https://webapps.sanantonio.gov/filenetarchive/%7BCDFE105E-763B-4D83-BFC0-

enabled Verizon to plan ahead, with predictability and stability, for its small cell deployment, while simultaneously enabling the City to protect key public interests (such as public safety), critical historic sites (such as the Alamo and historic Missions), and the vibrant tourism economy that is based on those historic sites and the City's unique history.

8.2 Treating wireless deployment like a development plan encourages industry to work with localities and satisfy public concerns

Treating wireless deployment planning like development planning enables creation of a comprehensive infrastructure plan ahead of time so as to ensure adequate capacity and efficiency of construction—with reduced need for subsequent retrofits.

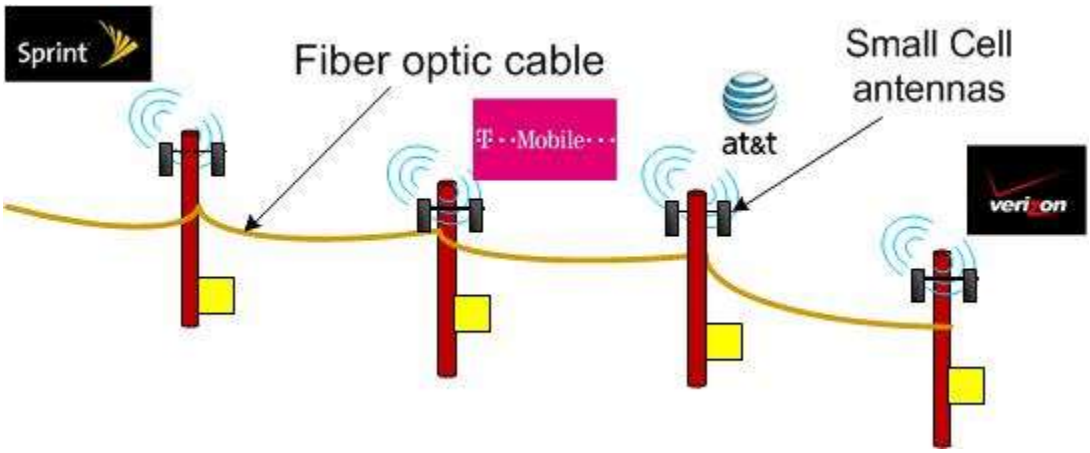
Broadband planning at the local level works best and most efficiently if it aligns with how communities plan for other forms of infrastructure: In new development areas, the community and utilities develop master plans to include all utility constructions in the appropriate locations and with the appropriate easements. This process ensures that there is sufficient space for all utilities and ensures that the utility companies are notified and given opportunity to place their infrastructure at the appropriate time, subject to the agreed-upon design criteria developed during the planning stage. And once the plan is in place, all parties agree not to deviate from it; all are obligated to meet the design parameters of the plan, which minimizes their costs and enables them the opportunity to participate.

Similarly, in the case of significant redesign projects (such as redesign of roads or sidewalks or water utilities), standard planning process requires all utilities to together to ensure coordinated, efficient planning and construction. This reduces the costs for all parties, and gives both public and private sectors certainty. So long as the wireless carriers are willing to work with the locality on such processes, they can benefit from this city-led effort to ensure that infrastructure is deployed efficiently and that the design works for as many of the companies as possible, at the same time as protecting the public interest.

For example, in one likely scenario (illustrated below), comprehensive planning creates mutually-beneficial design parameters that allocate poles to ensure all carriers have access to infrastructure. This effectively grants the carriers siting pre-approval and reduces process for carriers down the road so long as they comply with the design parameters.

2B4D11E4712A%7D/%7BCDFE105E-763B-4D83-BFC0-2B4D11E4712A%7D.pdf. Subsequent agreements have been developed with other entities, including Mobilitie.

Figure 12 – Illustration of Planned Allocation of Poles to Enable Deployment by Four Wireless Carriers



The following examples are illustrative of some of the other creative efforts underway at the local level to seek means of public-private collaboration. This list is by no means exhaustive; rather, hundreds of such processes are underway throughout the country in communities of all sizes.

The City of Seattle in February released a request for information (RFI) seeking private sector input and ideas regarding potential public-private collaboration for deployment of wireless infrastructure and services.[11] With one clear goal focused on enabling new access to broadband services by lower-income members of the community, the City's RFI seeks to "gauge the interest of for-profit and non-profit entities in forming collaborations or partnerships with the City to enable the deployment of wireless services in Seattle. The City is seeking ideas from the private sector with regard to ways that public and private sectors can work together, with the City as facilitator, enabler, and potential partner to the private sector, in deploying wireless network infrastructure to support key goals."

The RFI specifically invited "both competitors and incumbents of the communications industry" to respond, as well as "a wide range of non-traditional entities that may be interested" in wireless in Seattle."[12]

In the RFI, the City notes that it "seeks to utilize its assets, capabilities, and other attributes to enable deployment of new and cost-effective wireless services. Among other assets, the City may

[11]"Request for Information for Collaboration and/or Partnership between the City of Seattle and Private Sector Entities for Wireless Services and Potential Smart Cities Deployments, Including in Low-Income Districts, and Parks," February 2017, http://www.ctcnet.us/wp-content/uploads/2017/01/Seattle-Public-Wifi-RFI-FINAL.pdf.

[12] The request is specifically made to such potential respondents as companies involved in the emerging Smart Cities ecosystem, including solutions providers and manufacturers; companies involved in the emerging drone and aerial vehicle ecosystems; non-profit organizations; local businesses, including those in the technology sector; manufacturers of equipment, including of network equipment and of the physical housing and platforms for wireless services; nontraditional wireless providers (e.g., technology companies, technology integrators, software providers, and engineering companies); and investors. Ibid.

be able to make use of conduit, fiber, and wireless siting locations." The RFI invites responses that would help the City learn "more about what assets and contributions would facilitate the deployment of the provider's solution. Respondents should discuss permitting, rights-of-way, property usage, conduit access, fiber connections, electricity requirements, and any other required or beneficial contributions."

The City also offers that it "seeks to maximize its processes and structures to best enable and facilitate new and cost-effective wireless services. In keeping with Mayor Ed Murray's ongoing commitment to enable private deployment of broadband facilities, the City seeks to determine strategies by which to make itself as friendly as possible to private broadband investment."[13]

Similarly, the City of Fresno, California released a Request for Qualifications (RFQ) in 2016, seeking private interest in expansion of broadband, both wired and wireless, throughout the City.[14] The RFQ invited private entities to share their ideas about how public and private sectors could work together to expand broadband availability. In the RFQ, the City offers that it would work with the private sector to make available the City's extensive networks of light poles, towers, rooftops, structures, fiber optics, and conduit. The City also notes its streamlined permitting process and willingness to commit resources to facilitate private deployment.[15]

What is critical to these efforts is that the FCC rules are interpreted in a manner that permits localities to work with providers to pursue these solutions. It is, for example, much more difficult to come up with an acceptable development scheme if an acceptably designed facility in the right-of-way can be replaced by intrusive designs of the sort shown earlier in this report.

I declare under penalty of perjury that the foregoing is true and correct. Executed on March 8, 2017.

Andrew Afflerbach, Ph.D., P.E.
Director of Engineering
Columbia Telecommunications Corporation

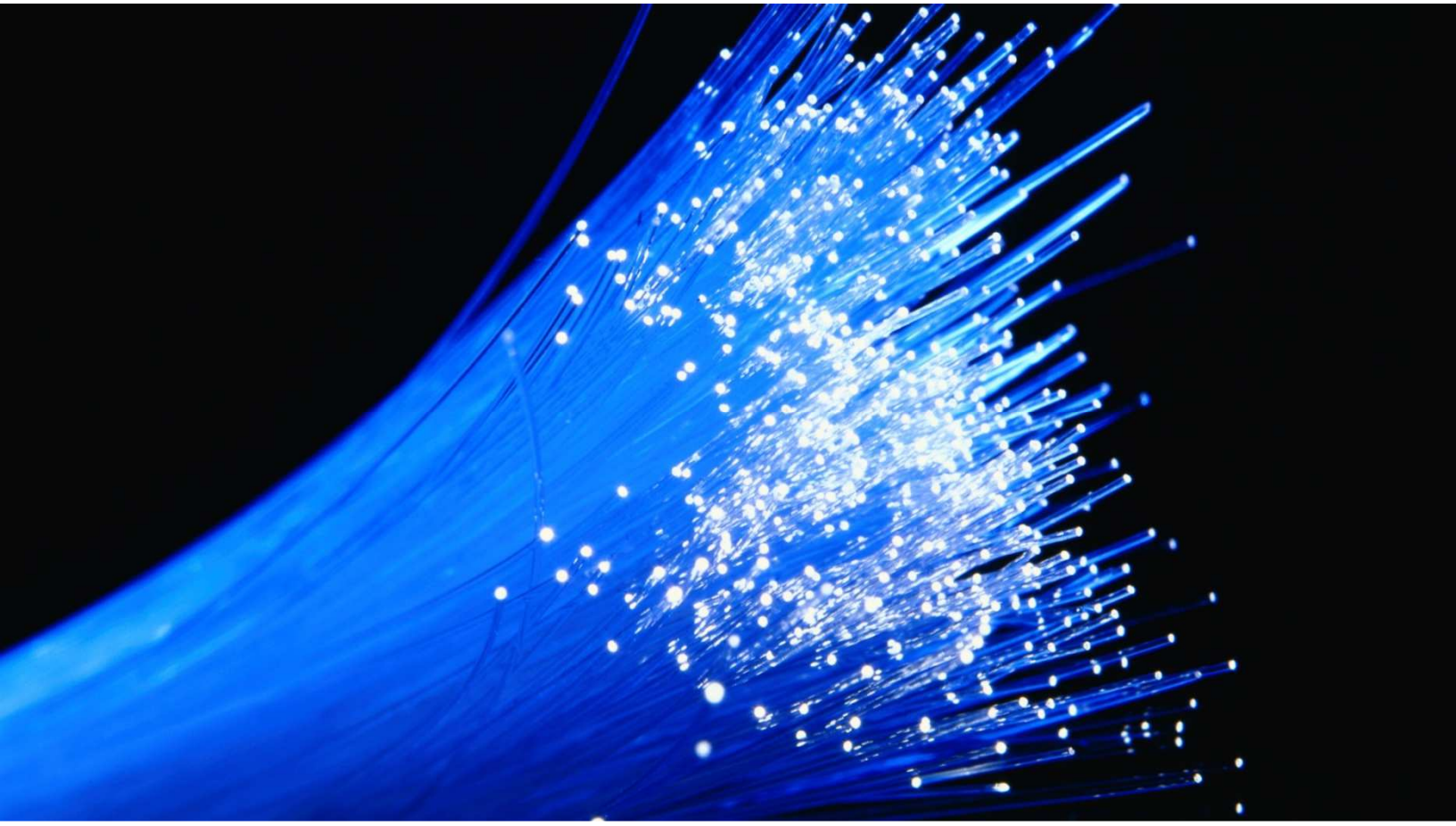
[13] Responses to the RFI are currently being reviewed by City staff.
[14] https://www.fresno.gov/informationservices/wp-content/uploads/sites/15/2016/10/WiFiRFQwithAppendices_FINAL.pdf
[15] Ibid., page 11. Responses to the RFQ were received in November 2016 and are currently under review.

Exhibit 1A
Report and Declaration of Andrew Afflerbach “Definitions of Small Cells, and the Review of Small Cell Applications, Supplemental Report”

EXHIBIT 1A

ctc technology & energy

engineering & business consulting



Definitions of Small Cells, and the Review of Small Cell Applications

Supplemental Report

Andrew Afflerbach, Ph.D., P.E.

April 2017

Table of Contents

Table of Figures

This report addresses requests by industry that the Commission adopt a definition of small cell that is based on excerpts from the definitions used to define circumstances under which a collocation is exempt from the Section 106 process; and to address the related suggestion that small cell applications can be reviewed in a shorter period of time.

As I explain, the small cell definition proposed permits installation of facilities that are intrusive and may raise significant safety and other issues that require significant review. As importantly, the definition proposed is not required to permit deployment of wireless facilities. There are some types of proposed installations that can be reviewed more quickly than others where the installation is truly small, and where certain other locational and physical characteristics are satisfied. Unfortunately, as a practical matter, it is now rare that a locality will receive a single small cell application; more often, multiple applications are received at once for a larger project. As a result, while individual applications may be quickly reviewable, "bulk" applications take as much or more time than traditional applications for macrocells.

1. Any Definition of Small Cells Based on Size Should Not Put Large Obtrusive Structures in the Same Category as Small Equipment

If one decided it was appropriate to define a maximum size for a small cell, it is important that this definition include only a configuration that is truly both small and low-impact. I have seen the size of small cells and DAS systems vary widely, over a factor of ten in volume, even within the deployments by the same companies (and this is not even considering the 120-foot "small cells" proposed by Mobilitie). The definitions from NEPA and WIA do not uniquely specify a class of standard equipment. Rather, they are a somewhat arbitrary designation that includes very large equipment, along with what most people would agree is "small":

- Each antenna is located inside an enclosure of no more than six cubic feet in volume or, in the case of an antenna that has exposed elements, the antenna and all of its exposed elements could fit within an imaginary enclosure of no more than six cubic feet; and
- All other wireless equipment associated with the facility is cumulatively no more than 28 cubic feet in volume.[1]

[1] I am generally responding to the definition in the Comments of the Wireless Infrastructure Association at p. 1, fn 2 (filed Mar. 8, 2017): "WIA will use the term "small wireless facility" to include both individual nodes in a DAS network and also stand-alone small wireless facility installations that are not part of a DAS network. In terms of the size of the equipment, as used in these Comments, WIA will use the volumetric definition contained in the Commission's First Amendment to the Nationwide Programmatic Agreement for the Collocation of Wireless Antennas, Public Notice, Wireless Telecommunications Bureau Announces Execution of First Amendment to Nationwide Programmatic Agreement for Collocation of Wireless Antennas, 31 FCC Rcd 8824, 8829 (2016), as well as legislation recently passed in Ohio (SB 331) and by the Virginia Legislature on February 20, 2017 (SB 1282), which defines a small wireless facility as a facility that meets both of the following qualifications: (i) each antenna is located inside an enclosure of no more than six cubic feet in volume or, in the case of an antenna that has exposed elements, the antenna and all of its exposed elements could fit within an imaginary enclosure of no more than six cubic feet; and (ii) all other wireless equipment associated with the facility is cumulatively no more than 28

Note that this definition does not obviously include equipment that the Commission treats as part of a base station and that could add significantly to the intrusiveness of an installation, depending on the location. That equipment includes, for example, back-up power supplies, meters and disconnect boxes. Other factors that contribute to larger deployment size include the type of backhaul used (with wireless backhaul requiring more antennas and radios), the number of providers served, the number of spectrum bands connected, the types of antennas (multiple panels versus a single whip) and the service area. Deployments that connect multiple bands or providers not only need multiple antennas but also need multiple radio cabinets, power supplies and power meters. Multiple cabinets may also be needed for interconnection to backhaul.

A deployment that is of reasonable size may become substantially larger if more spectrum bands or carriers are added. Each addition of a band or carrier may require additional antennas, and additional cabinets for power and telecommunications interconnection. Transitioning from one band to two or three can double or triple the volume of equipment needed.

To provide a sense of what the WIA definitions include, Figure 1 illustrates a DAS installation with a large antenna that fits just within the six-cubic foot definition, and multiple cabinets that are well within the 28-cubic foot definition.

cubic feet in volume." This definition, of course, excludes several other limitations included in the definitions in the Programmatic Agreement that distinguish among and further limit the size of certain installations.

Figure 1: Example DAS Installation within "Small Cell" Definition

While smaller than a macro site, this installation is clearly larger than many other small cell deployments, is highly obtrusive, and is likely to require a different level of review and consideration than a truly small installation.

Figure 2 and Figure 3 illustrate a multi-band DAS deployment with seven cabinets of various sizes for radios, fiber termination, and power. Collectively, these are less than half the 28 cubic feet proposed by WIA.[2] Two items to note from this example are: 1) a highly functional DAS or small system can be deployed using much less than 28 cubic feet of cabinets—28 cubic feet is significantly more than what is needed in most cases, and 2) even this collection of cabinets is significantly larger than what is seen now on poles, and is highly obtrusive. Cabinets of 28 cubic feet, plus additional cabinets for all the excluded ancillary equipment, can create hazards by blocking views in the right of way, can block sidewalks, and will have a significant aesthetic impact.

[2] In addition, the WIA proposes to exclude a long list of ancillary equipment from the 28 cubic-foot limit. In this case, the three lower boxes would be excluded from the calculation.

Figure 2: Multi-Band DAS Deployment

Figure 3: Multi-Band DAS Deployment – Detail of Cabinet Installation

By contrast, there are deployments with significantly smaller volumes of equipment that are achieve the goals of the Commission, particularly since those systems typically work in conjunction with existing towers. Figure 4 illustrates a small cell deployment with associated backhaul radio, telecommunications interconnection, and power meter. The small cell radio size is closer to one cubic foot, and total ancillary equipment is a few cubic feet. Figure 5 shows a close-up view of the radio component. This smaller deployment, incidentally, is closer in physical size to the original vision of 5G technology, using many small devices rather than the larger equipment shown earlier. In New York, carriers have been able to deploy small cells in the rights of way that occupy less than 3 cubic feet, and as important, are installing cells so that the width of the equipment is about the width of the pole.

As discussed, equipment sizes vary depending on the application sought by the deployer. Larger equipment can do different things than smaller equipment, and there is a place in the wireless ecosphere for the larger equipment, just as there is a place for wireless macrocells. But, there are often alternatives to the placement of the larger equipment that do not raise the issues raised when physically large equipment in placed in the right of way.

What is most important to consider is that the definition proposed by WIA for a small cell includes equipment that is by no means small, and that creates a radically different impression and impact than an installation that is dramatically smaller. If the Commission does adopt a small cell definition, it would be inappropriate to treat as identical installations that take up 28 cubic feet as equipment that is one-tenth that size. It is also critical that the FCC not base rules on the assumption that facilities being proposed are or remain small while some in the wireless industry seek to treat much larger equipment as “small”.

A truly small cell – one that does not involve back-up power, has a relatively small vertical antenna (designed to minimize wind loading), and small associated equipment flush mounted to existing utility poles, and of relatively small height, width or depth - will typically be reviewable in a shorter period than a facility that does not have those characteristics – at least assuming the Commission’s rules do not mandate approvals of expansions of these small cells. However, experience suggests that localities will be receiving applications for approval of multiple small cells at once.

While it may be faster in most cases to review a single small cell application, in reality, applications received in bulk will require more time to review than contemplated by the Commission’s current rules. Likewise, there may be particular situations (historical areas, undergrounded areas or environmentally sensitive areas and intersections – discussed in the next section) where even small cells may require significant review time.

In addition, it is often possible to install small cells without excavation or movement of existing utilities. Where excavation is required – particularly in the rights of way – additional issues arise. The effect on existing utilities and infrastructure must be considered, and that is particularly time-consuming where, e.g., the work requires removal and replacement of decorative sidewalks and streets, as well as potential impacts on accessibility.

Figure 4: Small Cell Deployment with Lower Impact

Figure 5: Small Cell Deployment with Lower Impact—View of Radio

2. The Importance of Assessing Risk of Placing Infrastructure in or Near Intersections

Intelligent equipment placement in intersections enables a small cell or DAS deployment to both use a single placement to cover a greater volume of potential users at once, and also use a smaller number of cells to cover a given area. All things being equal, it is always more efficient to place small cells and DAS at intersections rather than alongside a road, away from an intersection. However, there are many other important issues to consider when placing new infrastructure, including the need to avoid existing congestion due to traffic signals and associated signal cabinets, the density of existing utilities, the importance of keeping a clear view of traffic, and the need to keep a clear path for pedestrian access to crosswalks.

According to the Federal Highway Administration, intersection-related crashes make up 23 percent of total fatal crashes, and 50 percent of combined fatal and injury crashes,[3] despite the fact that intersections make up a much smaller percentage of the total right of way—these are essentially hotspots of risk. Thus, additional scrutiny of potential hazards from a new structure or attachment in or near an intersection is warranted, and that can translate into additional review time even for truly small cells, and more complex reviews for larger facilities of the sort that fit within the WIA definition.

3. Items and Issues That Require Review in Permitting

To have a fair, uniform, and complete process; wireless permitting should take the following issues into account:

- Proximity to or potential for interference with public safety communications (where public property is being used),
- Potential options for colocation of the structure, and understanding why colocation sites were not used,
- Potential alternatives for location that are less obtrusive,
- Improvement in coverage or capacity,
- Compliance with FCC standards for RF emissions,
- Implication for surrounding area, including residents and property owners,
- Justification for height and scale of deployment,
- Completeness and accuracy of application,
- Zoning in the proposed location,
- Verification that the landowner has been contacted and approved siting,
- Verification that the surrounding community has been given notice,
- Compliance with height and setback, screening, and other zoning requirements,
- Environmental impact,
- Impact on historical areas,
- Structural engineering review,
- Traffic plan for construction,
- Excavation and restoration requirements, and
- Noise and exhaust impact (if backup power is included)

The level of effort for review depends on many factors, including: the completeness and accuracy of the original application, the characteristics of the proposed location, the consistency of the proposed siting with previous sitings, and the scale of the proposed siting. Depending on the application, review may require a site visit, and consultation with several parties--including the applicant and the landowner. For some applications, there needs to be a meeting for public comment. And, depending on the application, there may need to be review by different permitting staff including transportation, building permitting and electrical permitting.

Many of these factors apply for small as well as larger sites, and for facilities in the rights of way, there may be other coordination/sight line/safety issues that require consideration. The cost of review can be

[3] Federal Highway Administration Research and Technology, Intersection Safety, https://www.fhwa.dot.gov/research/topics/safety/intersections/, accessed March 25, 2017.

lower if the applicant provides a complete application that is compliant with applicable regulations and is submitted after a careful review of the location.

It is common that an applicant becomes accustomed to the process and greatly reduces the time and expense of the process. However, there is frequent turnover among the permitting and site acquisition staff of carrier and tower companies, which wastes considerable time and expense, both for the applicant and for the permitting authorities. Further, the process for installations that fall within the WIA definition can require significant technical analysis and many hours of work for each location.

Exhibit 2
The Economics of Government Right of Way Fees, Dr. Kevin Cahill, Ph.D

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C.

STREAMLINING DEPLOYMENT OF SMALL CELL INFRASTRUCTURE BY IMPROVING WIRELESS FACILITIES SITING POLICIES; MOBILITIE, LLC PETITION FOR DECLARATORY RULING	WT Docket No. 16-421

THE ECONOMICS OF LOCAL GOVERNMENT RIGHT OF WAY FEES

DECLARATION OF

KEVIN E. CAHILL, PHD

March 8, 2017

THE ECONOMICS OF LOCAL GOVERNMENT RIGHT OF WAY FEES

I. INTRODUCTION

A. Author

1. My name is Kevin E. Cahill, PhD. I am a project director and senior economist at ECONorthwest, a public policy and economics consulting firm based in Portland, Oregon. I have published on a variety of topics related to applied microeconomics and have presented my research at academic conferences nationwide. I am also experienced in commercial litigation and antitrust matters, labor economics, and public policy and have testified numerous times in deposition and at trial. I earned my BA in mathematics and economics (with honors) from Rutgers College and MA and PhD in economics from Boston College. My professional and academic qualifications are described in my curriculum vitae, which is attached as Appendix A.

B. Purpose

2. My declaration in this matter addresses two topics: 1) the economic criteria that municipalities should apply when considering rights-of-way (ROW) charges, such as those at issue in the Mobilitie, Inc. ("Mobilitie") Petition;[1] and 2) the appropriate measures of economic cost for determining a fair, reasonable, and nondiscriminatory rate.

C. Summary of Opinions

3. Economic principles provide a clear justification for why municipalities should charge market-rate fees to access government-owned property such as rights-of-way.[2] First, market-rate fees ensure the efficient use of ROW—the allocation of this scarce resource that

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[1] Mobilitie, LLC. 2016. Petition for Declaratory Ruling. Before the Federal Communications Commission, In the Matter of Promoting Broadband for All American by Prohibiting Excessive Charges for Access to Public Rights of Way, WT Docket No. 16-421 (November 15).

[2] Mobiltie's petition, as I understand it, addresses two very different charges: regulatory fees, which are designed to capture the cost associated with regulating a particular voluntary activity in which a user engages, and market rents, which capture the costs associated with providing a benefit to a particular entity in return for a use of public properties. From an economics perspective the term "cost" as it pertains to access to ROW, and the "market rate" based on this cost, incorporates both those associated with regulatory fees (e.g., administrative costs and operations and management costs) and those associated with market rents (e.g., opportunity costs and negative externalities). As I note throughout this report, these costs should be fully considered in the price that municipalities charge for access to ROW in order for an efficient allocation of resources to take place. Further, while most of this report is focused on costs related to market rents, it bears emphasizing that, unless fees are set at a level that recovers all costs associated with a regulatory activity, that activity effectively is being subsidized by others and a marketplace benefit is being provided to the entity that is allowed to avoid these costs.

maximizes social welfare. Restricting fees below the market rate creates excess demand for ROW and leads to its overutilization. Second, the market rate should compensate the municipality not only for the administrative costs and operations and maintenance (O&M) costs associated with ROW access, but also for the fixed costs that the municipality incurred to create the ROW, the opportunity costs associated with occupying the ROW (e.g., increased costs in planning for future projects), and any negative externalities associated with placement of a facility in the rights of way (e.g., negative impacts on community aesthetics and property values). These components reflect the true cost to the municipality of granting access to its ROW.

4. Municipalities do not "profit" when users pay the full cost of accessing the ROW, nor is the socially-optimal level and rate of deployment of a new technology achieved when fees are restricted to just cover administrative costs and operations and maintenance costs. Quite the contrary. Such restrictions harm municipalities because resources are misallocated. The fact that some organizations might benefit from these restrictions—namely, by lowering their costs of production and supplying more of their product—does not imply that municipalities and its citizens and businesses also realize a net benefit (they do not).
5. Simply put, the efficient allocation of ROW is achieved when users pay the market price for accessing the ROW.

II. THE ECONOMIC PRINCIPLES OF ACCESSING ROW

6. Economics is the study of the efficient allocation of scarce resources. In an economic sense, a resource is scarce when demand or wants exceed the available supply. Very few resources would *not* be considered scarce—sand in the desert or seawater at the beach are two examples. Each household, city, state, and country has a limited supply of scarce resources (e.g., labor, land, knowledge, energy), and each entity decides how to allocate their resources. Municipalities, too, have scarce resources—land, infrastructure, vehicles, buildings—which they hold in trust for residents, businesses owners, and taxpayers.[3]

[3] Mankiw, G. 2015. *Principles of Microeconomics*. Stamford, CT: Cengage Learning; Samuelson, P. and W. Nordhaus. 2005. *Economics*. New York, NY: McGraw-Hill International Edition; Hall, R. and M. Lieberman. 1998. *Microeconomics: Principles and Applications*. Cincinnati, OH: South-Western College Publishing.

7. Economies allocate scarce resources via markets and prices. In general, producers want to sell their goods at the highest price possible and consumers want to buy their goods at the lowest price possible. A price must be acceptable to both producers *and* consumers for an exchange to occur because each party has the freedom not to participate in the exchange. Economists generally refer to the market-clearing or equilibrium price as one that satisfies two conditions: 1) the price enables producers to cover their costs and 2) the price satisfies consumers' willingness to pay given their preferences. A price below the market-clearing price will result in too many consumers willing to buy and too few producers willing to sell (excess demand) and a price above the market-clearing price will result in too few consumers willing to buy and too many producers willing to sell (excess supply). Price adjustments help ensure a match between supply and demand and an efficient allocation of scarce resources.[4]

A. Charging a fee to access ROW ensures the efficient allocation of a scarce resource

8. A municipal ROW—constrained by location and dimension—is a scarce economic resource. Because it is a scarce resource, charging a fee to access a municipal ROW makes good economic sense and is consistent with the trust responsibilities of municipal officials. Charging a market rate to access a municipal ROW is consistent with the economic principle of using prices to efficiently allocate scarce resources. The closer the charged rate is to the market price the closer the allocation of the ROW is to the efficient outcome.
9. Because a municipal ROW is a scarce resource choosing one use for the ROW means that the municipality foregoes other opportunities to use (or not use) the resource, so long as the user maintains its access to the ROW. The creation of a pedestrian-only mall prevents access to adjoining properties by vehicles, for example, and the placement of a pole may make use of a sidewalk more difficult for a pedestrian. Economists refer to the foregone use as an opportunity cost associated with the resource-allocation decision. Economists consider opportunity costs in resource allocation decisions because resources can be used in

[4] Mankiw, G. 2015. *Principles of Microeconomics, 7th Edition*. Stamford, CT: Cengage Learning; Samuelson, P. and W. Nordhaus. 2005. *Economics*. New York, NY: McGraw-Hill International Edition.

alternative ways and decisions made today can impact what choices are available in the future.[5]

10. Occupying space in the above- or below-ground portions of the ROW has opportunity costs. Access by others entities, including the locality, may become more expensive or more difficult, or in some cases, may be foreclosed. The three-dimensional space occupied by a given wire obviously cannot be occupied by another. Allowing one wireless provider to use a light pole may foreclose, or limit the use by others, unless the dimensions of the pole are substantially changed. Also, depending on the specifics of the use, the installation, the maintenance, and the replacement of any given facility in the ROW may create problems for and impose costs on the city, other users of the ROW, and on property owners adjacent to the ROW. For these reasons charging a fee to access ROW helps ensure that the ROW will be used in an efficient manner.

B. Below-market pricing results in excess demand

11. As noted above, if a price is set below the market-clearing price then there will be too many consumers willing to buy the product at that price and too few producers willing to sell the product at that price, resulting in an excess demand for the good or service. In the case of ROW, if a municipality is forced to sell access to its ROW at a below-market rate, then users will not fully consider the cost of accessing the ROW and will over utilize it. One form in which this overutilization could manifest itself is that existing ROW could become overcrowded, and be unable to accommodate new, innovative technologies. Another form is that a company like Mobilitie may abandon property for which it does pay rent in order to access property that it hopes to occupy at no charge, or at a heavily regulated charge.
12. Allocating the ROW by first-come, first-serve or on some other non-market price makes little economic sense, especially given the external costs imposed on third parties if a ROW is over-consumed by any user. The same result follows if one artificially limits a community to charging fees without regard to value. Charging a ROW fee that reflects the ROW as a

[5] Mankiw, G. 2015. *Principles of Microeconomics, 7th Edition*. Stamford, CT: Cengage Learning; Samuelson, P. and W. Nordhaus. 2005. *Economics*. New York, NY: McGraw-Hill International Edition; Nicholson, W. 1997. *Intermediate Microeconomics and Its Application*. Oak Brook, IL: The Dryden Press.

valuable asset or resource for which there are important and competing uses easily prevents this.

C. Above-market pricing is disciplined by municipal competition

13. Municipalities compete to attract business and jobs, retirees and their savings, and high-skilled workers. They use a variety of means to do this, such as by offering favorable tax policies and subsidies, providing municipal amenities, and investing in infrastructure.[6] Many cities have economic development departments whose purpose includes attracting businesses away from other jurisdictions to locate in their city and employ their residents. These activities are part of municipal managers' responsibilities to protect and support their community's quality of life and economic health and wellbeing.
14. Telecommunication services are an important component of cities' economic development plans.[7] The extent to which a community has high quality telecommunications services—including, in particular, high-quality broadband Internet access—can affect economic-development prospects and general quality of life. As such, some municipalities may choose to price access to ROW below the market rate in order to obtain these telecommunications services before other communities.
15. Critically, any given municipality is constrained by market forces if it attempts to charge an above-market price.[8] Consider the case in which a municipality attempts to extract excess revenues from interested users of a ROW with a fictitious opportunity cost argument. Some interested users of the ROW will no doubt opt not to use the ROW because of the higher price, leading to excess supply in the municipality's existing ROW. Meanwhile, its competitor municipalities have every incentive to take advantage of this misstep by pricing access to their own ROW such that no excess capacity exists. The result will be an enhanced availability of services in the competing municipalities. The enhanced services can then be

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[6] O'Sullivan, A. 2012. *Urban Economics*. New York, NY: McGraw-Hill Irwin.

[7] Lucky, R. and J. Eisenberg (eds.). 2006. *Renewing U.S. Telecommunications Research*. Committee on Telecommunications Research and Development, National Research Council. ISBN: 0-309-66396-2. http://www.nap.edu/catalog/11711.html; Salt Lake City. No date. *Economic Development – Research: Utilities and Telecommunication*. http://www.slcgov.com/economic-development/utilities-and-telecommunication.

[8] Price is just one factor. Market forces can also limit other outcomes, such as excessive regulation, that might be detrimental to a municipality's citizens and businesses.

touted by the competitor municipalities to lure away individuals and businesses from the municipality with excess capacity in its ROW.

16. Another form of competition exists *within* municipalities—leaders compete for the votes of their constituents. Unlike corporations, municipalities are not profit maximizers; rather, municipalities have an obligation to their citizens to promote economic development. If leaders within a municipality obstruct market forces and fail to establish market prices that invite technological innovation, citizens and businesses will no doubt be unsatisfied with such decisions and seek new leadership in subsequent elections. This threat of being voted out of office serves to discipline leaders within a municipality from demanding above-market prices.
17. Another disciplinary force is the option to use private property instead of a municipality's ROW. The right of way is, as I understand it, not necessarily the only property on which wireless facilities may be placed. While there may be different costs associated with placing facilities on private property (including costs of negotiation), the fact that there are alternatives to using the rights of way limits the pricing power of a municipality.
18. The key takeaway is that market forces—both across and within municipalities and between municipalities and private property owners—discipline those that seek to extract surplus revenues from ROW users. The argument that municipalities should be restricted from setting prices for fear that they will extract excess revenues from interested users is highly flawed because it ignores these disciplinary market forces.

III. QUANTIFYING FAIR, REASONABLE, AND NONDISCRIMINATORY PRICES

19. The previous section describes the economic principals of accessing ROW, and the importance of pricing in such a way that leads to the efficient allocation of this scarce resource. In this section, I describe the various components of such pricing. A key takeaway is that an artificial constraint that restricts municipalities to charging only the current out-of-pocket marginal cost of accessing the ROW will inevitably lead to an inefficient outcome that harms the municipality, its citizens, and its businesses.[9]

[9] For simplicity, I refer to administrative costs and operations and management costs as out-of-pocket marginal costs. Opportunity costs and those associated with negative externalities are technically marginal costs as well, in the sense that they increase incrementally with the introduction of a new user of a ROW.

A. Administrative and operations and maintenance (O&M) costs

20. In its Petition for Declaratory Ruling, Mobilitie states that, "The Commission should first declare that the phrase 'fair and reasonable compensation' means charges that enable a locality to recoup its reasonable costs to review and issue permits and manage its rights of way, and that additional charges are unlawful."[10]

21. Mobilitie is correct insofar as it acknowledges that municipalities should be able to charge for the (full) incremental administrative and operations and maintenance (O&M) costs that a municipality incurs when it grants access to ROW. As I note above, these sorts of costs are typically included in regulatory fees associated with issuing permits for activities inside or outside of the rights of way. These charges can include the cost of personnel time for permitting and maintenance of the ROW, the cost of any modifications to the ROW that are necessary and borne by the municipality, and any costs associated with regulation compliance with rules for use of the rights of way. These charges should also include any necessary engineering reviews, field inspections, utility adjustments, or site restoration tasks. Moreover, it is important to note that some of these costs are not one-time events. In these cases municipalities should be able to recover, over time, any costs related to access of ROW that are ongoing.

22. Economically speaking, however, these regulatory costs do not reflect what an economist would view as the full cost of use of the rights of way. Other components include fixed costs, opportunity costs, and negative externalities. Ignoring these components will lead to a below-market rate, excess demand, and an economically inefficient use of ROW (as well as a subsidy for users, such as Mobilitie).

B. The importance of including fixed costs

23. Mobilitie is incorrect in its assertion that pricing above current out-of-pocket marginal costs implies that municipalities are somehow profiting from the use of ROW. Specifically, Mobilitie states, "The Commission should declare, however, that additional charges that exceed these [marginal] costs are unlawful. Thus, a locality's one-time and recurring charges

[10] Mobilitie, LLC. 2016. Petition for Declaratory Ruling. Before the Federal Communications Commission, In the Matter of Promoting Broadband for All American by Prohibiting Excessive Charges for Access to Public Rights of Way, WT Docket No. 16-421 (November 15), p. 24.

and fees cannot be set at levels that are designed to raise revenues for the locality, because those charges would allow the locality to profit from its exclusive control of rights of way."[11,12]

24. Pricing above out-of-pocket marginal cost does not imply that municipalities earn "profits." The reason is that municipalities incur fixed costs and opportunity costs, and may experience impacts from negative externalities. First, municipalities have likely incurred at least some of the cost of establishing and maintaining the ROW up until the present time. Myrtle Beach, for example, has expended hundreds of millions to redevelop its beachfront, underground utilities and rebuild its roads.[13] It is economically nonsensical to imply that the municipality should be compelled to give away for free the fixed-cost value of establishing the ROW and maintaining it through the present time simply because the municipality incurred these costs in the past. Far from earning "profits," municipalities would be incurring a very tangible loss if they were not allowed to charge users for their fixed costs—or would be simply transferring costs which ought to be borne by those occupying the rights of way to others, such as taxpayers.
25. Municipalities can and have invested in infrastructure with the expectation that they would recoup at least some portion of such investment spending. For example, jurisdictions in Oregon charge a system development charge (SDC) for new residential and commercial development. The purpose of SDC is to recover the fixed costs of infrastructure capacity that serves new development. As new residential developments come on line they pay their portion of the fixed costs for infrastructure capacity needed to serve the new development.[14] Forcing municipalities to give away these assets for free makes little economic sense and could inhibit municipalities' investments in infrastructure going forward.

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[11] Mobilitie, LLC. 2016. Petition for Declaratory Ruling. Before the Federal Communications Commission, In the Matter of Promoting Broadband for All American by Prohibiting Excessive Charges for Access to Public Rights of Way, WT Docket No. 16-421 (November 15), p. 24.

[12] I note that the "exclusive control" of the rights of way is something of a misnomer. Property owners have exclusive control of their property but my understanding is that such exclusive control is rarely in and of itself viewed as a justification for regulating rates for access.

[13] MyrtleBeachOnline. 2016. "Myrtle Beach metro area again one of the fastest-growing in the country." March 24. http://www.myrtlebeachonline.com/news/local/article67886402.html.

[14] Galardi Consulting, Dr. A. Nelson, and Beery, Elsner and Hammond. 2007. *Promoting Vibrant Communities with System Development Charges*. Metro. July; Leung, M. 2015. *System Development Charges*. Portland Water Bureau. May 27.

26. Importantly, allowing municipalities to charge for their fixed costs does not imply that all municipalities will do so. The ROW is an asset to the municipality and some municipalities might decide to waive their fixed costs to compete with other municipalities to attract certain types of investment. This flexibility is a key feature of how municipalities compete, to the benefit of its citizens and businesses. This dimension of competition would be stifled if municipalities are not allowed to recoup their fixed costs.

C. The importance of including opportunity costs

27. As noted above, a municipality's ROW is a scarce resource in an economic sense. The potential for restricted availability and fewer options in the future is a cost to the municipality for granting access to the ROW today. As such, municipalities must be able to charge for their opportunity cost to achieve an efficient allocation of its ROW. Further, allowing a locality to recover its opportunity costs ensures that users pay the full cost associated with the use of the facility—or ensures that the municipality makes a conscious decision to subsidize certain behaviors. For example, a municipality might have a vested interest in encouraging the deployment of technologies to underserved areas and, to encourage such deployment, the municipality might set a discounted price, or even a zero price, for accessing its ROW in particular areas. Such decisions can be optimal depending on the objective function or strategy of the municipality. As with fixed costs, restricting municipalities from including opportunity costs, either in full or in part, constrains competition across municipalities and inevitably leads to inefficient outcomes.

D. The importance of taking negative externalities into account

28. Decision makers within municipalities must also consider any negative impacts that use of ROW might impose on the community. Such negative impacts are referred to in the economics literature as externalities—an impact, either positive or negative, to an outside party. In the case of access to ROW, a telecommunications company's cell tower might impose a negative externality in the community due to its unsightliness. Municipalities have attempted to mitigate such negative impacts on the community by requiring users to address the negative externalities they impose, for example, by requiring providers to make cell

towers look like trees.[15] In other cases, access to certain locations in or outside of the rights of way (for example, for locations in front of historic structures) may be subject to strict scrutiny.

29. Quantifying the impact of negative externalities on a given community can be complicated, and the challenges in doing so illustrate why it is important to let each municipality decide how to weigh the trade-offs associated with such negative impacts. Some communities might value the impact of a negative externality more so than others, just as some communities might value access to the latest telecommunications technology more than others. Competitive pricing allows municipalities to achieve an allocation of resources that takes these preferences into account. For example, if a locality charges a fee for use that is higher for those who place large facilities in the rights of way, and less for those who do not, the locality will encourage deployment of smaller facilities.
30. A key takeaway is that communities differ in how they view the impacts of negative externalities. Limiting municipalities' ability to set the prices they can charge (as well as limiting authority to mitigate impacts through land use regulation), therefore, will lead to a situation in which communities' preferences toward negative externalities are not taken into account, inevitably resulting in an economically inefficient outcome.

E. The importance of economic factors in assessing nondiscriminatory fees

31. In an economic sense, a fee is nondiscriminatory if entities pay similar fees for using a ROW in similar ways and under similar circumstances. Uses differ, and not all telecommunications providers use the ROW in the same way. For example, a wireline company may have hundreds or thousands of miles of fiber in a ROW. A wireless company, in contrast, may place only a few facilities in the ROW, but with more substantial negative externalities. One could reasonably distinguish among these types of providers for the purpose of arriving at compensation for access to the ROW.

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[15] Chicklas, D. 2014. "City code required cell phone tower to be disguised as tree." *Fox 17 West Michigan*. July 28. http://fox17online.com/2014/07/28/city-code-required-cell-phone-tower-to-be-disguised-as-tree/; Hecht, P. 2015. "Dressed up as trees, cellular towers stir depate." *The Sacramento Bee*. Dec. 5, http://www.sacbee.com/news/investigations/the-public-eye/article48213030.html.

32. In addition, economic conditions change over time. All else equal, providers that enter the market at different points in time face different economic conditions. In a competitive market, such providers would likely face different costs for the resources they use. Likewise, it would not necessarily be either discriminatory or non-neutral for the details of the ROW access charges between each of such providers and a city to differ.
33. It follows that there may be many different ways to capture fair market value for property and other resources used. For example, it is common in pricing to include a gross revenues based component. This is a common measure where a ROW grant gives someone a right to place facilities throughout the right of way (cable and telecommunications franchises, for example) but is also common in private markets (shopping centers, for example). Alternatively, an entity can price per site, price based on some measure of area (linear footage, square footage, or cubic footage), or price based on provision of non-monetary benefits that reduce costs to both parties (e.g., installation of excess conduit that reduces the need for future road cuts). Different pricing models may fit some policy goals better than others or some business plans better than others. Just as competition leads to marked-based prices and an efficient allocation of scarce resources, competition also leads to an optimal form in which payments are made.
34. Finally, other factors can affect ROW pricing in ways that are non-discriminatory in nature, such as opportunity costs and externalities. Regarding opportunity costs, it would be non-discriminatory from an economic perspective to charge higher ROW fees in highly congested portions of the ROW because congestion in ROW can limit future access for municipal services. Likewise, telecommunications companies may inflict negative externalities on communities by installing unsightly telecommunications equipment in historical districts or in neighborhoods with strict visual standards (e.g., signage limitations and requirements, limited or specified paint colors, period or culturally aesthetic architecture building codes). ROW fees that take these consequences into consideration would not be considered discriminatory in an economic sense.

IV. FACTORS SPECIFIC TO SMALL CELL DEPLOYMENT

35. Mobilitie notes that access to ROW for the purposes of 5G technology differs from prior cellular technology uses. The technology requires more densely distributed equipment and,

therefore, access to many more ROW points. Mobilitie then argues that these technical requirements somehow imply that the economics of access to ROW should be different. In fact, the economic principles of access to ROW hold no matter what the technology, including 5G and taking Mobilitie's technical arguments at face value.

36. One of the major differences between the anticipated roll out of small cell and DAS networks from current wireless technology is the number of antenna attachments and deployments that municipalities will process. Mobilitie's Petition for Declaratory Ruling, states that 200,000 cell towers currently exist in the United States. These towers were not all installed in one year, rather they accumulated over time. In contrast, it is anticipated that one million new small cell and DAS antenna could be deployed in the next five years.[16] On average, municipalities would have to process ROW antenna requests at an annual rate equivalent to all cell towers currently in operation, each year, for the next five years.
37. Mobilitie claims that, due to the large number of expected access requests, a more uniform system of gaining access to ROW might be required. It is beyond the scope of this report to consider the costs associated with imposing a "uniform" permitting scheme on localities across the nation, except to note that it would likely be quite significant, potentially involving changes in ordinances, software systems, forms and the like. But a critical piece of information left out of Mobilitie's argument is that municipalities have every incentive to work with telecommunications companies and advance 5G technology to the extent that such technology offers value to its constituents. If the value is as alluring as Mobilitie claims it to be, municipalities have every incentive to facilitate its adoption within the community. No declaratory ruling or mandated uniformity would be required.
38. Likewise, market-based pricing mechanisms are consistent with and not in conflict with rapid deployment. As a society, we do not want the most rapid deployment imaginable; we want the speed of deployment that is consistent with the most efficient use of available resources. This rate of deployment leads to intelligent choices among types of properties that may be used to deploy wireless facilities. The methodology Mobilitie proposes will predictably lead to inefficient deployment at substantial social cost.

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[16] Mobilitie, LLC. 2016. *Petition for Declaratory Ruling*. Before the Federal Communications Commission, In the Matter of Promoting Broadband for All Americans by Prohibiting Excessive Charges for Access to Public Rights of Way. Washington, DC. November 15.

39. Moreover, as a basic economic principle, firms will first deploy in the areas that are most profitable. The areas that are most profitable under a system with market-based prices will, when ROW are underpriced, likely remain among the most profitable areas (albeit *more* profitable due to lower costs). The systematic underpricing of access to ROW is unlikely to lead to increased deployment in underserved areas over existing profitable ones.

V. CONCLUSION

40. An efficient, market-based price to access ROW compensates a municipality for its administrative costs and operations and management costs, its fixed costs of establishing and developing the ROW, its opportunity cost of granting access to the user, and any negative externalities from the user. Restricting fees below the market rate, as proposed by Mobilitie, creates excess demand for the ROW, leading to an overutilization and suboptimal allocation of ROW.
41. Concerns about municipalities extracting rents from potential users of ROW are unwarranted because competitive forces within and across municipalities, and between municipalities and private property owners, discipline such behavior. Municipalities that attempt to extract higher-than-market rates will simply be undercut by other municipalities that do not, or sidestepped by private property owners, and risk falling behind technologically. Leaders who advocate for extracting higher-than-market rates will be forced to explain to voters why their municipality is falling behind technologically, and risk losing their positions. The result is that municipalities and their leaders cannot sustain above-market prices.
42. The most rapid rate of deployment imaginable for 5G technology is not the socially-optimal outcome; rather what is socially optimal is the speed of deployment that is consistent with the most efficient use of available resources. The efficient allocation of ROW is achieved when users pay the full cost of accessing the ROW. The closer the fee is to the market price the closer the allocation of ROW access is to the social optimum.

I declare under penalty of perjury that the foregoing is true and correct. Executed on March 8, 2017.

Kevin E. Cahill, PhD
Project Director
ECONorthwest

VI. APPENDIX A: Curriculum Vitae

CURRICULUM VITAE

KEVIN E. CAHILL

Education

Ph.D. Economics, Boston College, Chestnut Hill, MA, 2000
M.A. Economics, Boston College, Chestnut Hill, MA, 1997
B.A. Mathematics and Economics (with honors), Rutgers College, New Brunswick, NJ, 1993

Professional Experience

2012 – present	ECONorthwest: Project Director / Senior Economist
2005 – present	Center on Aging and Work at Boston College: Research Economist
2005 – 2010	Analysis Group, Inc.: Associate (2005 – 2008); Manager (2009 – 2010)
2004 – 2005	Tinari Economics Group: Economist and Expert Witness
2003	Center for Retirement Research at Boston College: Associate Director for Research
2000 – 2002	Abt Associates, Inc.: Associate

Academic Papers and Publications

Cahill, Kevin E., Michael D. Giandrea, and Joseph F. Quinn. *submitted*. "Is Bridge Job Activity Overstated?" *Monthly Labor Review*.

Quinn, Joseph F. and Kevin E. Cahill. *submitted*. "The Relative Effectiveness of the Minimum Wage and the Earned Income Tax Credit as Anti-Poverty Tools." *Religions*.

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Cahill, Kevin E., Michael D. Giandrea, and Joseph F. Quinn. 2010. "The Role of Re-entry in the Retirement Process." U.S. Bureau of Labor Statistics Working Paper, 439 (June).

Jaff, Michael R., Kevin E. Cahill, Andrew P. Yu, Howard G. Birnbaum, and Luella M. Engelhart. 2010. "Clinical Outcomes and Medical Care Costs among Medicare Beneficiaries Receiving Therapy for Peripheral Arterial Disease." *Annals of Vascular Surgery*, 24(5), 577-587 (July).

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Cahill, Kevin E., and Sheila Campbell. 2004. "Basic Investment Theory Explained." Center for Retirement Research *Just the Facts*, No. 9 (January).

Cahill, Kevin E., and Mauricio Soto. 2003. "How Do Cash Balance Plans Affect the Pension Landscape?" Center for Retirement Research *Issue in Brief*, No. 14 (December).

Munnell, Alicia H., Kevin E. Cahill, and Natalia A. Jivan. 2003. "How Has the Shift to 401(k)s Affected the Retirement Age?" Center for Retirement Research *Issue in Brief*, No. 13 (September).

Marshall, Nancy L., Cindy L. Creps, Nancy R. Burstein, Kevin E. Cahill, Wendy W. Robeson, Sue Y. Wang, Nancy Keefe, Jennifer Schimmenti, and Frederic B. Glantz. 2003. "Massachusetts Family Child Care Today: A Report on the Findings from the Massachusetts Cost and Quality Study." Wellesley Centers for Women, Wellesley, MA.

"401(k) Plans and Retirement Saving: Lessons for Personal Accounts." 2002. Summary document of a presentation by William G. Gale and James M. Poterba prepared for the Social Security Administration (November).

Beecroft, Erik, Kevin E. Cahill and Barbara D. Goodson, 2002. "The Impacts of Welfare Reform on Children: The Indiana Welfare Reform Evaluation." Abt Associates Inc. (December).

Burstein, Nancy, Jean I. Layzer, and Kevin E. Cahill. 2001. "National Study of Child Care for Low-Income Families: Patterns of Child Care Use Among Low-Income Families." Abt Associates Inc. (August).

Wrobel, Marian V., and Kevin E. Cahill. 2001. "An Evaluation of the Choosing Health Program." Abt Associates Inc. (April).

Cahill, Kevin E., 2000. "Heterogeneity in the Retirement Process: Patterns and Determinants of Labor Force Withdrawal among Individuals with Low-Wage and Short-Duration Jobs." Boston College Doctoral Dissertation.

Quinn, Joseph F., Richard V. Burkhauser, Kevin E. Cahill, and Robert Weathers. 1998. "Microeconomic Analysis of the Retirement Decision: United States." The OECD Economics Department Working Paper No. 203, Paris.

Professional Activities, Honors and Awards

Member, Founding Editorial Board of *Work, Aging and Retirement*, 2014 – present.

Member, Editorial Board of *Research on Aging*, 2016 – present.

Member, Editorial Board of *Journal of Aging & Social Policy*, 2016 – present.

At-Large Vice President, Board of Directors, National Association of Forensic Economics, 2013 – 2016.

2011 Lawrence R. Klein Award for best *Monthly Labor Review* article by joint BLS and non-BLS authors.

Ad hoc referee, 2000 – 2016, *The Gerontologist, Journal of Gerontology: Social Sciences, Journal of Applied Gerontology, Industrial and Labor Relations Review, Journal of Human Resources, Work, Aging and Retirement, Demography, Population Research and Policy Review, Journal of Population Economics, Research on Aging, Applied Health Economics and Health Policy, Sociology Quarterly, Journal of Aging and Social Policy, Ageing & Society, Atlantic Economic Journal, Social Problems, Australian Journal of Social Issues, Asian Social Science, The Journal of Forensic Economics, AARP, Alfred P. Sloan Foundation, Oxford University Press*

American Economics Association, member, 2002 – present.

Gerontological Society of America, member, 2012 – present, investment committee, 2015 – present.

Western Economics Association, member, 2004 – 2008, 2012 – present.

National Association of Forensic Economics (NAFE), member, 2004 – present;

NAFE, organizer of ASSA conference sessions, 2015, 2016 (with Larry Spizman), 2017 (with Scott Gilbert)

Eastern Economics Association, member, 2005 – 2010, 2014

Allied Social Sciences Associations Annual Meeting, Conference Book Cover, 2017, 2015, 2014, 2013, 2012.

Salmon River Art Guild, Regional Art Show, Other Media: First Place (2014, 2012); Second Place (2016, 2011); Third Place (2016, 2011); Honorable Mention (2016, 2014).

Reviewer of grant proposals, Sandell Grant Program, 2002 – 2003.

Doctoral Fellowship, Social Security Administration, Center for Retirement Research, 1999.

Teaching Excellence Award, Boston College Graduate School of Arts and Sciences, 1998.

Michael Mann Summer Dissertation Award, Boston College Department of Economics, 1997.

Graduate Student Fellowship, Boston College Department of Economics, 1995 – 1998.

Henry Rutgers Scholar, Rutgers College, Department of Economics, 1993.

Presentations and Conferences Attended

"Notable Economic Trends in Idaho and the Pacific Northwest." Invited speaker at the Northwest Credit Union Association's Governmental Affairs Conference, Boise, ID, January 26, 2017.

"What Determines Gradual Retirement? Differences in the Path to Retirement between Low- and High-Educated Older Workers." Discussant at the 2017 Annual Meeting of the Allied Social Science Associations, Chicago, IL, January 8, 2017.

"The Impact of Oregon's Pension Legacy Costs on New Teacher Turnover and Quality" Presentation at the 2017 Annual Meeting of the Allied Social Science Associations, Chicago, IL, January 7, 2017.

"Pension Generosity in Oregon and Its Impact on Mid-Career Teacher Attrition and Older Teachers' Retirement Decisions." Presentation at the 2016 Fall Research Conference of the Association for Public Policy Analysis and Management (APPAM), Washington, DC, November 6, 2016.

"How Do You Study the Impact of Immigrant Inclusion? Considerations for Quantitative Research." Presentation at the Welcoming Economies Global Network Conference, Philadelphia, PA, October 20, 2016.

"Economic Damages in Employment Cases." Presentation for the Multnomah Bar Association, Portland, OR, September 20, 2016, and the Oregon Trial Lawyers Association, Portland, OR, October 5, 2016.

"Pension Generosity in Oregon and its Impact on the K12 Workforce." Presentation at the 91st Annual Conference of the Western Economic Association International, Portland, OR, July 1, 2016.

"Measure of Damages for Employer-Paid Health Insurance Denied While Working." Discussant at the 91st Annual Conference of the Western Economic Association International, Portland, OR, July 1, 2016.

"Is Bridge Job Activity Overstated?" Presentation at the 2016 Annual Meeting of the Allied Social Science Associations, San Francisco, CA, January 4, 2016.

"Does the Option of Continued Work Later in Life Result in a More Optimistic View of Retirement?" Presentation at the 68th Annual Scientific Meeting of the Gerontological Society of America (GSA), Orlando, FL, November 22, 2015.

"To What Extent is Gradual Retirement a Product of Financial Necessity?" Presentation at the 68th Annual Scientific Meeting of the Gerontological Society of America (GSA), Orlando, FL, November 21, 2015.

"The Impact of a Time & Place Intervention on Economic Outcomes at a Large Healthcare Organization." Presentation at the 68th Annual Scientific Meeting of the Gerontological Society of America (GSA) Pre-Conference Workshop: Change in the Meaning and Experience of Work Later in Life, Orlando, FL, November 18, 2015.

"The Economic Dynamics and Fiscal Impacts of an Aging Society." Invited panelist at the 10th Annual Conference of the Oregon Oral Health Coalition, Oral Health in the Age of Aging: Perspectives on Epigenetics, Gerontology, and Chronic Diseases, Portland, OR, October 2, 2015.

"Pathways to Retirement in the United States: An Evolving Process." Invited speaker at the Center for Senior Policy's Conference on Extending Working Life: The American Experience, Oslo, Norway, September 15, 2015.

"Midyear Commercial Real Estate Economic Forum." Invited panelist at a forum sponsored by TitleOne Corporation, Boise, ID, June 17, 2015.

"Boomers and the Future of Oregon's Economy." Speaker at a jointly-sponsored ECONorthwest–AARP event on leveraging Oregon's 50-plus population, Portland, OR, March 17, 2015.

"The Impact of a Randomly-Assigned Time & Place Management Initiative on Work and Retirement Expectations." Presentation at the 2015 Annual Meeting of the Allied Social Science Associations, Boston, MA, January 4, 2015.

"A Balanced Look at Self-Employment Transitions Later in Life." Presentation at the 67th Annual Scientific Meeting of the Gerontological Society of America (GSA), Policy Series: Self-Employment and Entrepreneurship: The Aging Workforce's 'Encore'?, Washington, DC, November 8, 2014.

"How Might the Affordable Care Act Impact Retirement Transitions?" Presentation at the 89th Annual Conference of the Western Economic Association International, Denver, CO, June 28, 2014.

"Hours Flexibility Preferences and Work/Retirement Decisions." Presentation at the Work and Family Researchers Network (WFRN) 2014 Conference, New York, NY, June 19, 2014.

"Bridge Jobs and the New Era of Retirement." Invited speaker at the Sloan Foundation's Workshop on Measuring, Modeling, and Modifying Late in Life Workplace Dynamics, New York, NY, June 5, 2014.

"The Impact of Hours Flexibility on Retirement Transitions." Presentation at the Pacific Northwest Regional Economics Conference (PNREC) 2014, Portland, OR, May 8, 2014.

"Job Transitions among Today's Older Americans: Challenges and Opportunities." Keynote speaker at AARP's Finding Work at 50+ Event, Beaverton, OR, April 22, 2014.

"Retirement Communities – the Golden Age of Real Estate." Invited panelist at a forum sponsored by the Idaho Business Review, Boise, ID, April 1, 2014.

"Transitions into Self-Employment at Older Ages: 1992 to 2012." Presentation at the 40th Annual Conference of the Eastern Economics Association, Boston, MA, March 8, 2014.

"What Forensic Economists Need to Know about Societal Aging." Presentation at the NAFE Sessions of the 40th Annual Conference of the Eastern Economics Association, Boston, MA, March 8, 2014.

"Preparing for the Aging Boom: Best Practices for Employers." Invited panelist at a forum sponsored by the Vision Action Network and the Washington County Chamber of Commerce Partnership, Portland, OR, January 29, 2014.

"The New Era of Retirement." Presentation at the Osher Lifelong Learning Institute at Boise State University, Boise, ID, January 9, 2014.

"The Impact of Hours Flexibility on Career Employment, Bridge Jobs, and the Timing of Retirement." Presentation at the 2014 Annual Meeting of the Allied Social Science Associations, Philadelphia, PA, January 4, 2014.

"Schedule Matches and Work-life Fit among Older Healthcare Workers." Presentation at the 66th Annual Scientific Meeting of the Gerontological Society of America (GSA), New Orleans, LA, November 21, 2013.

"Self-Employment Transitions among Older Americans." Invited speaker at the AARP Public Policy Institute Roundtable on Crafting a Workforce Development System that Better Meets the Needs of Older Jobseekers and Workers, Washington, DC, November 7, 2013.

"The Uncertainty of Planning for Retirement." Invited guest on Chicago Public Radio, WBEZ's "Morning Shift," Chicago, IL, November 4, 2013.

"The Role of Gender in the Retirement Patterns of Older Americans." Invited speaker at the U.S. Department of Labor's Older Women Workers Roundtable, Washington, DC, September 27, 2013.

"Are Gender Differences Emerging in the Retirement Patterns of the Early Boomers?" Presentation at the 88th Annual Conference of the Western Economic Association International, Seattle, WA, June 30, 2013.

"Getting Older, Getting Hired." Invited guest on WGBH's "Boston Public Radio," Boston, MA, January 22, 2013.

"Employment Experiences of Older Workers in the Context of Shifts in the National Economy." Presentation at the 65th Annual Scientific Meeting of the Gerontological Society of America (GSA), San Diego, CA, November 17, 2012.

"Retirement Patterns and the Macroeconomy, 1992 to 2010: The Prevalence and Determinants of Bridge Jobs, Phased Retirement, and Reentry among Different Cohorts of Older Americans." Presentation at the 2012 Fall Research Conference of the Association for Public Policy Analysis and Management (APPAM), Baltimore, MD, November 9, 2012.

"New Evidence on Self-Employment Transitions among Older Americans with Career Jobs." Presentation at the 87th Annual Conference of the Western Economic Association International, San Francisco, CA, June 30, 2012.

"Work after Retirement: Lessons for Employers and Policymakers from the United States." Invited speaker at Eurofound's "Income from Work after Retirement" Expert Workshop, European Foundation for the Improvement of Living and Work Conditions, Brussels, Belgium, June 15, 2012.

"The Relationship between Work Decisions and Location Later in Life." Presentation at the 2012 Annual Meeting of the Allied Social Science Associations, Chicago, IL, January 7, 2012.

"Building Your Bridge to Retirement'?" Invited guest on AARP's "Inside E Street" for Public Television, Washington, DC, December 7, 2011.

"How Does Occupational Status Impact Bridge Job Prevalence." Presentation at the 2011 Annual Meeting of the Allied Social Science Associations, Denver, CO, January 8, 2011.

"Stepping Stones and Bridge Jobs: Determinants and Outcomes." Presentation at the 2010 Annual Meeting of the Allied Social Science Associations, Atlanta, GA, January 4, 2010.

"Adapting U.S. Retirement Behavior." Discussant at the 2009 Annual Meeting of the Eastern Economic Association, New York, NY, February 27, 2009.

"Retirement Patterns and Determinants among Individuals with a History of Short-Duration Jobs." Presentation at the 2009 Annual Meeting of the Allied Social Science Associations, San Francisco, CA, January 4, 2009.

"The Role of Bridge Jobs in the Retirement Process." Presentation at The Ann Richards Invitational Roundtable on Gender and the Media, Older Workers: Benefits and Obstacles for Women's and Men's Continued Employment, Brandeis University, Waltham, MA, October 24, 2008.

"The Role of Re-entry in the Retirement Process." Presentation at the 2008 Annual Meeting of the Allied Social Science Associations, New Orleans, LA, January 4, 2008.

"A Micro-level Analysis of Recent Increases in Labor Force Participation among Older Workers." Presentation at the Korea Labor Institute Conference on Panel Data, Seoul, Korea, October 25, 2007.

"Bridge Jobs and Retiree Well-being." Presentation at the 2007 Annual Meeting of the Western Economic Association, Seattle, WA, July 2, 2007.

"Self Employment Transitions among Older Workers with Career Jobs," Presentation at the 2007 Annual Meeting of the Eastern Economic Association, New York, NY, February 24, 2007.

"A Micro-level Analysis of Recent Increases in Labor Force Participation among Older Workers." Presentation at the 2006 Annual Meeting of the Western Economic Association, San Diego, CA, July 2, 2006.

"Retirement Patterns and Bridge Jobs among the HRS War Babies." Presentation at the 2005 Annual Meeting of the Western Economic Association, San Francisco, CA, July 7, 2005.

SEAK Annual National Expert Witness Conference, Hyannis, MA, June 16-17, 2005.

"The Social Security Debate: Why Should I Care about Reforms?" Invited guest for a panel discussion on Social Security Personal Accounts, Drew University Economics Department, Madison, NJ, April 12, 2005.

"The Role of the Economist in Assessing Damages for Defendants." Presentation at Liberty Mutual Group, Marlton, NJ, March 18, 2005.

"Was the 9/11 Victim Compensation Fund a Success? A Forensic Economist's View." Presentation at the 2005 Annual Meeting of the Eastern Economic Association, New York, NY, March 5, 2005.

"Recent Evidence on Retirement Patterns and Bridge Jobs." Presentation at the 2005 Annual Meeting of the Eastern Economic Association, New York, NY, March 4, 2005.

"A Retrospective Examination of the 9/11 Victim Compensation Fund Awards: Calculated vs. Actual Economic Loss Awards." Presentation at the 2005 Annual Meeting of the Allied Social Science Associations: Expanding the Frontiers of Economics, Philadelphia, PA, January 8, 2005.

"Are Traditional Retirements a Thing of the Past?" Presentation at the U.S. Bureau of Labor Statistics, Washington, DC, December 16, 2004.

"How Well Prepared Are Massachusetts Families for Retirement?" Presentation at the New England Study Group, Federal Reserve Bank of Boston, Boston, MA, October 12, 2004.

Annual Meeting of the Allied Social Science Associations, San Diego, CA, January 3-5, 2004.

"Securing Retirement Income for Tomorrow's Retirees." Session Chair for the Sandell Grant Program Presentations at the Fifth Annual Conference of the Social Security Retirement Research Consortium, Washington, DC, May 15-16, 2003.

"Retirees Back at Work." Invited guest for "On Point," *National Public Radio*, Boston, MA, March 12, 2003.

"The Changing Retirement Income Landscape." Presentation at the Ethics and Aging Seminar Series at Boston College, Chestnut Hill, MA, February 3, 2003.

"Social Security Reform: The Relationship between Today's Program and Tomorrow's." Discussant at the 55th Annual Scientific Meeting of the Gerontological Society of America, Boston, MA, November 26th, 2002.

"Patterns of Child Care Use among Low-Income Families." Presentation at the National Association for Welfare Research and Statistics (NAWRS) 42nd Annual Workshop: Research, Reauthorization, and Beyond, Albuquerque, NM, August 25-28, 2002.

Annual Meeting of the Allied Social Science Associations, Boston, MA, January 7-9, 2000.

"The Outlook for Retirement Income." Second Annual Conference of the Social Security Retirement Research Consortium, Washington, DC, May 17-18, 2000.

"New Developments in Retirement Research." First Annual Joint Conference of the Social Security Retirement Research Consortium, Washington, DC, May 20-21, 1999.

"AHEAD (Asset and Health Dynamics Among the Oldest Old) Summer Workshop." Survey Research Center, The University of Michigan, Ann Arbor, MI, Summer 1997.

"GSOEP-PSID Summer Workshop." Center for Policy Research, Syracuse University, Syracuse, NY, Summer 1997.

Conference Posters

Cahill KE, James JB, Pitt-Catsouphes M, "How Do Older Healthcare Workers' Preferences for Flexibility Affect Work and Retirement Decisions?" Gerontological Society of America (GSA) 66th Annual Scientific Meeting, November 20-24, 2013.

Wu E, Cahill KE, Bieri C, Ben-Hamadi R, Yu AP, Erder MH, "Comparison of Hospitalization Use and Health Care Costs of Elderly Major Depressive Disorder (MDD) Patients Treated with Escitalopram, Generic SSRIs, and SNRIs," International Society for Pharmacoeconomics and Outcomes Research (ISPOR) 14th Annual International Meeting, May 16-20, 2009.

Cahill, KE, Giandrea MD, Quinn JF, "Retirement Behavior among Individuals with Erratic Work Histories," Gerontological Society of America (GSA) 61st Annual Scientific Meeting, November 21-25, 2008.

Jaff MR, Engelhart L, Rosen E, Yu AP, Cahill KE, "Clinical and Economic Outcomes among U.S. Medicare Beneficiaries with Lower Extremity Peripheral Arterial Disease (PAD)," International Symposium on Endovascular Therapy (ISET), January 20-24, 2008.

Giandrea MD, Cahill KE, Quinn JF, "Self Employment Transitions among Older Workers with Career Jobs," Gerontological Society of America (GSA) 60th Annual Scientific Meeting, November 16-20, 2007.

Lee LJ, Yu AP, Cahill KE, Birnbaum HG, Oglesby AK, Tang J, Qiu Y, "Direct and Indirect Costs among Employees with Diabetic Retinopathy," American Diabetes Association (ADA) 67th Scientific Sessions, June 22-26, 2007.

Yu AP, Cahill KE, Birnbaum HG, Lee LJ, Oglesby AK, Tang J, Qiu, Y, "Direct and Indirect Costs Associated with Photocoagulation and Vitrectomy among Employees with Diabetic Retinopathy," International Society for Pharmacoeconomics and Outcomes Research (ISPOR) 12th International Meeting, May 19-23, 2007.

Wu E, Patel P, Krishnan E, Yu AP, Cahill KE, Tang J, Mody R, "Healthcare Cost of Gout in an Elderly Population: A Claims Database Analysis," American Geriatrics Society (AGS) 2007 Annual Scientific Meeting, May 2-6, 2007.

Wu E, Mody R, Krishnan E, Yu AP, Cahill KE, Tang J, Patel P, "Tighter Control of Serum Uric Acid in Gout is Associated with Lower Morbidity and Health Care Costs," American College of Rheumatology (ACR) Annual Scientific Meeting, November 10-15, 2006.

Expert Reports, Trial and Deposition Declaration

Michael Davis and Julie Davis, et al. vs. Cedar Grove Composting, Inc., loss of use and enjoyment of property proceeding, Superior Court for Snohomish County, State of Washington, opinion as to defendant's positive economic impacts and achievement of stated public policy goals, declaration taken in deposition, February 13, 2017; Catherine Avila and Dionicilo Avila, et al. vs. Cedar Grove Composting, Inc., loss of use and enjoyment of property proceeding, Superior Court for King County, State of Washington, opinion as to defendant's positive economic impacts and achievement of stated public policy goals, declaration taken in deposition, February 13, 2017.

Application by TransCanada Keystone Pipeline, LP for a Permit to Construct Keystone XL Pipeline, Before the Public Utilities Commission (PUC) of the State of South Dakota, rebuttal declaration on behalf of Standing Rock Sioux Tribe regarding the socioeconomic analysis contained in the U.S. Department of State's Final Supplemental

Environmental Impact Statement on the Keystone XL Pipeline Project, declaration taken in Pierre, SD in front of the PUC, August 3, 2015.

Multnomah County vs. Conway Construction Company, et al., bridge construction damages proceeding, Multnomah County Circuit Court, Oregon, opinion as to plaintiff's economic damages due to the installation of defective bridge decking, declaration taken in trial, February 25, 2015.

KForce vs. Brett Oxenhandler, et al., business damages proceeding, United States District Court, Western District of Washington at Seattle, opinion as to plaintiff's calculation of economic damages, declaration taken in deposition, February 5, 2015.

State of Oregon, ex rel. John Kroger, Attorney General vs. AU Optronics Corporation, et al., TFT-LCD antitrust litigation, United States District Court, Northern District of California at San Francisco, opinion as to the apportionment of damages across purchaser and product groups, declaration taken in deposition, August 11, 2014.

David Sawyer and Joan Sawyer vs. Metropolitan Life Insurance Company, et al., personal injury proceeding, Middlesex County Superior Court, Massachusetts, opinion as to plaintiff's lost earning capacity, declaration taken in deposition, April 16, 2013.

Expert Economic Assessment of the USAF Socioeconomic Impact Analysis for Boise AGS, report submitted to the United States Air Force, March 3, 2012.

Council on American Islamic Relations – New Jersey, Inc., et al. vs. Bergman Real Estate Group, et al., business damages proceeding, Essex County Superior Court, New Jersey, opinion as to plaintiff's lost fundraising revenue, declaration taken in deposition, September 21, 2005.

Garfinkel vs. Morristown Obstetrics and Gynecology Associates, et al., Hon. Stephen F. Smith, Morris County Superior Court, New Jersey, opinion as to defendants' lost profits, declaration taken in trial, June 23, 2005.

Edwards vs. City of New York, wrongful termination proceeding, Hon. Fernando Tapia, New York City Civil Court, Bronx County, New York, opinion as to the loss of earnings, fringe benefits, and pension benefits, declaration taken in trial, June 1, 2005.

Allen vs. Euromarket Designs, Inc., wrongful termination proceeding, Hon. Stephen J. Burnstein, Essex County Superior Court, New Jersey, opinion as to the loss of earnings, declaration taken in trial, April 20, 2005.

Ali vs. Cervelli, personal injury proceeding, Hon. Robert P. Contillo, Bergen County Superior Court, New Jersey, opinion as to the loss of income from the family business and the loss of household services, declaration taken in trial, April 13-14, 2005.

Peskin vs. AT&T Corporation, wrongful termination proceeding, Somerset County Superior Court, New Jersey, opinion as to the loss of earnings, declaration taken in deposition, April 8, 2005.

Garfinkel vs. Morristown Obstetrics and Gynecology Associates, et al., wrongful termination proceeding, Morris County Superior Court, New Jersey, opinion as to defendants' lost profits, declaration taken in deposition, March 16, 2005.

Packard vs. The Bessemer Group, wrongful termination proceeding, Middlesex County Superior Court, New Jersey, opinion as to the loss of earnings and pension benefits, declaration taken in deposition, February 17, 2005.

Durant vs. The Associates, business damages proceeding, Hon. Nicholas J. Stroumtsos, Jr., Middlesex County Superior Court, New Jersey, opinion as to the loss of incremental profit, declaration taken in trial, December 15, 2004.

Durant vs. The Associates, business damages proceeding, Middlesex County Superior Court, New Jersey, opinion as to the loss of incremental profit, declaration taken in deposition, November 22, 2004.

Luisi vs. Luisi, divorce proceeding, Hon. Rachel A. Adams, Richmond County Supreme Court, New York, opinion as to the value of enhanced earning capacity, declaration taken in trial, November 11, 2004.

Newspaper, Periodicals, Blogs and Other Publications

Cahill, Kevin E., and Casey Keck. 2017. "What Are the Economic, Social, and Civic Impacts of a Welcoming Framework?" Working Paper. Research funded by Welcoming America.

Cahill, Kevin E. 2016. "It's Baaaack: The Flawed Argument That Older Workers Should Step Aside." *Huffington Post* (September).

Cahill, Kevin E., Andrew Dyke, and John Tapogna. 2016. "Pension Generosity in Oregon and Its Impact on Midcareer Teacher Attrition and Older Teachers' K12 Workforce Exit Decisions." CEDR Policy Brief 2016-6. University of Washington, Seattle, WA.

Cahill, Kevin E., Andrew Dyke, and John Tapogna. 2016. "The Impact of Oregon's Pension Legacy Costs on New Teacher Turnover and Quality." CEDR Policy Brief 2016-5. University of Washington, Seattle, WA.

Cahill, Kevin E. 2016. "Shouldn't We Lead by Example if We Want Americans to Save More for Retirement?" *Huffington Post* (May).

Cahill, Kevin E., Andrew Dyke, and John Tapogna. 2016. "Does Idaho Come Up Short on College and Career Readiness? Absolutely." *Idaho Statesman* (March).

Cahill, Kevin E., John Tapogna, Andrew Dyke, Melissa Rowe, Tessa Krebs, and Ryan Knapp. 2015. "To What Extent is there a Skills Gap in Idaho?" ECONorthwest *Issue Brief* (July).

Cahill, Kevin E. 2014. "A New Perspective on Older Workers." *Idaho Business Review* (June).

Tapogna, John, Kevin E. Cahill, and Andrew Dyke. 2014. "Comparing Spending and Academic Results is Imperative." *Idaho Education News* (June).

Cahill, Kevin E., John Tapogna, and Jay Bloom. 2014. "Societal Aging Need Not Mean Slower Growth for Oregon." *The Oregonian* (May).

Cahill, Kevin E., Michael D. Giandrea, and Gene J. Kovacs. 2014. "Self-Employment: The Answer for an Aging Workforce and a Sluggish Economy?" Sloan Center on Aging & Work, AGE*nda* (March).

Cahill, Kevin E., and Jacquelyn B. James. 2013. "A Cost/Benefit View of Occasional Flexibility." Sloan Center on Aging & Work, AGE*nda* (December).

Cahill, Kevin E. and Jacquelyn B. James. 2013. "Small Request, Big Impact: The Importance of Occasional Flexibility in a Healthcare Setting." Sloan Center on Aging & Work at Boston College *Issue Brief* (November).

Cahill, Kevin E., John Tapogna, Rod Gramer, and Diana Lachiondo. 2013. "To What Extent Will Demographic Changes Help Idaho Reach Its Educational Attainment Goals for 2020?" ECONorthwest *Issue Brief* (October).

Cahill, Kevin E., and Gene J. Kovacs. 2013. "Santa Claus, the Easter Bunny, and Traditional Retirement." Sloan Center on Aging & Work, AGE*nda* (May).

Cahill, Kevin E., Jacquelyn James, Marcie Pitt-Catsouphes, and Maureen O'Keeffe. 2012. "Late-Career Flexibility: Beyond Phased Retirement." *HR Pulse Magazine* (December).

Cahill, Kevin E. and Paul Thoma. 2012. "What Does the Aging of Idaho Mean for its Citizens, Employers, and Policymakers?" ECONorthwest *Issue Brief* (September).

Cahill, Kevin E., and Gene J. Kovacs. 2012. "Should You Be Counting on the Social Security Trust Fund?" Sloan Center on Aging & Work, AGE*nda* (September).

Cahill, Kevin E., John Tapogna, Paul Thoma, and Bryce Ward. 2012. "Is Boise Over- or Underperforming Economically?" ECONorthwest *Issue Brief* (August).

Cahill, Kevin E. 2012. "What Ichiro's Departure Says About Loyalty and the Employer-Employee Relationship." *The Seattle Times* (July).

Cahill, Kevin E. 2012. "Thinking about Phased Retirement?" Sloan Center on Aging & Work, AGE*nda* (June).

Sweet, Stephen and Kevin E. Cahill. 2012. "How the Health Care Sector Can Prepare for the Aging of Its Workforce?" Sloan Center on Aging & Work, AGE*nda* (April).

Cahill, Kevin E. and Stephen Sweet. 2012. "Should Older Americans Feel Gloomy About Their Job Prospects?" Sloan Center on Aging & Work, AGE*nda* (March).

Cahill, Kevin E. 2012. "F-35 Opponent Questions Air Force Report." *The Boise Guardian* (February).

Cahill, Kevin E. 2012. "Five Reasons Why Flexible Work Options Are Good Business in a Bad Economy." Sloan Center on Aging & Work, AGE*nda* (February).

Cahill, Kevin E. 2011. "Should Older Workers Step Aside?" *Huffington Post Blog* (featured article) (August) and Sloan Center on Aging & Work, AGE*nda* (December).

Letters to the Editor, *The Wall Street Journal*, 2015 (April), 2014 (March), 2013 (November), 2012 (May), 2011 (March), 2006 (November), 2005 (May); *The Idaho Statesman*, 2012 (April).

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Exhibit 2A
“Reply Declaration of Kevin E. Cahill, PhD, Regarding the Accenture Report and the Economics of Local Government Right of Way Fees.”

EXHIBIT 2A
Exhibit 3

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C.

STREAMLINING DEPLOYMENT OF SMALL CELL INFRASTRUCTURE BY IMPROVING WIRELESS FACILITIES SITING POLICIES; MOBILITIE, LLC PETITION FOR DECLARATORY RULING	WT Docket No. 16-421

REPLY DECLARATION OF KEVIN E. CAHILL, PHD
REGARDING THE ACCENTURE REPORT AND
THE ECONOMICS OF LOCAL GOVERNMENT RIGHT OF WAY FEES

April 7, 2017

REPLY DECLARATION OF KEVIN E. CAHILL, PHD
REGARDING THE ACCENTURE REPORT AND
THE ECONOMICS OF LOCAL GOVERNMENT RIGHT OF WAY FEES

I. INTRODUCTION

A. Author

1. My name is Kevin E. Cahill, PhD. I am a project director, senior economist, and litigation practice area lead at ECONorthwest, a public policy and economics consulting firm based in Portland, Oregon. I have published on a variety of topics related to applied microeconomics and have presented my research at academic conferences nationwide. I am also experienced in commercial litigation and antitrust matters, labor economics, and public policy and have testified numerous times in deposition and at trial. I earned my BA in mathematics and economics (with honors) from Rutgers College and MA and PhD in economics from Boston College. My professional and academic qualifications are described in my curriculum vitae, which is attached as Appendix A to my March 8, 2017 Declaration in this matter.[1]

B. Purpose

2. This Reply Declaration addresses a recent report by Accenture that was submitted during the Comment phase in this matter.[2] Specifically, I address four topics in the Accenture Report that pertain to my Declaration dated March 8, 2017. These four topics are: 1) access to public rights of way; 2) local permitting and regulations; 3) fee structures; and 4) subsidizing 5G technology.

C. Summary of Opinions

3. The efficient allocation of rights of way (ROW) comes about when municipalities can charge fair market rates for ROW access. As I explained in my Declaration dated March 8, 2017, the fair market rate should "compensate the municipality not only for the administrative costs and operations and maintenance (O&M) costs associated with ROW access, but also for the fixed costs that the municipality incurred to create the ROW, the opportunity costs associated with occupying the ROW ... and any negative externalities associated with placement of a

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[1] Declaration of Kevin E. Cahill, PhD, *The Economics of Local Government Right of Way Fees*, Before the Federal Communications Commission. In the Matter of Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies; Mobilitie, LLC Petition for Declaratory Ruling, WT Docket No. 16-421 (March 8, 2017) ("Cahill Declaration").

[2] Amine, M. A., Mathias, K., and Dyer, T. 2017. *Smart Cities: How 5G Can Help Municipalities Become Vibrant Smart Cities*. Report commissioned by CTIA. Toronto, Canada: Accenture ("Accenture Report"). https://newsroom.accenture.com/content/1101/files/Accenture_5G-Municipalities-Become-Smart-Cities.pdf.

facility in the rights of way …"[3, 4] Such pricing does not inefficiently limit the economic benefits of 5G technology described in the Accenture Report. Quite the contrary. Such pricing leads to the efficient allocation of ROW, a scarce resource, and can also be expected to lead to the most efficient deployment of 5G, which may or may not be within the rights of way.

4. Regarding the benefits of 5G, the authors of the Accenture Report estimate that, "This next generation of wireless technology is expected to create 3 million new jobs and boost annual GDP by $500 billion, driven by a projected $275 billion investment from telecom operators."[5] Competition within and between municipalities, and between municipalities and private land owners, implies that municipalities have little incentive to impede the rollout of 5G technology and every incentive to work with telecom operators to bring such sizable benefits to their communities.
5. Regarding local permitting and regulations, the Accenture Report largely ignores the costs to municipalities for processing and managing the volume of anticipated industry requests for 5G ROW access. My understanding is that a common model is to charge a fee that covers the costs that a municipality incurs in conducting the inspections and proceedings required to allow entry, fees that cover ongoing costs associated with inspection or expansion of facilities, and a rent that reflects, in effect, the value of the property occupied. All of these costs, including the fixed and variable costs associated with managing requests to access ROW, need to be taken into account by a municipality to achieve the efficient allocation of the ROW. Indeed, one way to ensure that municipalities have adequate resources to respond to the increase in ROW requests is by charging market rates. As noted above, this rate should include the full incremental administrative and operations and management (O&M) costs, in addition to considering fixed costs, opportunity costs, and negative externalities.

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[3] Cahill Declaration, ¶ 3.

[4] Throughout this report I use the term "market rate" in an economic sense. As I noted in my Declaration dated March 8, 2017, "[f]rom an economics perspective the term 'cost' as it pertains to access to ROW, and the 'market rate' based on this cost, incorporates both those associated with regulatory fees (e.g., administrative costs and operations and management costs) and those associated with market rents (e.g., opportunity costs and negative externalities)" (Cahill Declaration, fn. 2).

[5] Accenture Report, p. 3.

6. Regarding fee structures, the Accenture Report implies that fees structures could be a barrier to the deployment of 5G technology and make implementation financially unfeasible.[6] This statement simply does not pass any reasonable smell test. It seems implausible that the economic benefits of 5G technology are expected to increase GDP *annually* by one half *trillion* dollars but that a subsidy is required due to existing fee structures. More realistically, competitive forces will reveal the optimal fee structure for ROW access in addition to the optimal level.
7. Regarding subsidies, allowing telecom operators to access ROW at below-market rates constitutes an implicit subsidy that will result in the overutilization of ROW for the purposes of deploying 5G technology. Such overutilization would likely inhibit the rollout of subsequent generations of technology and thereby discourage the most efficient deployment of 5G in an intertemporal sense. As I understand it, based on the report by Andrew Afflerbach, no 5G standards have been adopted yet, and it is far from clear how 5G will be deployed, and with what form factors.[7] Essentially, by placing a thumb on the scale in the form of a subsidy, the FCC could be encouraging deployment with high negative externalities (e.g., deployments that reduce the value of adjoining properties or affect third party use of assets) because municipalities will be unable to charge rates that discourage such deployments.

II. COMMENTS ON ACCESS TO PUBLIC RIGHTS OF WAY

8. The Accenture Report notes the importance of access to public rights of way to the rollout of 5G technology. The report states, "Without Public Rights of Way, the deployment of next-generation small-cell technology will continue to suffer—and communities will not be able to enjoy its benefits."[8] I note at the outset of this report that, as a technical matter, my understanding is that there is evidence before the Commission, submitted in the report by

[6] Accenture Report, p. 13.

[7] Report and Declaration of Andrew Afflerbach for the Smart Communities Siting Coalition, Before the Federal Communications Commission. In the Matter of Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies; Mobilite, LLC Petition for Declaratory Ruling. WT Docket No. 16-421 (March 8, 2017) ("Afflerbach Declaration"), p. 15.

[8] Accenture Report, p. 13.

Andrew Afflerbach, that calls this assertion into question on several basic levels.[9] For the purposes of this report, I will take this statement as true. As I explain below, even if this statement is true, it does not necessitate limiting fees that can be charged by localities (whether for permits or for rents) to administrative costs and operations and maintenance (O&M) costs.

9. As I documented in my Declaration dated March 8, 2017, a municipal ROW is a scarce economic resource.[10] As such, a municipality's choice to allocate ROW for one purpose means that, so long as the user has access to the ROW, the municipality foregoes other opportunities to use the resource.[11] The efficient allocation of this scarce resource depends on the price municipalities charge users to access the ROW. A price set too low (i.e., below the market-clearing price) will result in excess demand and an overutilization of the resource. A price set too high will lead to insufficient demand and an underutilization of the resource. Moreover, one would expect that different uses of ROW would have different impacts on surrounding properties, a point made in the report before the Commission on potential impacts on property values.[12] Underpricing right of way encourages deployments with negative externalities, because municipalities cannot charge to discourage such uses, and further discourages investment on behalf of potential users that may result in more innovative deployments.

10. Accenture estimates that, "This next generation of wireless technology is expected to create 3 million new jobs and boost annual GDP by $500 billion, driven by a projected $275 billion investment from telecom operators."[13] Municipalities have every incentive to work with telecom operators to bring such sizable benefits to their communities and have little or no incentive to impede the rollout of 5G technology. As I noted in my Declaration dated March

[9] Afflerbach Declaration, p. 16.

[10] Cahill Declaration, ¶ 8.

[11] This statement does not imply that the ROW cannot be shared. My point is that the use of ROW forecloses the use of that space by others. For example, the placement of a structure, such as a pole, in the right of way favors the pole owner and those who wish to place facilities on the pole. The presence of the pole, however, can block other uses of the ROW (e.g., the placement of a public trash can at that spot that helps keep streets clean).

[12] Report and Declaration of David E. Burgoyne for the Smart Communities Siting Coalition, Before the Federal Communications Commission. In the Matter of Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies; Mobilitie, LLC Petition for Declaratory Ruling. WT Docket No. 16-421 (March 7, 2017) ("Burgoyne Declaration"), pp. 1-2; 5-9.

[13] Accenture Report, p. 3.

8, 2017, competition both within and across municipalities and between municipalities and private property owners disciplines municipalities from overcharging for access to ROW.[14]

11. The determination of the fair and reasonable market price for accessing public ROW will depend on the circumstances of each municipality, including the preferences of its citizens. To be sure, some municipalities may choose to price below the market rate, an implicit subsidy, to attract telecommunications companies, just as localities sometimes subsidize new business entry into a community. Indeed, an economist would expect differences in pricing to encourage the efficient use of the rights of way, and such differences in pricing can manifest itself in many different ways (e.g., public-private financing, service subsidies). In contrast, a situation in which every community is required to charge less than market value for the deployment of a particular technology is equivalent to requiring all municipalities to offer a subsidy, regardless of whether such a subsidy is justified. Such forced subsidies (when not the outcome of a well-vetted public policy objective) will inevitably lead to an inefficient outcome with respect to the use of ROW and possibly also with respect to the use of private property.
12. In short, charging the market rate to access public ROWs will help ensure efficient allocation of the ROW resource.[15] It will also help ensure that municipalities have sufficient labor and related resources to process the expected dramatic increase in 5G ROW requests, discussed in the following section.

III. COMMENTS ON LOCAL PERMITTING AND REGULATIONS

13. The Accenture Report notes that deploying 5G technology throughout municipal ROW will "pose a tremendous challenge to both telecom operators and municipalities."[16] The remainder of this section in the Accenture Report, however, describes problems exclusively associated with telecom operators, such as slow turnaround and approval times, numerous tribunals for approval, and discretionary reviews of installations. Further, very few specifics are provided in this section, and it is not clear whether the authors of the Accenture Report have any

[14] Cahill Declaration, ¶¶ 13-18.

[15] I use the term "market rate" in an economic sense. See footnote 4 for more information.

[16] Accenture Report, p. 13.

significant basis for their assertions or whether the authors have conducted any independent effort to assess delays.

14. Setting aside these verification issues, the Accenture Report ignores the difficulties that *municipalities* will face processing and managing the volume of industry requests for 5G ROW access. The Accenture Report notes that ROW requests could be up to 100 times greater than requests for current technology.[17] Increasing such requests by a factor of 100 will place unprecedented demands on municipal staff, resources, and budgets, as shown in the Smart Communities filing, and the filing by other municipalities in this docket.[18]
15. The Accenture Report implies that 5G technology will be deployed coincidently with existing towers: "Existing towers will provide coverage for miles, while small cells will support the increased needs of a Smart City."[19] Such an approach burdens municipalities with managing existing antenna sites in the ROW, along with the rollout of 5G ROW requests, and thereby increases costs on municipalities beyond just the demands for 5G ROW access.
16. As I describe in my Declaration dated March 8, 2017, one way of ensuring that municipalities have adequate resources to respond to the increase in ROW requests is by charging market rates to access municipal ROWs.[20] In addition to taking into account fixed costs, opportunity costs, and negative externalities, the rate should also take into account the full incremental administrative and operations and management (O&M) costs that come with granting access to ROW.[21] Restricting what municipalities can charge would result in an implicit subsidy to telecom operators at the expense of municipalities and lead to an inefficient allocation of ROW.
17. A related point is that the Accenture Report, in commenting about "slow" turnaround and approval times and partial approvals, is silent about instances in which these outcomes are due to telecom operators' actions. Incomplete applications for ROW access, for example, and the increased burden this imposes on municipalities, can be a significant driver of turnaround

[17] Accenture Report, p. 13.

[18] Afflerbach Declaration, pp. 15; 20-21.

[19] Accenture Report, p. 12.

[20] Again, I use the term "market rate" in an economic sense. See footnote 4 for more information.

[21] Cahill Declaration, ¶¶ 21-22.

times for processing applications.[22] Yet such explanations are left out of the Accenture Report.

18. Finally, the Accenture Reports provides no documentation or citations to support the purported challenges that telecom operators face when having to comply with municipal permitting and regulation requirements. The Accenture Report includes statements such as, "In many cities…," and "Some cities …," without attribution or support.[23] As such, their description of alleged problems amounts to unsubstantiated anecdotes.

IV. COMMENTS ON FEE STRUCTURES

19. The Accenture Report implies that fees structures could be a barrier to the deployment of 5G technology and make implementation unfeasible. "In many instances, fees imposed on small cells are comparable to those imposed on macro cells without regard to their differences. The application fees and other acquisition fees (including rental) of macrocell sites are applied to each of the 50 to 100 small cells required resulting in costs being multiplied and deployment becoming financially unfeasible."[24]
20. As the reports prepared by the Smart Communities have shown, however, placement in the rights of way can involve significantly different and more complex issues than, say, placement of a tower on farmland.[25] While the latter undoubtedly requires important analyses, deployment of small cell technology requires coordination with other utilities, consideration of Americans with Disabilities Act (ADA) impacts, potential traffic interference/sight line, and other issues that may not arise at all for a larger facility. Likewise, the "small cell" may not be physically "small" at all as the term refers to its covering a small area. It is far from obvious that because one cell covers a large area, and another serves a small area, that issues for the placement of one are less costly to consider than the other.[26]

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[22] Afflerbach Declaration, pp. 20-21.

[23] Accenture Report, p. 13.

[24] Accenture Report, p. 13.

[25] Afflerbach Declaration, pp. 2-8; Report and Declaration of Steven M. Puuri for the Smart Communities Siting Coalition, Before the Federal Communications Commission. In the Matter of Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies; Mobilitie, LLC Petition for Declaratory Ruling. WT Docket No. 16-421 (March 7, 2017) ("Puuri Declaration"), pp. 1-5.

[26] Afflerbach Declaration, pp. 2-11.

21. Setting aside the issue that no supporting documentation is provided for the Accenture Report's claim regarding "small cell" fees, and that their claim is in fact contradicted by evidence before the Commission,[27] this statement indicates that 5G technology might not be financially feasible if telecom operators are required to pay the market rate. In effect, the industry needs municipalities to subsidize 5G technology for deployment to be financially feasible. This statement simply does not pass any reasonable smell test. It seems implausible that the economic benefits of 5G technology are expected to increase GDP *annually* by one half *trillion* dollars but that a subsidy is required due to existing fee structures. If the technology is as beneficial as Accenture claims, one would expect that the industry would be able to charge for services in a manner that allows it to pay fair market value for the resources it will use. If the industry will be unable to pay fair market value for its inputs, then that implies the economic benefits touted in the Accenture Report are overstated. Generally speaking, either the economic benefits are very large or the industry needs to be subsidized.
22. Another reason that arguments about fee structures do not make sense is that municipalities have every incentive to implement an efficient fee structure. As I noted in my Declaration dated March 8, 2017, competition not only reveals the market rate for ROW access, but competition also reveals the optimal form in which payments are made.[28] If the benefits of 5G are as large as Accenture claims them to be, municipalities have every incentive to work with telecom operators with respect to the level and structure of fees to facilitate the adoption of the new technology in an economically efficient manner.
23. Finally, given the competitive environment in which municipalities reside, one economically meaningful approach to assessing the validity of the industry's arguments regarding 5G ROW requests is to consider the municipalities' perspective. Does a municipality incur fewer costs to process and manage ROW requests for 5G versus existing technology? Are economies of scale possible when a municipality processes a 100-fold increase in ROW requests from multiple providers in a short timeframe? If cost savings can be obtained through a different pricing structure, a municipality will adopt that structure lest its competitors do so and gain a strategic advantage in the process.

[27] Afflerbach Declaration, pp. 2-8; 15.

[28] Cahill Declaration, ¶ 33.

V. COMMENTS ON SUBSIDIZING 5G TECHNOLOGY

24. Just because an activity has an economic benefit, however large, does not imply that the activity is worthwhile or that a subsidy is warranted. The benefits of any activity need to be weighed against the costs in order to achieve an economically efficient outcome. The Accenture Report focuses almost exclusively on the telecom industry's interests, and ignores the municipalities' perspective and the costs municipalities will incur. The fact that 5G deployment will support jobs, for example, is no reason to require municipalities to charge below-market ROW fees to promote the rollout of 5G technology.[29] Such an action would simply transfer costs from the industry—and from their customers, the consumers of 5G technology—to municipalities. Critically, if the economic impact analysis conducted by Accenture is correct, we would expect to see these economic benefits even if the market value for ROW access is charged.
25. Pricing below the market rate amounts to an implicit subsidy for 5G technology. Of course, in many instances, it is in societal interest to subsidize an industry. As noted above, for example, and as stated in my initial Declaration, some municipalities might offer discounts for ROW access in order to promote an earlier adoption of 5G technology in their communities. Further, some broad-based policy in which subsidies are applied to all communities could be socially optimal should the Commission decide that deployment of 5G technology serves some broader social interest or that some market failure exists in the industry, such as a free-rider problem. Crucially, the Accenture Report provides no justification for such a society-wide subsidy for 5G technology, yet the industry's advocacy for a below-market rate is, at its core, a request for such a subsidy. As noted throughout this report, forcing municipalities to offer a subsidy via below-market pricing for access to its ROW will inevitably result in an overutilization of ROW and an inefficient deployment of 5G technology.
26. For example, one consequence of subsidizing 5G deployment through below-market rates is that overutilization of ROW for the purposes of deploying 5G technology could very well inhibit the rollout of subsequent generations of technology. This places regulators in the

[29] The Accenture Report states, "Communities of all sizes are likely to see jobs created. Small to medium-sized cities with a population of 30,000 to 100,000 could see 300 to 1000 jobs created. In larger cities like Chicago, we could see as many as 90,000 jobs created" (p. 4).

position of picking "winning" technologies, from a chronological standpoint, rather than having market forces dictate the efficient outcome. Another consequence is that below-market pricing could inhibit innovation with respect to how ROW are used, such as a recent innovative collaborative between Philips and PG&E with respect to how a two-way communicating meter was attached to a smart pole.[30]

VI. CONCLUSION

27. The efficient allocation of ROW access comes about when municipalities can charge a market rate for public ROW access. This rate should compensate the municipality for its administrative costs and O&M costs, its fixed costs that were incurred to create the ROW, its opportunity costs of providing access to the ROW, and any negative externalities from the user. This market rate will not inhibit the efficient rollout of 5G technology, nor will it inefficiently limit the economic benefits of 5G technology described in the Accenture Report.

[30] Philips. 2015. *Philips and City of San Jose Partner to Deploy Philips SmartPoles Pilot Project Combining Energy Efficient LED Street Lighting with Wireless Broadband Technology from Ericsson*. Somerset, NJ: Philips. http://www.philips.com/a-w/about/news/archive/standard/news/press/2015/20151208-Philips-and-City-of-San-Jose-partner-to-deploy-Philips-SmartPoles-pilot-project.html.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 7, 2017.

Kevin E. Cahill, PhD
Project Director
ECONorthwest

Exhibit 3
Report and Declaration of David E Burgoyne for the Smart Communities Siting Coalition

DAVID E. BURGOYNE ASA SR/WA
CERTIFIED GENERAL REAL ESTATE APPRAISER
MICHIGAN, INDIANA, NORTH AND SOUTH CAROLINA
AQB CERTIFIED USPAP INSTRUCTOR

MARK J. ST. DENNIS
BRIAN A. O'NEILL SR/WA RW-AC
SCOTT M. CARLSON
RICHARD J. ANTIO
GOKHAN ANDI

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C.

STREAMLINING DEPLOYMENT	)	
OF SMALL CELL INFRASTRUCTURE	)	
BY IMPROVING WIRELESS FACILITIES	)	WT Docket No. 16-421
SITING POLICIES;	)	
	)	
MOBILITIE, LLC	)	
PETITION FOR DECLARATORY RULING	)	
	)	

REPORT AND DECLARATION OF DAVID E. BURGOYNE
FOR THE SMART COMMUNITIES SITING COALITION

BURGOYNE
APPRAISAL COMPANY

DAVID E. BURGOYNE ASA SR/WA
CERTIFIED GENERAL REAL ESTATE APPRAISER
MICHIGAN, INDIANA, NORTH AND SOUTH CAROLINA
AQB CERTIFIED USPAP INSTRUCTOR

MARK J. ST. DENNIS
BRIAN A. O'NEILL SR/WA RW-AC
SCOTT M. CARLSON
RICHARD J. ANTIO
GOKHAN ANDI

Burgoyne Appraisal Company has investigated the impact of communication towers and communication equipment on nearby property values, including residential properties, commercial properties, and properties in historically designated areas. Our report on such impacts is based upon our more than thirty years of professional appraisal experience and drawing upon literature search of other articles and appraisal papers.

Please note that due to the nature of the report our investigation is general in nature and is not specifically related to any given location.

IMPACT OF COMMUNICATION TOWERS AND EQUIPMENT

ON NEARBY PROPERTY VALUES

I. Executive Summary

- The Burgoyne Appraisal Company ("Burgoyne"), drawing upon its thirty-two (32) years of experience as a Real Estate Appraiser specializing in detrimental conditions, takings, adverse impacts and right-of-way, finds that:

- As a general matter, assuming two generally comparable areas, aesthetics will have the most significant impact on property values. If, for example, I assume two houses of equal age, size and condition in the same residential area, the relative value of one home will be most affected by the aesthetics in the immediate vicinity of that home.

- As a general matter, visible utility structures do adversely affect property values. This is reflected in the fact that, as a general matter property values are higher in areas where there are no aboveground utility facilities (other than lighting) than in areas where utilities are aboveground.

- The impact will generally be related to the size of the facility, the characteristics of the facility, its location (including proximity), and visibility. That is to say, I would expect a tower or other structure that is larger than existing structures to have a greater impact on property values than a structure that is similarly sized and in keeping with other structures. I would expect that installation of equipment that is widely visible to have a more significant impact than equipment that is not (so, for example, a transformer at the top of a pole would have less of an impact than a box of similar size that is within a normal site line, or on the

ground). The characteristics of the facility are also important. An unorganized conglomeration of various boxes and wires would have a greater impact than a streamlined and contained single cabinet.

The literature does not tell us the impact of various iterations of DAS designs on residential properties; there is more information about towers of the sort imposed by Mobilitie. Nonetheless, based on my experience, it would be unwise to assume that the impact of additional ground cabinets, or of structures of the sort that entities would be entitled to install under the FCC's Section 6409 rules is zero or so near to zero. Just looking at the literature on property values in underground v. non-underground areas, there are reasons for concern that justify maintenance of significant latitude at the local level over siting and compensation.

While it is certainly recognized that DAS systems and Cellular antennas are an important part of our nation's infrastructure, and that it is inevitable that new antennas will need to be installed as we move into the future, it is important for municipalities (and property owners, in the case of right-of-way easements) to retain significant control over the size, location, scope, expansion, and characterization of the installations. This is because adverse impacts from negative externalities vary considerably with the size, location, scope, expansion, and characterization of the installations.

Hidden, smaller, and neatly mounted "small cells," will have an impact, but that impact will be lesser than other alternatives. Likewise, there needs to be control over future growth of installed facilities. It is my opinion that the Commission needs to analyze those impacts in detail before considering additional rules. It is also my opinion that municipalities need to retain some regulatory control over these installations in order to minimize impacts and protect the health, welfare, and safety of their residents in the same way that other regulations and the exercise of reasonable police powers do.

II. Qualifications

David E. Burgoyne, ASA, SR/WA, is a native of Ann Arbor, Michigan and attended Greenhills School in Ann Arbor. He graduated in 1981 from Colgate University in Hamilton, New York with a Bachelor of Arts Degree in Liberal Arts with a concentration in Physics-Astronomy. He also served as a graduate instructor at the University of Wyoming as a Doctoral Candidate in Astrophysics.

Mr. Burgoyne is an independent fee appraiser currently licensed as a Certified General Real Estate Appraiser by the States of Michigan, Indiana, North and South Carolina. Mr. Burgoyne is a Senior Member of the American Society of Appraisers holding the ASA Designation for Real Property. Mr. Burgoyne is currently re-accredited as an ASA through June 10, 2017. He is also a senior member holding the SR/WA designation and is a Past Chapter President of the International Right of Way Association. Mr. Burgoyne is currently re-certified as an SR/WA through June 15, 2018.

Mr. Burgoyne is an AQB certified USPAP instructor #44603 (expiring March 31, 2018) and is also a CLIMB Certified Instructor of right-of-way appraisal and other courses for IRWA, including courses on the appraisal of partial takings, easement valuation, appraisal review, ethics and standards, USPAP, adult education, and the valuation of contaminated properties. In 2015, Mr. Burgoyne was awarded the 2014 W. Howard Armstrong International Instructor of the Year Award by the International Right of Way Association.

Mr. Burgoyne has qualified as an expert witness in the United States Court of Claims, the United States District Courts for the Eastern and Western Districts of Michigan; the Michigan Circuit Courts of Allegan, Barry, Cass, Eaton, Genesee, Grand Traverse, Huron, Ingham, Jackson, Kent, Lapeer, Leelanau, Lenawee, Macomb, Montmorency, Muskegon, Oakland, Ottawa, Tuscola, Washtenaw, Wayne, and Wexford Counties; Hamilton and Marion Counties in Indiana, The Michigan Public Service Commission, and The Michigan Tax Tribunal. He has also been appointed as an independent appraiser by the U. S. District Court, Eastern District of Michigan.

FORMAL EDUCATION

Greenhills School - Ann Arbor, Michigan (1976)

Colgate University - Hamilton, New York: BA in Liberal Arts - concentrating in Physics-Astronomy (1981)

Courses included Architecture, Economics, Mathematics, Statistics and Economic Geography.

University of Wyoming - Laramie, Wyoming: Ph.D. candidate in Astrophysics. (1981-1982)

III. Introduction

Our analysis and the literature we reviewed is focused on single family residential units, and does not take into account any location-specific analysis. For example, we do not consider whether there are special impacts of an installation on particular historic properties, or commercial properties. Burgoyne understands that this report will be contained in a filing by Smart Communities Siting Coalition in response to the Federal Communications Wireless Telecommunications Bureau request for public input[1] including, but not limited to suggestions offered by Mobilitie in its Petition for Declaratory Ruling.[2]

Burgoyne provides the following analysis following a literature scan on appraiser research on communications towers impact and on Mr. Burgoyne's more than 32 years in business.

[1] Public Notice, *Comment Sought on Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies; Mobilitie, LLC Petition for Declaratory Ruling*, WT Docket No. 16-421 (released Dec. 22, 2016)("Public Notice").

[2] *See* Mobilitie, LLC Petition for Declaratory Ruling, *Promoting Broadband for All Americans by Prohibiting Excessive Charges for Access to Public Rights of Way* (filed Nov. 15, 2016)(Mobilitie Petition).

IV. Background

The FCC Notice focuses on small cells and DAS systems. It is our understanding that the placement of these systems could involve:

- Erection of a new tower or monopole 100 to 120 feet in height in public right-of-way. This in fact appears to be proposed by applicant Mobilitie.

- Placement of new base station equipment on existing utility poles in the rights of way, which may involve an initial extension of anywhere between 3-15 feet to that pole for placement of an antenna at the top of the pole, and addition of equipment cabinets, plus additional utility infrastructure (meters and disconnect boxes). It is our understanding that the wireless industry is seeking authority in several states to place equipment cabinets as large as 28 cubic feet on the poles, which could then be expanded significantly as of right under the FCC's Section 6409 rules. In addition, there may be ground cabinets for back-up power or for equipment that might otherwise be placed on the poles of up to 50 cubic feet. Under Section 6409, the placement of these facilities could result in up to three additional ground cabinets being added in the right of way in front of a residential unit.

- Erection of new utility poles, sometimes exceeding 40 feet in height, in the public right-of-way for placement of the above referenced equipment

- Please note that public road rights-of-way are often owned in fee by the municipality but are also not uncommonly easements over private property owned in fee by a private citizen or company. This can be common in areas served by the Government Survey System (outside of the original 13 colonies as well as portions of Ohio, Kentucky and Tennessee). As a result, in these cases, neither the municipality, nor the utility, have complete authority to dictate what is permitted within the right of way.[3]

- From the point of view of sound appraisal practice, it is necessary to presume and consider full utilization of rights granted by virtue of a particular authorization. That is, one must consider the impact of a 120 foot pole if a 120 foot is allowed as of right (even if only a 100 foot pole is installed in the instant case at this time). Likewise, in assessing whether the impact of the authorization of a DAS in a residential neighborhood, one would consider the additions and expansions that would be permitted as of right under the Commission's Section 6409 rules.

[3] "... "[a]ctivities by the owner of the dominant estate [easement holder] that go beyond the reasonable exercise of the use granted by the easement may constitute a trespass to the owner of the servient estate." Schadewald v Brule, 225 Mich App 26, 40; 570 NW2d 788 (1997)... p.2

....we decline to infringe on the private property rights of a landowner through unsupported implication, particularly when there is a complete absence of any legislative intent in the LDA to give a public utility free reign to build on an easement as it pleases. ... AT&T provided no legal basis, facts, or documentary evidence to establish that the city or county has the legal authority to decide on the nature, size, or scope of equipment a utility may install in a utility easement or whether the city or county actually considers said questions when they issue a building permit...p.3. 289 Mich App 70 (2010)

Thus, unless a provider can agree otherwise, if a DAS cabinet is not subject to concealment elements, it appears an appurtenance up to 6 feet could be attached horizontally to the same pole, and that appurtenance would only be subject to the limits that might be imposed by the owner of the pole.

- In this case, I have attempted to consider the impacts of various "small cell" and "DAS" installations by Mobilitie and others, both in light of, and without considering the impact of the FCC Section 6409 rules. I have also looked at state legislation and considered possible impacts if facilities of the permitted size were installed.

V. Areas of Concern

The following areas of concern have been considered and investigated. The most significant are discussed in the following sections.

- Market resistance (or stigma) in general.
- Aesthetics.
- Underground Utilities.
- Changes in the highest and best use of properties.
- Wireless infrastructure and service providers' history of paying for the right to place towers on private property.
- Perceived safety risks from potential failure of a structure.
- Right of way easements

A. Market Resistance

Market resistance (or stigma) in general is quantified in scholarly articles and peer-reviewed journal publications as it relates to the impact of communication towers and equipment on nearby property values. Hedonic studies and surveys generally address market resistance to the placement of new towers or equipment without regard to the cause of said market resistance.

There has been significant research regarding the question of the impact on residential property values from construction of cell phone towers in neighborhoods. The results of these studies vary but they commonly indicate that there is a significant impact. While the magnitude of the impact varies, the studies uniformly indicate that there is a significant impact on residential property values from installation of cell phone towers. Not surprisingly, the studies that show little or no impact are universally commissioned by and paid for by the telecommunications industry.

Most studies have dealt with more conventional, larger towers and not DAS installations. These studies would nevertheless be directly applicable to the proposed 100 to 120 foot monopole referenced on the previous page. As to "small cell" and DAS

installations, it should be noted that “small cell” references the size of the coverage area and not necessarily the size of the equipment. Furthermore, small cell and DAS installations will generally be located much closer to nearby properties and they will be installed in hundreds of locations ubiquitously. The FCC Public Notice dated December 22, 2106 states “Although the facilities used in these networks are smaller and less obtrusive than traditional cell towers and antennas, they must be deployed more densely – *i.e.,* in many more location – to function effectively (Page 1).

In addition, to numbers that exceed the location of larger towers by orders of magnitude, small cell and DAS installations are often directly within the line of site (midway up a 40 foot pole, for example) and even include ground cabinets, which are particularly egregious. Even if the individual impact of small cells is lesser than for larger towers (which is by no means a given), this may be offset or partially offset by the location, closer proximity and the numbers that exceed tower installations by orders of magnitude. Some of the studies are briefly discussed below.

Sandy Bond and Ko-Kang Wang performed a 2005 study in New Zealand where they support a 15% diminution in residential property value within 300 Meters of communication antennas. Their Summer 2005 publication in the Appraisal Journal (as published by the Appraisal Institute, Summer 2005, Pages 256 – 277) summarizes this study. They indicate survey results ranging from 10% to over 20% diminution, which is supported by multiple regression analysis (a hedonic study) indicating 21% diminution in residential property values.

Sandy Bond also performed and presented a study from December 2003 in Florida that supported just over 2% diminution.

Stephen L. Locke and Glenn C. Blomquist published “The Cost of Convenience: Estimating the Impact of Communication Antennas on Residential Property Values” in *Land Economics in* February 2106. This is the most current study. They conclude that a visible antenna up to 1,000 feet away (vs 4,500 feet as the control) results in a market diminution of 1.82% for residential homes ($3,342 per home in the market studied). While this seems like a relatively small percentage, they correlate this to an Aggregate impact of a reduction of market value of Ten Million Dollars when applied to all of the homes around a single tower in their study area.

While there have not been any scientific studies of the impact on property values from small cell and DAS deployments, there are many anecdotal examples indicating both a negative market perception and adverse impacts on property values. (Of course, negative market perception is precisely what causes an adverse impact on property values). These include published articles and petitions from Real Estate Professionals ranging from Manhattan to Burbank indicating negative impact, reduced property value, and market resistance. From an August 10, 2010 article in the New York Times…

“TINA CANARIS, an associate broker and a co-owner of RE/MAX Hearthstone in Merrick, has a $999,000 listing for a high ranch on the water in South Merrick, one of a handful of homes on the block on the market. But her listing has what some consider a disadvantage: a cell antenna poking from the top of a telephone pole at the front of the 65-by-100-foot lot. “Even houses where there are transformers in front” make “people shy away,” Ms. Canaris said. “If they have the opportunity to buy another home, they

do." She said cell antennas and towers near homes affected property values, adding, "You can see a buyer's dismay over the sight of a cell tower near a home just by their expression, even if they don't say anything."

B. Aesthetics and Underground Utilities

In 32 years of experience as a Real Estate Appraiser specializing in detrimental conditions, takings, adverse impacts and right-of-way, I have found that aesthetics (or rather the adverse impact on aesthetics) of externalities routinely has the largest impact on property values. As a result, proximity to towers of all types (cell, wind turbine, and electric transmission) has an impact on property values. The same is true with all sorts of surface installations such as pump stations and communication equipment boxes. This would apply to new small cell and DAS equipment, although again, one would expect that the less intrusive the facility, the less significant the impact. Small cell and DAS installations can be unsightly, bulky, inconsistent, and even noisy. A few demonstrative photos are included on Page 10.

While it is certainly recognized that DAS systems and Cellular antennas are an important part of our nation's infrastructure, and that it is inevitable that new antennas will need to be installed as we move into the future, it is important for municipalities (and property owners, in the case of right-of-way easements) to retain some control over the size, location, scope, expansion, and characterization of the installations. This is because adverse impacts from negative externalities vary considerably with the size, location, scope, expansion, and characterization of the installations.

All things being otherwise equal…

- Larger facilities have a greater impact than smaller facilities.

- Facilities on the ground and located closer to common sight lines have a greater impact than those that are less visible.

- Underground facilities have a lesser impact than above-ground facilities in most instances (although there are cases where the structures required for vaulting may be as intrusive as the above-ground facilities).

- Streamlined and contained facilities have a lesser impact than unorganized conglomerations of diverse elements.

- Impact tends to lessen over time as a facility remains unchanged so that changes and expansions have an additional negative impact.

- Facilities that are designed to be in balance with existing utility structures have a lesser impact than less harmonious installations. For example, an above ground facility will have a greater impact in an area with existing underground utilities. And a new pole that is three times higher than existing poles will have a greater impact than a new pole that is the same height as existing poles. Please reference the proposed Tx 120 (120 foot) Mobilitie tower shown below (particularly as compared to the existing wood utility poles).

Likewise, please compare this set of examples of unorganized and uncontrolled conglomerations of diverse elements with more streamlined installations.

It is not an accident that the articles, cases, and publications of the wireless industry often address circumstances that involve *hiding* wireless facilities, or show pictures of physically small "small cells" neatly mounted. Hidden, smaller, and neatly mounted "small cells," will have an impact, but that impact will be lesser than other alternatives. Likewise, there needs to be control over future growth of installed facilities.

It is my opinion that the Federal Communications Commission should analyze the potential impact of small cell and DAS deployments in detail before considering additional rules. It is important for the Commission to have information as to which installations may have *De Minimis* impacts and which may have significant impacts before establishing national rules.

It is also my opinion that municipalities need to retain significant regulatory control over these installations in public rights-of-way in order to minimize impacts and protect the health, welfare, and safety of their residences in the same way that other regulations and the reasonable exercise of police powers have over the last hundred years.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on March 7, 2017.

David E. Burgoyne, ASA, SR/WA
Certified General Real Estate Appraiser
(Indiana, Michigan, North and South Carolina)

DET02:2350248.1

Exhibit 4
Report and Declaration of Steven M. Puuri for the Smart Communities Siting Coalition

PUURI ENGINEERING,LLC

6480 Zeeb Road, Dexter, MI 48130

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
COMMENT SOUGHT ON STREAMLINING DEPLOYMENT OF SMALL CELL INFRASTRUCTURE BY IMPROVING WIRELESS FACILITIES SITING POLICIES;	)	WT Docket No. 16-421
MOBILITIE, LLC PETITION FOR DECLARATORY RULING	)	

REPORT AND DECLARATION OF STEVEN M. PUURI
FOR THE SMART COMMUNITIES SITING COALITION

About the Author

I have been involved in road design safety issues for 25 years on behalf of Washtenaw County Road Commission, Michigan, and most recently as a consultant to the County Road Association of Michigan. My formal education includes an engineering bachelor of science degree in 1978 from Michigan State University, as well as various continuing education workshops and seminars on road safety and operation. The commentary and opinions I offer below are based upon this education and experience dedicated to keeping roadways safe for the motoring public as well as other users of the rights of way. See my CV attached as **Exhibit A**.

Background

Road agencies across the State of Michigan and the rest of the United States, have recognized for years that roadsides should be maintained as near free of obstacles as possible. A roadside obstacle is defined as any object that projects above the ground more than 4 inches and which is rigid or non-forgiving when struck by a vehicle. A considerable amount of effort has been invested in Michigan to maintain the roadsides clear of non-critical obstacles that can be hazardous to drivers and passengers if their vehicle leaves the improved portion of the roadway or road surface.

Nationally Recognized Road Safety Guidelines

The American Association of State Highway and Transportation Officials (AASHTO) is the primary source of guidance on road and road right of way safety design and has established guidelines for state and

local agencies in the United States. AASHTO has created various standing committees that review transportation research studies and promulgate guidelines on specific areas of road safety. The AASHTO Highway Subcommittee on Design developed the roadside design guidelines, which in my opinion specifically apply to those Communication Service Providers (CSP) installations recently being proposed along roadways. This committee developed guidelines that establish nationally recognized best practices for safe roadside design which are published in the AASHTO Roadside Design Guidelines.

Roadside Design Guidelines

The AASHTO Roadside Design Guidelines 4th edition was published in October 2011 and has been updated most recently as of 2015. Typically, the Michigan Department of Transportation adopts the guidelines for use in Michigan and then each road agency can and typically does adopt the guidelines for use on their particular road system. These guidelines include recommended best safe design practices to assure that roadsides are free of obstacles or, if an obstacle must be placed within the clear zone, it recommends that a crash tested barrier system should also be installed to minimize the injuries to drivers and passengers should an errant vehicle collide with the roadside obstacle. The reason that these are treated as guidelines, rather than adopted as srict code requirements, is that the there are enough locally unique variations in roadways (as a result of the historical evolution of particular roadways, as well as conditions and uses of surrounding property) that states and localities require latitude in the application of the guidelines. Nonetheless, these guidelines reflect practices developed over years of experience and the accumulation of extensive accident statistics to ensure that roadways are as safe as possible. Safety encompasses immediate concerns (will a structure add to the risk of death or injury to those using the roadway; will it interfere with uses of the roadbed by other utilities) but also longer term concerns: (for example, will the road be more vulnerable to collapse risks, will the road be more likely to crack or buckle, will the underpavement structure of the road be adversely affected?).

Documents Reviewed

In addition to reviewing certain of the AASHTO Guidelines, some of which are discussed herin and attached as Exhibit B,[1] I have reviewed several other documents including:

a. The attached Mobilitie, LLC Site Plan proposed in Leelanau County, Michigan and attached here as Exhibit C as well as other Mobilitie site plans and drawings.
b. A photograph and the related accident report pertaining to a vehicle/CSP crash that occurred with an improperly locatedDAS related pole located in the right of way in Genesee County, Michigan, attached here as Exhibit D.

[1] Some of the other sections of the AASHTO guidelines that also warrant consideration, but not specifically addressed here in an attempt at some level of brevity, include Sections 4.8, discussing technical specifications in detail and the risks associated with utlity poles and which includes a discussion for example, of breakaway standards regarding same. See also Section 10.2.2.3.1 discussing similar technical aspects of utility pole placement and guarding considerations in urban areas. Copies of these sections are attached to the AASHTO excerpts at Exh B.

6480 Zeeb Road, Dexter, MI 48130

Opinions

The addition of structures in the right of way such as those proposed by Mobilitie and other similar entities, create immediate hazards to travelers. This hazard can be mitigated but not eliminated, and it is serious, as records of highway accidents suggest. The hazard exists in urban, suburban and rural areas where structures are placed in the rights of way. Further, the placement of roadside barriers themselves, as protective installations and as discussed, are themselves also a form of a hazard.

The addition of structures in the rights of way create immediate issues for maintenance of the rights of way, and to the extent that the structures must be maintained and modified over time, can interfere with traffic flow at significant cost to the public.

The addition of structures complicates planning, installation, modification and maintenance for other utilities, including storm water drainage and other systems. Moreover, every aboveground structure presents a potential hazard for other systems (e.g. if a pole is of a height that a falling pole may knock out electrical and other communications lines).

The addition of structures may affect emergency responses. Utility poles do fail during storms, and it is often up to the governmental entity that manages the roadway to clear the road of hazards so that rescue vehicles and repairs can begin. If facilities like the 120 foot Mobilitie tower are placed in the right of way, it may exceed the emergency response capabilities of many entities to remove it. And of course, if it cannot be cleared using standard equipment, then Mobilitie must have the equipment and response teams in place to respond very quickly.

The cost of planning, emergency response, and of reviewing proposed facilities is expensive and can be time-consuming depending on the complexity of the roadway and the systems surrounding it. See estimates of local government materials costs of providing a safe roadside both initially and annually thereafter attached as Exhibit E.

Conditions may vary from location to location, so submission of information in batches may simplify some reviews but not site specific location-related reviews.

Basis of Opinions

In a ddition to the AASHTO guidelines referenced, according to the Insurance Institute for Highway safety, about 20 percent of motor vehicle crash deaths “result from a vehicle leaving the roadway and hitting a fixed object alongside the road. Trees, utility poles, and traffic barriers are the most common objects struck. AASHTO data reflects 12% of these, attributable to collisions with utlity poles. Almost half of the deaths in fixed object crashes occur at night. Alcohol is a frequent contributing factor. Motorists also run off the road because of excessive speeds, falling asleep, inattention or poor visibility. Efforts to reduce these driver errors are only somewhat effective, so it's important to remove fixed objects or avoid putting them along roads in the first place if feasible, especially on roads where vehicles are more likely to leave the pavement. Less preferred options include using breakaway objects, shielding objects and increasing the visibility of objects.” http://www.iihs.org/iihs/topics/t/roadway-and-environment/fatalityfacts/fixed-object-crashes NHTSA's study

"The Economic and Society Impact of Motor Vehicle Crashes, 2010," suggests that automobile accidents impose a staggering cost on the economy – about $891 billion in damage annually.

While my opinions recognize that under ASSHTO guidelines, a rigid pole can be in the road right of way if it is protected by a crash tested barrier system (AASHTO Section 5.1.1; Section 5.1.2; Table 5-3); it should be recognized, the crash tested barrier systems themselves constitute a roadside hazard (AASHTO Figure 1-2, page 1-3). So placement of these systems should be limited to only those roadside hazards or obstacles that must be placed within the roadside clear zone.

To begin to understand some of the costs and risks created by placement of facilities that could be placed elsewhere, on rights of way, it is important to understand the complexity of the design of rights of way. I focus here on examples rights of way in rural areas in Michigan, but equally and more complex issues arise with respect to placement in suburban and urban areas, where designs accommodate increased overall traffic as well as foot and bicycle use and multiple utilities.

Attached as Exhibits F and G are representative diagrams of a typical rural (open ditch) roadside where a barrier system is placed to protect the vehicles from a roadside non-breakaway pole, such as the 120 foot towers proposed by Mobilitie, LLC (Exh C). These sketches also depict placement of a culvert/storm sewer system to provide unimpeded storm water flow with an appropriate culvert end protection (AASHTO Figure 3-12, page 3-18). Also displayedis an appropriately designed guardrail system, which is crash tested to protect a vehicle occupant from crashing into the proposed 120-foot steel tower or the foundation which obviously projects above the ground by more than 4 inches.

Clear Zone

In Michigan, a typical 66-foot wide rural road right of way includes a roadbed, shoulders, steep front slopes (steeper than 3 on 1 are considered non-recoverable; AASHTO Figure 3-2) and roadside ditches to accommodate storm runoff. These road features typically encompass the entire 66-foot width of the right of way. Also, the established speed limit in Michigan for these rural roads is 55 mph. The AASHTO Roadside Design guideline has established a method to determine the recommended clear zone that should be provided along rural roads (AASHTO Section 3.3).

The AASHTO roadside clear zone width for rural roads is based on the speed limit, traffic volume, and roadside recovery width which include traversable slopes (recoverable slopes flatter than 4 on 1). Typically, rural roads in Michigan do not include recoverable front slopes so the clear zone is extended beyond the bottom of the ditch (AASHTO Table 3-1).

Additionally, the roadside ditch slopes are often too steep to be included in the clear zone calculation, therefore the clear zone often extends partially up the ditch backslope (ASSHTO Section 3.3.2). The typical clear zone along rural rods would extend beyond the near edge of a 6-foot diameter foundation assuming this foundation is placed one foot inside the right of way.

Typical Cross Section Sketch

Exhibit F depicts a cross section of a typical rural roadside in Michigan, where a fixed obstacle is placed within the clear zone. This sketch includes a non-recoverable side slope (steeper than 4 on

1) that warrants a barrier system. Additionally, Exhibit F depicts the additional features required to maintain a reasonably safe roadside, if a tower and foundation is placed within an established clear zone. This sketch demonstrates the need to modify the roadside ditches to be enclosed in storm sewers and the need to install a crash tested barrier system to shield the fixed objects from traffic.

Typical Plan View Sketch

Exhibit G depicts a plan view of a typical rural roadside in Michigan, where a fixed obstacle is placed within the clear zone. This sketch illustrates the typical length of modifications along the roadside, as well as the typical placement of road drainage and barriers in relation to the road edge. The actual lengths and placement would be dependent on the unique and specific road parameters and detail design calculations.

Additionally, Exhibit G depicts the additional features required to maintain a reasonably safe roadside, if a tower and foundation is placed within an established clear zone. This sketch demonstrates the need to modify the roadside ditches to be enclosed in storm sewers with protected end treatments; and the need to install a sufficient amount of crash tested barrier system to shield the fixed objects from traffic approaching from both directions of travel, including barrier end treatments. Once again, the actual placement, size and type of features would be dependent on the specific road parameters.

Conclusion

Note that not only does the placement of these facilities create unnecessary hazards in and of themsleves, they lead to other modifications which themselves impact roadway safety. Moreover, the placement of foundations and supporting structures may affect drainage, and undermine the roadway itself in the short term and over the long term. The risks and harms are not speculative, as the statistics and the photograph of the destroyed DAS pole suggests (Exh D). Nor are these concerns addressed by application of generalized building or electrical codes to a proposed structure.

From the stand point of both safety design for the sake of the public, and bearing cost in mind, these proposed and installed communications related structures represent very significant concerns to all rights of way responsible agencies. Accordingly, such installation proposals must be very carefully addressed, viable alternative off right of way sites closely considered and where approved, proper preparation and guarding utilized, in order to reduce the risk of harm to the public as much as possible.

I declare under penalty of perjury that the foregoing is true and correct. Executed on 3-7-17.

Steven M Puuri, P.E. Digitally signed by Steven M Puuri, P.E.
DN: cn=Steven M Puuri, P.E., o=Puuri Engineering, LLC, ou, email=spuuri@gmail.com, c=US
Date: 2017.03.08 09:24:52 -05'00'

Steven Puuri, P.E.

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Exhibit A

Steven M. Puuri, P.E.

6480 Zeeb Road
Dexter, MI 48130

734-426-3097
spuuri@gmail.com

Career Summary

A proficient transportation infrastructure chief executive with an impressive background of building partnerships, securing innovative funding and delivering context sensitive solutions. An accomplished engineering director with an established track record of accomplishing projects on time and on budget. Mentored technical staff to handle challenges associated with rapid growth and workload expansion. An assertive public relations leader who successfully engaged stakeholders from US Congress, State Legislators, Local Officials as well as project stakeholders in a progressive university community.

Areas of Expertise/Core Competency

Extensive executive level expertise in Road Construction, Design, Traffic Operations, Routine
Maintenance, Construction Contracts, Transportation Funding, Legal Issues, Property Acquisition, Board Relations, Government Relations, Employee and Public Relations

Extensive experience in Michigan County Road Law, Tort Liability, Road Construction, Road Maintenance, Traffic Operation, Riparian Rights, Storm Water Management, Wetland Mitigation, Organizational Policies, Management Dashboards, Information Technology and Computer Networks.

Extensive working knowledge of American Association of State Highways and Transportation
Officials Guidelines; Michigan Department of Transportation Guidelines and Specifications; Michigan Vehicle Code; Michigan Manual For Uniform Traffic Control; Federal NEPA Guidelines and Federal Relocation & Assistance Guidelines.

Work Experience

Puuri Engineering LLC 2014 - Present

Engineering Specialist

Serves as an engineering consultant to advise the County Road Association, Michigan Municipal League and the Michigan Department of Transportation on technical matters related to local road agencies. Provides the Road Commissions and Michigan Municipal League with an experienced road engineering resource to assist with road maintenance and

construction initiatives related to legislation, policy development, rule writing and dispute resolutions.

Puuri Engineering LLC 2012 - Present

Managing Director

Owner and lead engineer of a consulting engineering practice which provides technical advice on legislative and policy development related to local road agencies. Provides planning, design and construction engineering services for transportation projects. Serving a variety of Municipal and private clients to assist with advancing infrastructure improvements. I have also provided expert witness services for many years on road liability cases, including cases where I have been qualified and testified in several Michigan Courts as a road design, drainage and maintenance expert. Also I have never been rejected by a court to testify as an expert.

Washtenaw County Road Commission 1987 - 2011

Managing Director 2003 - 2011

As the Chief Executive Officer provided direction and leadership for the Board of Directors and 156 employees. Led a $70 million organization recognized as a progressive trendsetter in management practices. Successfully administered an autonomous organization requiring transparent Board Meetings, Audited Financial Statements, Tort Liability, Self Funded Insurance programs, fleet acquisition and maintenance for 150 licensed vehicles, property management of 25 building and 300 acres, public relations, extensive construction and maintenance programs for 1650 miles of roads, 111 bridges and 150 traffic signals.
In this capacity key accomplishments included:

- Established a 5 Year Capital Improvement Program which dramatically improved the coordination of all projects in the region
- Established a multi-year budgeting process creating consistently increasing reserves
- Recognized innovative project funding leader who delivered results
- Established design, construction and maintenance standards that lead to high quality projects, cost effective maintenance practices and improved road safety.
- Established a model partnership program that successfully collaborated with private developers resulting in over $100 million of private investment in public infrastructure projects
- Transformed accounting methods to fully recognize unfunded liabilities
- Successfully negotiated benefit reductions to sustainable levels
- Established Planning and Public Relations programs leading to enhance stakeholder involvement and documented improvements in public perception
- Modernized stormwater management and environmental programs earning recognition from community environmental leaders as an outstanding example for maintenance practices and environmental stewardship

- Conducted organization assessments implemented cultural transforming strategies earning recognition from local officials for improvements in performance
- Lead an innovative public agency initiative obtaining recognition for Best Management Practices International Standards Organization 9001-2008

Director of Engineering 1990 - 2003

Engineer responsible for providing technical leadership for a rapidly developing community while modernizing construction practices, rigorously enforcing contractual and permit compliance. Supervised a department of 56 engineers, professional specialist and administrative staff. Established a quality based consultant selection program leading to improved consultant performance and financial accountability. Successfully completed hundreds of major infrastructure projects totaling over $200 million. Administered a state of the art traffic operations program including construction and maintenance of integrated operations center for 150 signals, 30,000 signs and 800 miles of pavement markings. Successfully served as Project Engineer on planning, design, property acquisition and construction projects often handling numerous concurrent projects in various stages of development. Served as the Contract Administrator on numerous construction and consultant contracts involving preparation of contract documents, advertising, awarding, claims resolution and legal disputes. Successfully served as an expert witness for numerous tort liability cases.

Key accomplishments in this capacity:

- Jackson Road $50 million multi-phase boulevard construction and research project
- Dixboro Road bridge $20 million 550 ft. long multi-lane multi-modal bridge
- US 23, Geddes Rd, Dixboro Rd. and Huron River Dr. $5 million corridor expansion project
- Earhart Road $3 million new road enabling 100-acre medical & commercial development
- Ellsworth Road $8 million realignment & corridor expansion project
- Served as the local catalyst for $50 million in state interchange expansion projects
- Served as the Project Engineer on 8 Federal NEPA clearance projects involving interchanges, new road alignments, capacity projects, wetland mitigation, new and historic bridges
- Served as Project Manager for 27,000 sf. new office building construction project involving architectural design, interior planning, access roads, parking areas, landscaping, relocation coordinator and building demolition
- Served as the Lead Engineer who successfully collaborated with hundreds of Residential and Commercial Developers to assure that the new developments were completed with appropriate public infrastructure investments

6480 Zeeb Road, Dexter, MI 48130

Assistant Director of Engineering 1987 - 1990

Provided direction and leadership for design, construction, survey and traffic services. Transformed the culture of a 23 member engineering staff by successfully solving low morale, improving quality and increasing productivity. Developed a staffing plan to address rapid population growth challenges, secured Management endorsement, leading to increasing staff capabilities, increased project output and improved project quality.

USDA Soil Conservation Service 1978 - 1987

Area Engineer 1983 - 1987

Provided design and field engineering services for stream and shoreline stabilization, flood control and storm water management projects for several counties in Northwest Michigan. Ensured prompt delivery of project services including land surveys, design, contract documents, construction administration and claims resolution. Successfully worked with public officials and private landowner to accomplish a variety of clients in a positive work relationship. Supervised technicians and clerical staff in regional office locations. Key accomplishments:

- Rouge River Flood Control Projects Design and Construction
- Numerous Private Landowner drainage systems design and construction

Civil Engineer 1978 – 1983

Assisted the State Office Hydraulic Engineer and Other Professional Staff Specialists to develop watershed hydraulic analysis and flood plain mapping projects.

- Petoskey Winter Sports Park Drainage Construction
- Woolsey Airport Tile Drainage Construction

Education

B.S. Civil Engineering Michigan State University 1978

Extensive Continuing Education Credits and training programs in water resources and transportation related areas

Professional Associations & Boards

Professional Engineering License in Michigan No. 29798

National Association County Engineers

County Road Association of Michigan

County Road Association Engineering Committee Chair

Governors Traffic Safety Advisory Commission

Michigan County Road Association Self-Insurance Pool Board

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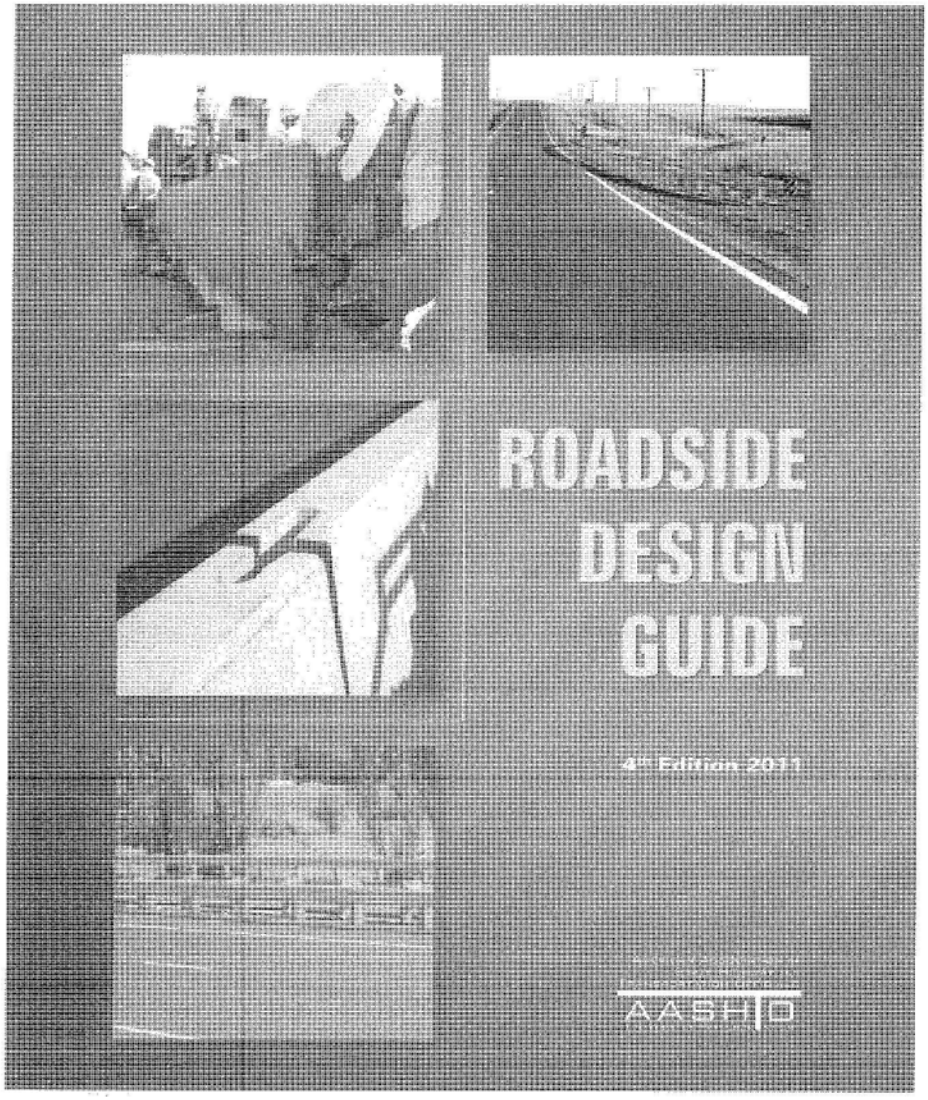
Exhibit B

AASHTO Citations



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ONTARIO, Joe Bucik

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5.2.3 Bystanders, Pedestrians, and Bicyclists

The conventional criteria presented in the previous sections cannot be used to establish barrier needs for pedestrians or bicyclists. For example, a major roadway may be relatively close to a schoolyard, but the boundaries are beyond the clear distance. There are no criteria that would require that a barrier be installed. If, however, a barrier is installed, it could be placed near the school boundary to minimize the potential for vehicle impacts. Reference should be made to Section 5.6.1 for lateral placement criteria. Consideration might also be given to installing a barrier to shield businesses and residences that are near the right-of-way, particularly at locations having a history of run-off-the-road crashes. Occasional functions that use, or are adjacent to, public right-of-way with concentrated pedestrian activity such as farmer's markets and street fairs may be considered for temporary barriers or delineation.

Pedestrians and cyclists along a route are a concern that might be given design consideration. Depending on the route type, traffic volumes, number of bicyclists and pedestrians, and traffic speed, a possible solution might be to separate them from vehicular traffic. Since this solution is not always practical, alternate means of separating them from vehicular traffic are sometimes necessary. Currently there are no objective criteria to draw on for pedestrian and cyclist barrier recommendations.

On low-speed streets, the practice generally is to separate pedestrians from traffic by a sidewalk separated from the roadway by a raised curb. However, at speeds of over 40 km/h [25 mph] a vehicle may mount the curb for relatively flat approach angles. Furthermore, it is generally impractical to separate pedestrians from the roadway with a longitudinal roadside barrier. Thus, for streets with speeds of over 40 km/h [25 mph], separating the sidewalk from the edge of the roadway with a buffer space is encouraged. See Chapter 10 for more information.

When sidewalks or multi-use paths are adjacent to the traveled way of high-speed facilities, some provision might be made to shield the sidewalk or path from vehicular traffic on the roadway. Factors to consider for barrier protection include traffic and pedestrian volumes, roadway geometry, sidewalk/path offset, and cross-section features.

5.2.4 Motorcycles and Barrier Design

Nationwide, there have been some instances where roadside barriers have contributed to the severity of crashes involving motorcycles. Motorcyclists have a higher risk of being seriously injured or killed in a crash as compared to occupants in automobiles. This is mostly due to the higher level of occupant safety provided in modern automobiles. It has been noted that motorcyclists involved in crashes with some types of open-faced traffic barriers have sustained serious to fatal injuries, particularly after contacting the edges of steel guardrail posts or the tops of these posts where they project above the rail element. Some European countries have attempted to address these concerns at locations having both high motorcycle use and a high number of crashes by adding a lower rubrail to the design or by padding the posts with expanded foam. However, no systematic approach toward this issue has been developed because of the random nature of motorcycle crashes and the questionable effectiveness of modifications to existing barriers. Based on the experience of other countries and the lack of any system-wide, cost-effective countermeasures or barrier designs, there appears to be little basis for developing guardrails designed for motorcyclists for all barrier installations. There is some perception that a smooth, solid-faced barrier such as a concrete safety shape may be less likely to cause traumatic injuries to motorcyclists upon contact. Additional research is being conducted regarding motorcycle interaction with barriers.

5.3 TEST LEVEL SELECTION FACTORS

Many barriers have been developed to accommodate both small cars and pickup trucks in accordance with NCHRP Report 350 and MASH testing criteria. Properly designed and installed barrier systems have proven to be very effective in reducing the amount of damage and lessening the severity of personal injuries. However, in certain locations it may be appropriate to utilize a higher performance barrier capable of redirecting large vehicles such as tractor-trailer combination trucks. Although objective warrants for the use of higher performance traffic barriers do not presently exist, subjective factors most often considered for new construction or safety upgrading include:

- High percentage of heavy vehicles in the traffic stream or a high concentration of trucks at an interchange
- Hazardous materials routes

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- Adverse geometrics, such as sharp curvature, which are often combined with limited sight distance, or long downhill grades combined with horizontal curvature
- Severe consequences associated with penetration of a barrier by a large vehicle, such as multi-level interchange ramps, highly sensitive environmental areas, or critical highway components (nationally significant bridges or tunnels).

Some of the above-listed factors become worthy of more consideration when they occur in combination with other factors. For example, a moderate length bridge over a portion of a reservoir may be at low risk for environmental consequences unless combined with geometric factors that increase the likelihood of truck impact with the rail.

These same factors also apply to reconstruction or rehabilitation projects. However, in these cases, the designer will usually have the added benefit of past crash history, the past performance of the system, and maintenance costs associated with the existing barrier. In addition, a higher performance barrier is likely to lessen the severity of future crashes or reduce maintenance costs significantly. Section 5.4 includes information on the size of vehicle for which each system has been successfully crash tested.

5.4 STRUCTURAL AND SAFETY CHARACTERISTICS OF ROADSIDE BARRIERS

This section includes information on the most commonly used roadside barriers. Separate subsections address standard sections of roadside barriers and transition sections. Figure 5-4 graphically depicts each of these elements for typical installations. Information on the structural and safety characteristics of each system is presented in narrative format. Refer to Section 5.1 for additional information on FHWA acceptance letters and individual barrier systems.

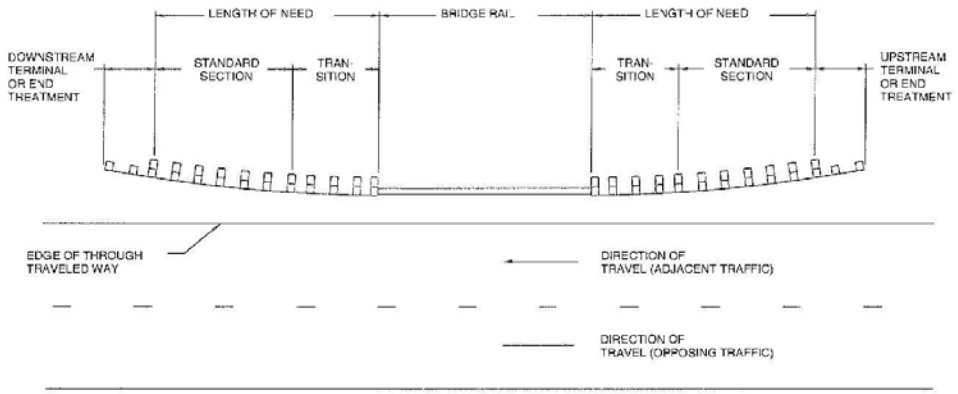

Figure 5-4. Definition of Roadside Barriers

5.4.1 Standard Sections of Roadside Barriers

Roadside barriers are usually categorized as flexible, semi-rigid, or rigid, depending on their deflection characteristics resulting from an impact. Flexible systems are generally more forgiving than the other categories since much of the impact energy is dissipated by the deflection of the barrier and lower impact forces are imposed upon the vehicle. This section is not intended to be all-inclusive, but to cover the most widely used roadside barriers. The barriers and approved test levels included in the following subsections are listed in Table 5-3.

For additional barrier systems, including barriers tested to meet MASH criteria, please refer to the FHWA for acceptance letters and the AASHTO Task Force 13 website for design details, as mentioned previously in Sections 5.1.1 and 5.1.2.

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Unfortunately, roadside crashes still account for far too great a portion of the total fatal highway crashes. In 2008, 23.1 percent of the fatal crashes were single-vehicle, run-off-the-road crashes. These figures mean that the roadside environment comes into play in a very significant percentage of fatal and serious-injury crashes.

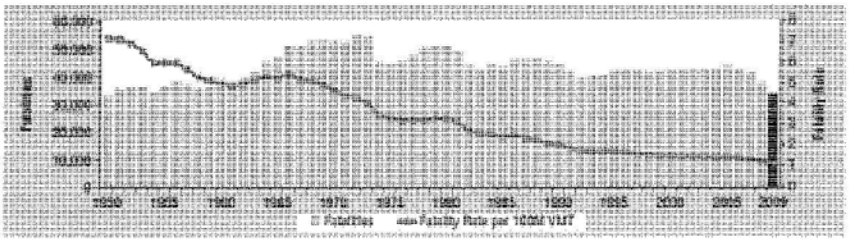

Figure 1-1. Motor Vehicle Crash Deaths and Deaths Per 100 Million Vehicle Miles Traveled, 1950–2008 *(6)*

1.2 STRATEGIC PLAN FOR IMPROVING ROADSIDE SAFETY

According to the Insurance Institute for Highway Safety (IIHS) and Highway Loss Data Institute (HLDI), the proportion of motor vehicle deaths involving collisions with fixed objects has fluctuated between 19 and 23 percent since 1979 *(4)*. Almost all fixed-object crashes involve only one vehicle and occur in both urban and rural areas. Figure 1-2 shows the percentage distribution of fixed-object fatalities by the object struck in 2008. Trees were by far the most common object struck, accounting for approximately half of all fixed-object fatal crashes. Utility poles were the second most common objects struck, accounting for 12 percent of all fixed object crashes, followed by traffic barriers with 8 percent. Furthermore, for 2008, 18 percent of fixed-object crashes involved vehicles that rolled over, while 18 percent involved occupant ejection. More detailed crash statistics are available from the following website at http://www.nhtsa.gov/FARS.

In 1967, the American Association for State Highway Officials (AASHO; currently the American Association for State Highway and Transportation Officials [AASHTO]) released its *Highway Design and Operational Practices Related to Highway Safety (1)*, the first official report that focused attention on hazardous roadside elements and suggested appropriate treatment for many of them. This guide, also known as the AASHTO "Yellow Book," was revised and updated in 1974 with the introduction of the forgiving roadside concept. In 1989, AASHTO published the first edition of the *Roadside Design Guide*.

In 1998, AASHTO approved their Strategic Highway Safety Plan *(3)*, which provides objectives and strategies for keeping vehicles on the roadway and for minimizing the consequences when a vehicle does encroach on the roadside. The National Cooperative Highway Research Program (NCHRP) also has published a series of guides, called the NCHRP Report 500 *(9)*, to assist state and local agencies in their efforts to reduce injuries and fatalities in targeted emphasis areas. These guides correspond to the emphasis areas outlined in AASHTO's Strategic Highway Safety Plan. The Strategic Highway Safety Plan and associated NCHRP Report 500 guides are available from the AASHTO website at http://safety.transportation.org/guides.aspx.

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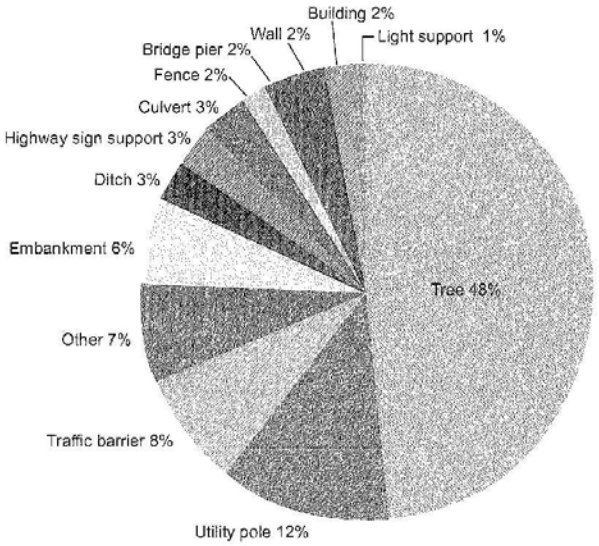

Figure 1-2. Percent Distribution of Fixed-Object Fatalities by Object Struck, 2008 *(4)*

For roadside design, Volumes 3, 6, and 8 of NCHRP Report 500 address collisions with trees in hazardous locations, run-off-the-road collisions, and the reduction of collisions involving utility poles.

A vehicle will leave the roadway and encroach on the roadside for many reasons, including the following:

- Driver fatigue
- Driver distractions or inattention
- Excessive speed
- Driving under the influence of drugs or alcohol
- Crash avoidance
- Adverse roadway conditions, such as ice, snow, or rain
- Vehicle component failure
- Poor visibility

Regardless of the reason for a vehicle leaving the roadway, a roadside environment free of fixed objects and with stable, flattened slopes enhances the opportunity for motorists to regain control of their vehicles and reduce crash severity. The forgiving roadside concept allows for errant vehicles leaving the roadway and supports a roadside design in which the serious consequences of such incidents are reduced.

Through decades of experience and research, the application of the forgiving roadside concept has been refined to the point where roadside design is an integral part of the transportation design process. Design options for reducing roadside obstacles, in order of preference, are as follows:

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equal to that of a standard headwall design as a result of decreased entrance turbulence. In those locations where headwater depth is critical, a larger pipe should be used or the parallel drainage structure may be positioned outside the clear zone, as discussed in the following section.

3.4.3.3 Relocate the Structure

Some parallel drainage structures can be moved laterally farther from the through traveled way. This treatment often affords the designer the opportunity to flatten the transverse slope within the selected clear-zone distance of the roadway under design. If the embankment at the new culvert locations is traversable and likely to be encroached upon by traffic from either the main road or side road, safety treatment should be considered. It is suggested that the inlet or outlet match the transverse slope regardless of whether additional safety treatment is deemed necessary. Figure 3-11 shows a suggested design treatment, while Figure 3-12 shows a recommended safety treatment for parallel drainage pipes.

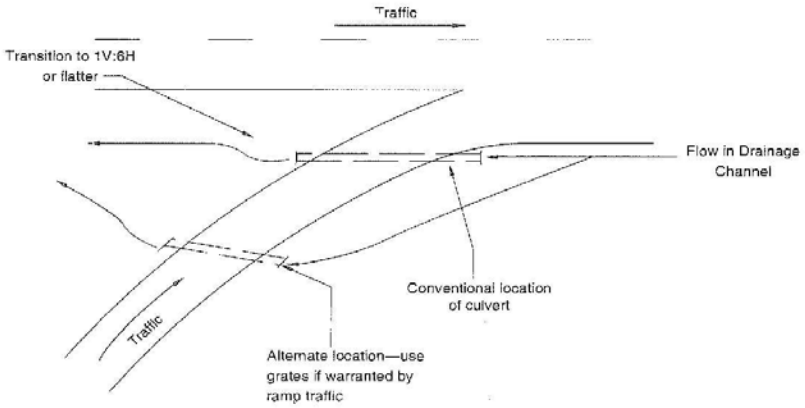

Figure 3-11. Alternate Location for a Parallel Drainage Culvert

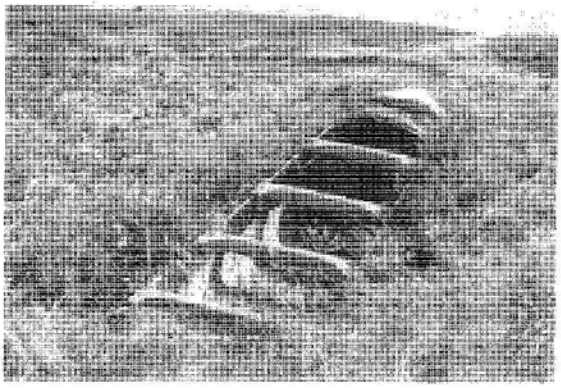

Figure 3-12. Safety Treatment for Parallel Drainage Pipe

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3.4.3.4 Shielding

In cases in which the transverse slope cannot be made traversable, the structure is too large to be safety treated effectively, and relocation is not feasible, shielding the obstacle with a traffic barrier may be necessary. Specific information on the selection, location, and design of an appropriate barrier system is in Chapter 5.

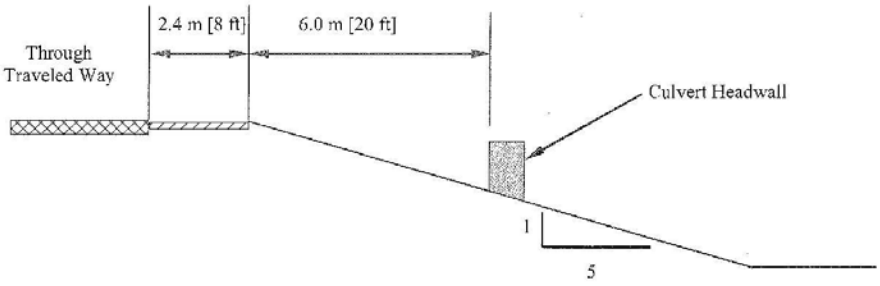
3.4.4 Drop Inlets

Drop inlets can be classified as on-roadway or off-roadway structures. On-roadway inlets are usually located on or alongside the shoulder of a street or highway and are designed to intercept runoff from the road surface. These include curb opening inlets, grated inlets, slotted drain inlets, or combinations of these three basic designs. Because they are installed flush with the pavement surface, they do not constitute a significant safety problem to errant motorists. However, they should be selected and sized to accommodate design water runoff. In addition, they should be capable of supporting vehicle wheel loads and should be pedestrian and bicycle compatible.

Off-roadway drop inlets are used in medians of divided roadways and sometimes in roadside ditches. Although their purpose is to collect runoff, they should be designed and located to present a minimal obstacle to errant motorists. This goal can be accomplished by building these features flush with the channel bottom or slope on which they are located. No portion of the drop inlet should project more than 100 mm [4 in.] above the ground line *(10)*. The opening should be treated to prevent a vehicle wheel from dropping into it; however, unless pedestrians are a consideration, grates with openings as small as those used for pavement drainage are not necessary. Neither is it necessary to design for a smooth ride over the inlet; it is sufficient to prevent wheel snagging and the resultant sudden deceleration or loss of control.

3.5 EXAMPLES OF THE CLEAR-ZONE CONCEPT TO RECOVERABLE FORESLOPES

EXAMPLE 3-A
Design ADT: 4000
Design Speed: 100 km/h [60 mph]
Suggested clear-zone distance for 1V:5H foreslope: 10 to 12 m [32 to 40 ft] (from Table 3-1)



Discussion—The available recovery area of 8.4 m [28 ft] is 1.6 m to 3.6 m [4 to 12 ft] less than the suggested clear-zone distance. If the culvert headwall is greater than 100 mm [4 in.] in height and is the only obstruction on an otherwise traversable foreslope, it should be removed and the inlet modified to match the 1V:5H foreslope. If the foreslope contains rough outcroppings or boulders and the headwall does not significantly increase the obstruction to a motorist, the decision to do nothing may be appropriate. A review of the highway's crash history, if available, may be made to determine the nature and extent of vehicle encroachments and to identify any specific locations that may require special treatment.

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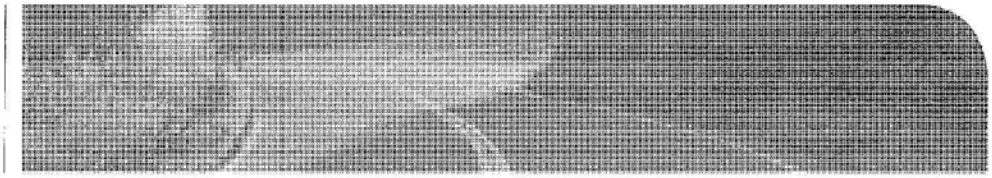

Chapter 3
Roadside Topography and Drainage Features

3.0 OVERVIEW

This chapter discusses the development and evaluation of the forgiving roadside concept and its application to roadside design and clear zones. It also discusses embankment slopes and ditches and how these features influence roadside features such as curbs, culverts, and drop inlets, whose purpose is to provide adequate roadway drainage. The designer is presented with several options that enhance safety without affecting the capabilities of these elements to drain the highway.

Most of the forgiving roadside design principles discussed in this chapter have been practiced to varying degrees for several years. This chapter attempts to reemphasize and collect the currently accepted design principles to provide guidance in the area of roadside design. However, to include every recommendation or design value in this chapter on every future highway project is neither feasible nor possible. Engineering judgment will have to play a part in determining the extent to which improvements reasonably can be made with the limited resources available.

As the designer studies the options available, some consideration should be given to the future maintenance of drainage facilities and roadside topography. Ongoing repair and upkeep will be necessary to ensure the continued function and safety of various roadside drainage features. Personnel, materials, equipment, and cost are some of the considerations in every maintenance program. The designer should take into account the exposure of crews to traffic conditions while completing repairs. Also, maintenance activities can cause various levels of disruption in the traffic flow, which may increase the potential for crashes.

3.1 THE CLEAR-ZONE CONCEPT

Beginning in the early 1960s, as more Interstate highways and other freeways were opened to traffic, the nature and characteristics of the typical rural highway crashes began to change. Instead of head-on crashes with other vehicles or crashes involving trees immediately adjacent to the roadway, many drivers were running off the new freeways and colliding with man-made objects, such as bridge piers, sign supports, culverts, ditches, and other design features of the roadside. In 1967, the American Association of State Highway Officials (AASHO) Traffic Safety Committee (currently the American Association of State Highway and Transportation Officials [AASHTO] Standing Committee on Highway Traffic Safety) issued a report entitled, *Highway Design and Operational Practices Related to Highway Safety (2)*. This document became known as the "Yellow Book," and its principles were widely applied to highway construction projects, particularly high-speed, controlled-access facilities. A second edition of the Yellow Book, published by AASHTO in 1974, stated that "for adequate safety, it is desirable to provide an unencumbered roadside recovery area that is as wide as practical on a specific highway section. Studies have indicated that on high-speed highways, a width of 9 m [30 ft] or more from the edge of the through traveled way permits about 80 percent of the errant vehicles leaving the roadway to recover"*(6)*.

Subsequently, most highway agencies began to try to provide a 9-m [30-ft] clear zone, particularly on high-volume, high-speed, rural roadways. A clear zone is the unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery

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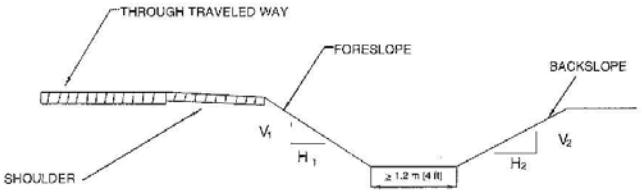

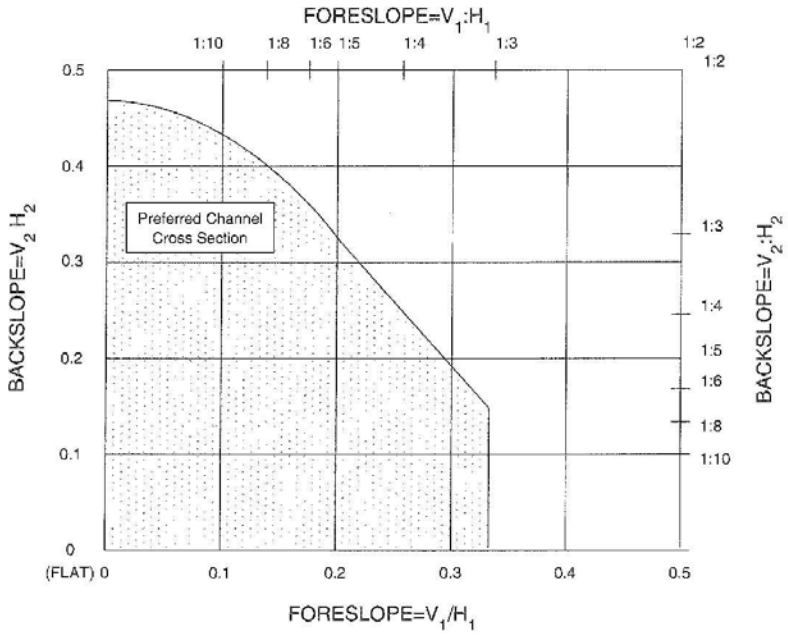

*This chart is applicable to rounded channels with bottom widths of 2.4 m [8 ft] or more and to trapezoidal channels with bottom widths equal to or greater than 1.2 m [4 ft].

Figure 3-7. Preferred Cross Sections for Channels with Gradual Slope Changes

If practical, drainage channels with cross sections outside the shaded regions and located in vulnerable areas may be reshaped and converted to a closed system (culvert or pipe) or, in some cases, shielded by a traffic barrier. Information from various jurisdictions for the use of roadside barrier to shield non-traversable channels within the clear zone is included in Chapter 5.

3.3 APPLICATION OF THE CLEAR-ZONE CONCEPT

A basic understanding of the clear-zone concept is critical to its proper application. The suggested clear-zone distances in Table 3-1 are based on limited empirical data that then were extrapolated to provide data for a wide range of conditions. Thus, the distances

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obtained from these tables represent a reasonable measure of the degree of safety suggested for a particular roadside, but they are neither absolute nor precise. In some cases, it is reasonable to leave a fixed object within the clear zone; in other instances, an object beyond the clear-zone distance may require removal or shielding. Use of an appropriate clear-zone distance amounts to a compromise between maximizing safety and minimizing construction costs. Appropriate application of the clear-zone concept often will result in more than one possible solution. The following sections intend to illustrate a process that may be used to determine if a fixed object or non-traversable terrain feature should be relocated, modified, removed, shielded, or remain in place.

The guidelines in this chapter may be most applicable to new construction or major reconstruction. On 3R projects, the primary emphasis is placed on the roadway itself. The actual performance of an existing facility may be evaluated through an analysis of crash records and on-site inspections as part of the design effort or in response to public input from road users and other stakeholders. It may not be cost-effective or practical to bring a 3R project into full compliance with all of the clear-zone width recommendations provided in this Guide because of environmental effects or limited right-of-way. Because of the scope of such projects and the limited funding available, emphasis should be placed on correcting or shielding areas in the project with identifiable safety problems related to clear-zone widths. Bodies of water and steep cliffs are the types of areas that may be considered for special emphasis.

3.3.1 Recoverable Foreslopes

The suggested clear-zone distance for recoverable foreslopes of 1V:4H or flatter may be obtained directly from Table 3-1. On new construction or major reconstruction, smooth slopes with no significant discontinuities and no protruding fixed objects are desirable from a safety standpoint. It also is desirable to have the top of the slope rounded so an encroaching vehicle remains in contact with the ground *(14)*. It also is desirable for the toe of the slope to be rounded to improve traversability by an errant vehicle. The flatter the selected slope, the easier it is to mow or otherwise maintain and the safer it becomes to negotiate. Examples at the end of this chapter illustrate the application of the clear-zone concept to recoverable foreslopes.

3.3.2 Non-Recoverable Foreslopes

Foreslopes from 1V:3H up to 1V:4H are considered traversable if they are smooth and free of fixed objects *(14)*. However, a clear runout area beyond the toe of the non-recoverable foreslope is desirable because many vehicles on slopes this steep will continue on to the bottom. The extent of this clear runout area could be determined by first finding the available distance between the edge of the through traveled way and the breakpoint of the recoverable foreslope to the non-recoverable foreslope, as previously shown in Figure 3-2. This distance then is subtracted from the suggested clear-zone distance based on the steepest recoverable foreslope before or after the non-recoverable foreslope and should be at least 3 m [10 ft] if practicable. The result is the desirable clear runout area that should be provided beyond the non-recoverable foreslope if practical. Such a variable sloped typical section often is used as a compromise between roadside safety and economics. By providing a relatively flat recovery area immediately adjacent to the roadway, most errant motorists can recover before reaching the steeper foreslope beyond. The foreslope break may be liberally rounded so that an encroaching vehicle does not become airborne. The steeper slope also may be made as smooth as practical and rounded at the bottom. Figure 3-2 illustrates a recoverable foreslope followed by a non-recoverable foreslope. Example 3-C demonstrates the method for calculating the desirable runout area.

3.3.3 Critical Foreslopes

Critical foreslopes are those steeper than 1V:3H *(5)*. These slopes create a higher propensity for an errant vehicle to overturn and should be treated if they begin within the clear-zone distance of a particular highway and meet the suggested barrier recommendations for shielding contained in Chapter 5. Examples 3-C, 3-D, and 3-E illustrate the application of the clear-zone concept to critical foreslopes.

3.3.4 Examples of Clear-Zone Application on Variable Slopes

A variable foreslope often is specified on new construction to provide a relatively flat recovery area immediately adjacent to the roadway followed by a steeper foreslope. This design requires less right-of-way and embankment material than a continuous, relatively

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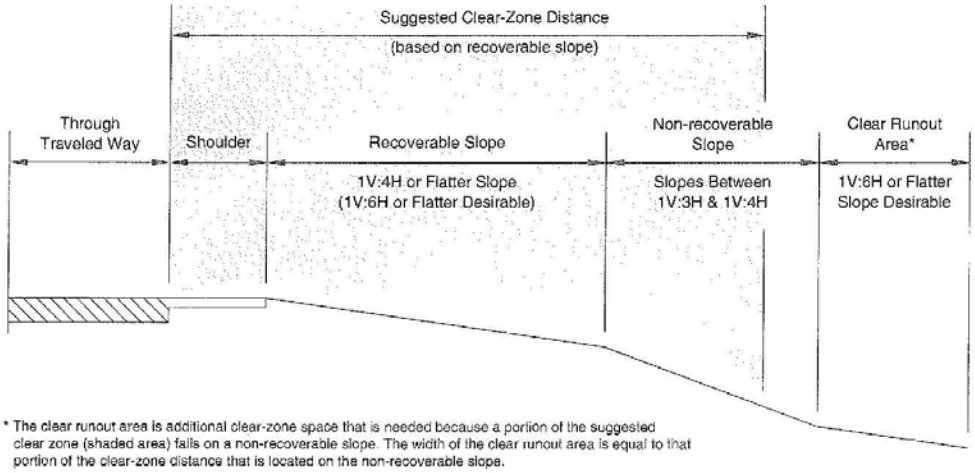

Figure 3-2. Clear Zone for Non-Recoverable Parallel Foreslope

3.2.2 Backslopes

When a highway is located in a cut section, the backslope may be traversable depending on its relative smoothness and the presence of fixed obstacles. If the foreslope between the roadway and the base of the backslope is traversable (1V:3H or flatter) and the backslope is obstacle-free, it may not be a significant obstacle, regardless of its distance from the roadway. On the other hand, a steep, rough-sided rock cut normally should begin outside the clear zone or be shielded. A rock cut normally is considered to be rough-sided when the face will cause excessive vehicle snagging rather than provide relatively smooth redirection.

3.2.3 Transverse Slopes

A common obstacle on roadsides are transverse slopes created by median crossovers, berms, driveways, or intersecting side roads. Although the exposure for transverse slopes is less than that for foreslopes or backslopes, they generally are more critical to errant motorists because run-off-the-road vehicles typically strike them head-on.

Transverse slopes of 1V:10H are desirable *(7)*; however, their practicality may be limited by width restrictions and the maintenance problems associated with the long tapered ends of pipes or culverts. Transverse slopes of 1V:6H or flatter are suggested for high-speed roadways, particularly for the section of the transverse slope that is located immediately adjacent to traffic *(3)*. This slope then can be transitioned to a steeper slope as the distance from the edge of the through traveled way increases. Transverse slopes steeper than 1V:6H may be considered for urban areas or for low-speed facilities. Figures 3-3 and 3-4 show suggested designs for these slopes, while Section 3.4.3 discusses safety treatments for parallel drainage structures.

Figure 3-5 shows some alternative designs for drains at median openings. The water flows into a grated drop inlet in the median to a cross-drainage structure or directly underneath the travel lanes to an outside channel. This eliminates the two pipe ends that would be exposed to traffic in the median. The transverse slopes of the median opening then would be desirably sloped at 1V:10H or flatter.

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of errant vehicles. The clear zone includes shoulders, bike lanes, and auxiliary lanes, except those auxiliary lanes that function like through lanes. Many obstacles located within this clear-zone distance were removed, relocated, redesigned, or shielded by traffic barriers or crash cushions. It soon became apparent, however, that in some limited situations in which the embankment sloped significantly downward, a vehicle could encroach farther from the through traveled way and a 9-m [30-ft] clear zone might not be adequate. Conversely, on most low-volume, urban, or low-speed facilities, a 9-m [30-ft] clear-zone distance was considered excessive and seldom could be justified for engineering, environmental, or economic reasons.

The 1977 AASHTO *Guide for Selecting, Locating, and Designing Traffic Barriers (1)* modified the earlier clear-zone concept by introducing variable clear-zone distances based on traffic volumes, speeds, and roadside geometry. Table 3-1 can be used to determine the suggested clear-zone distance for selected traffic volumes and speeds. However, Table 3-1 provides only a general approximation of the needed clear-zone distance. These data are based on limited empirical data that were extrapolated to provide information for a wide range of conditions. The designer should keep in mind site-specific conditions, design speeds, rural versus urban locations, and practicality. The distances obtained from Table 3-1 should suggest only the approximate center of a range to be considered and not a precise distance to be held as absolute. For roadways with low traffic volumes, it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

Table 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane *(6)*

Metric Units

Design Speed (km/h)	Design ADT	Foreslopes			Backslopes		
		1V:6H or flatter	1V:5H to 1V:4H	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
≤60	UNDER 750[c]	2.0–3.0	2.0–3.0	[a]	2.0–3.0	2.0–3.0	2.0–3.0
	750–1500	3.0–3.5	3.5–4.5	[a]	3.0–3.5	3.0–3.5	3.0–3.5
	1500–6000	3.5–4.5	4.5–5.0	[a]	3.5–4.5	3.5–4.5	3.5–4.5
	OVER 6000	4.5–5.0	5.0–5.5	[a]	4.5–5.0	4.5–5.0	4.5–5.0
70–80	UNDER 750[c]	3.0–3.5	3.5–4.5	[b]	2.5–3.0	2.5–3.0	3.0–3.5
	750–1500	4.5–5.0	5.0–6.0	[b]	3.0–3.5	3.5–4.5	4.5–5.0
	1500–6000	5.0–5.5	6.0–8.0	[b]	3.5–4.5	4.5–5.0	5.0–5.5
	OVER 6000	6.0–6.5	7.5–8.5	[b]	4.5–5.0	5.5–6.0	6.0–6.5
90	UNDER 750[c]	3.5–4.5	4.5–5.5	[b]	2.5–3.0	3.0–3.5	3.0–3.5
	750–1500	5.0–5.5	6.0–7.5	[b]	3.0–3.5	4.5–5.0	5.0–5.5
	1500–6000	6.0–6.5	7.5–9.0	[b]	4.5–5.0	5.0–5.5	6.0–6.5
	OVER 6000	6.5–7.5	8.0–10.0[e]	[b]	5.0–5.5	6.0–6.5	6.5–7.5
100	UNDER 750[c]	5.0–5.5	6.0–7.5	[b]	3.0–3.5	3.5–4.5	4.5–5.0
	750–1500	6.0–7.5	8.0–10.0[e]	[b]	3.5–4.5	5.0–5.5	6.0–6.5
	1500–6000	8.0–9.0	10.0–12.0[e]	[b]	4.5–5.5	5.5–6.5	7.5–8.0
	OVER 6000	9.0–10.0[e]	11.0–13.5[e]	[b]	6.0–6.5	7.5–8.0	8.0–8.5
110[d]	UNDER 750[c]	5.5–6.0	6.0–8.0	[b]	3.0–3.5	4.5–5.0	4.5–5.0
	750–1500	7.5–8.0	8.5–11.0[e]	[b]	3.5–5.0	5.5–6.0	6.0–6.5
	1500–6000	8.5–10.0[e]	10.5–13.0[e]	[b]	5.0–6.0	6.5–7.5	8.0–8.5
	OVER 6000	9.0–10.5[e]	11.5–14.0[e]	[b]	6.5–7.5	8.0–9.0	8.5–9.0

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 9 m for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H foreslope on a fill section, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 3-m recovery area at the toe of slope should be provided for all traversable, non-recoverable fill slopes.

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July 2015 Errata

c) For roadways with low volumes, it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

U.S. Customary Units

Design Speed (mph)	Design ADT	Foreslopes			Backslopes		
		1V:3H or flatter	1V:2H to 1V:4H	1V:3H	1V:3H	1V:2H to 1V:4H	1V:3H or flatter
≤40	UNDER 750[c]	7–10	7–10	[a]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[e]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[e]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[e]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[d]	36–44[e]	[b]	20–22	24–26	26–28
65–70[f]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[e]	[b]	12–16	18–20	20–22
	1500–6000	28–32[e]	34–42[e]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[e]	38–46[e]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

The designer may choose to modify the clear-zone distances in Table 3-1 with adjustment factors to account for horizontal curvature, as shown in Table 3-2. These modifications normally are considered only when crash histories indicate such a need, when a specific site investigation shows a definitive crash potential that could be significantly lessened by increasing the clear zone width, and when such increases are cost-effective. Horizontal curves, particularly for high-speed facilities, are usually superelevated to increase safety and provide a more comfortable ride. Increased banking on curves where the superelevation is inadequate is an alternate method of increasing roadway safety within a horizontal curve, except where snow and ice conditions limit the use of increased superelevation.

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Traffic signal supports present a special situation where a breakaway support may not be practical or desirable. As with luminaire supports, a fallen signal post support may become an obstruction. However, the potential risks associated with the temporary loss of full signalization at the intersection should be considered.

When traffic signals are installed on high-speed facilities (generally defined as those having speed limits of 80 km/h [50 mph] or greater), the signal supports and, if not mounted on one of the signal support poles, the signal support box, should be placed as far away from the roadway as practicable. Shielding these supports can be considered if they are within the clear zone for that particular roadway. Traffic signal supports with mast arms, or those that have a support on both sides of the roadway and a wire (span wire) or other components (overhead) that spans the facility, normally are not provided with a breakaway device. Post-mounted signals are commonly installed in close proximity to traffic lanes or in wide medians; therefore, consideration should be given to using breakaway devices for these supports.

4.7 SUPPORTS FOR MISCELLANEOUS DEVICES

Other relatively narrow objects that are usually located adjacent to the roadway include intelligent transportation systems, railroad warning devices, fire hydrants, and mailboxes. These devices are discussed in the following sections.

4.7.1 Railroad Crossing Warning Devices

Highway and railroad officials should cooperatively decide on the type of warning device needed at a particular crossing (e.g., crossbucks, flashing light signals, or gates). As a minimum, crossbucks are required and should be installed on an acceptable support. Other warning device supports, such as signals or gates, can cause an increase in the severity of injuries to vehicle occupants if struck at high speeds. In these cases, if the support is located in the clear zone, consideration should be given to shielding the support with a crash cushion. A longitudinal barrier often is not used because there is seldom sufficient space for a proper downstream end treatment, a longer obstacle is created by installing a guardrail, and a vehicle striking a longitudinal barrier when a train is occupying the crossing may be redirected into the train. The designer also should be aware of the immediate risk to other motorists just after the devices are knocked down by impacting vehicles.

4.7.2 Fire Hydrants

Fire hydrants are another type of roadside feature that may be an obstacle. While most fire hydrants are made of cast iron and could be expected to fracture upon impact, crash testing meeting current testing procedures has not been done to verify that designs meet breakaway criteria. However, at least one fire hydrant stem and coupling design that provides for immediate water shutoff if struck by a vehicle is available.

Whenever possible, fire hydrants should be located sufficiently far away from the roadway so that they do not become obstructions for the motorist, yet are still readily accessible to and usable by emergency personnel. Any portion of the hydrant not designed to break away should be within 100 mm [4 in.] of the ground.

4.7.3 Mailbox Supports

Mailbox supports are addressed in Chapter 11.

4.8 UTILITY POLES

Motor vehicle crashes with utility poles account for approximately 12 percent of all fixed-object fatal crashes annually. This degree of involvement is related to the number of poles in use, their proximity to the traveled way, and their unyielding nature.

As with sign and luminaire supports, the most desirable solution is to locate utility poles where they are least likely to be struck. One alternative unique to power and telephone lines is to bury them, thereby eliminating the obstacles. For poles that cannot be eliminated or relocated, breakaway designs have been developed and successfully crash tested. This alternative is briefly discussed in this sec-

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tion. Because utility poles are generally privately owned and installed devices permitted on publicly owned rights-of-way, they are not under the direct control of a highway agency. This dual responsibility sometimes complicates the implementation of effective countermeasures.

For new construction or major reconstruction, every effort should be made to install or relocate utility poles as far from the traveled way as practical. Two AASHTO publications—*A Policy on the Accommodation of Utilities within Freeway Right-of-Way (1)* and *A Guide for Accommodating Utilities within Highway Right-of-Way (2)*—provide more detailed information on locating utility facilities within highway rights-of-way.

For existing utility pole installations, a concentration of crashes at a site or a certain type of crash that seems to occur frequently in a given jurisdiction may indicate that the highway or utility system is contributing to the crash potential. Utility pole crashes are subject to the same patterns as other types of roadway crashes; thus, they are subject to traditional highway crash study procedures. A detailed study of crash records may identify high-frequency crash locations and point out improvements that will reduce the number and severity of future crashes. Road users (the public and utility firms) also can provide input into the nature and causes of highway and utility crashes. The steps that are normally included in a comprehensive crash-reduction program are the following:

- Setting up a traffic records system
- Identifying high-frequency crash locations
- Analyzing high-frequency crash locations
- Correcting the high-frequency crash locations
- Reviewing the results of the program

Identification and analysis programs of high-frequency crash locations can vary from simple to complex depending on the size and resources of the agency. The *NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan (8)* includes Volume 8: *A Guide for Reducing Collisions Involving Utility Poles*. This report suggests objectives and strategies for reducing the consequences and frequency of utility pole crashes. Table 4-1 suggests strategies in response to specific objectives.

The use of breakaway poles is intended to reduce the severity of an accident rather than its frequency. The designs shown in Figure 4-14, consisting of ground-level slip base and upper hinge assembly, have been successfully crash tested. These designs may be considered for poles in vulnerable locations that cannot be economically removed or relocated, such as gore areas, the outside of sharp curves, and opposite the intersecting roadway at T-intersections. Several variations of the breakaway utility pole are available and have demonstrated satisfactory in-service performance in the limited field trials to date.

Table 4-1. Objectives and Strategies for Reducing Utility Pole Crashes

Objectives		Strategies
A	Treat specific utility poles in high-crash and high-risk spot locations.	A1 Remove poles in hazardous locations.
		A2 Relocate poles in hazardous locations further from the roadway or to a less vulnerable location.
		A3 Use breakaway poles.
		A4 Shield drivers from poles in a hazardous location.
		A5 Improve the drivers' ability to see poles in a hazardous location.
		A6 Apply traffic-calming measures to reduce speeds on high-risk sections.
B	Prevent placing utility poles in high-risk locations.	B1 Develop, revise, and implement policies to prevent placing or replacing poles within the recovery area.
C	Treat several utility poles along a corridor to minimize the likelihood of crashing into a utility pole if a vehicle runs off the road.	C1 Place utilities underground.
		C2 Relocate poles along the corridor farther from the roadway and/or to less vulnerable locations.
		C3 Decrease the number of poles along the corridor.

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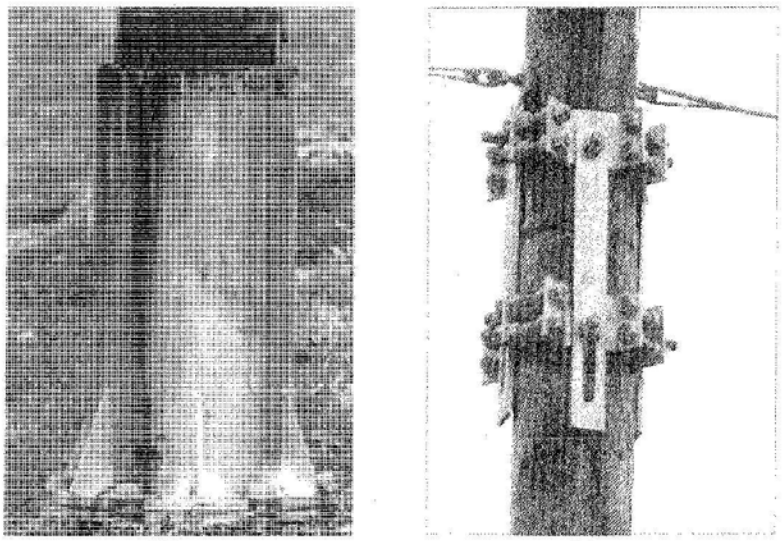

(A) (B)

Figure 4-14. Prototype Breakaway Design for Utility Poles

4.9 TREES

Single vehicle crashes with trees account for more than 50 percent of all fixed-object fatal crashes annually and result in the deaths of approximately 4,550 persons each year. Unlike the roadside hardware previously addressed in this chapter, trees are not generally a design element over which highway designers have direct control. With the exception of landscaping projects in which the types and locations of trees and other vegetation can be carefully chosen, the problem most often faced by designers is the treatment of existing trees that are likely to be impacted by an errant vehicle. To promote consistency within a state, each highway agency should develop a formal policy to provide guidance to design, landscape, construction, and maintenance personnel for this situation. The concept of context-sensitive design has been embraced in much of the country and is endorsed by AASHTO. Policies that focus solely on the safety aspects of trees and promote tree removal over other measures may not be acceptable to all involved parties. This section is intended to provide general guidelines from which a specific policy on trees may be developed.

Trees are potential obstructions by virtue of their size and their location in relation to vehicular traffic. Generally, an existing tree with an expected mature size greater than 100 mm [4 in.] at stub height is considered a fixed object. When trees or shrubs with multiple trunks or groups of small trees are close together, they may be considered as having the effect of a single tree with their combined cross-sectional area. Maintenance forces can minimize future problems by mowing clear zones to prevent seedlings from becoming established. The location factor is more difficult to address than tree size. Typically, large trees should be removed from within the selected clear zone for new construction and for reconstruction. As noted in Chapter 3, the extent of the clear zone depends on several variables, including highway speeds, traffic volumes, and roadside slopes. Segments of a highway can be analyzed to identify individual trees or groups of trees that are candidates for corrective measures. County and township roads, which generally have restrictive geometric designs and narrow off-road recovery areas, account for a large percentage of the annual tree-related fatal crashes, followed by state and U.S. numbered highways on curved alignment. Fatal crashes involving trees along Interstate highways are relatively rare in most states.

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The *NCHRP REPORT 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan (8)* includes *Volume 3: A Guide for Addressing Collisions with Trees in Hazardous Locations*. This guide provides objectives and strategies that can be employed to reduce the number and severity of run-off-the-road crashes with trees. Table 4-2 suggests strategies in response to specific objectives.

Table 4-2. Objectives and Strategies for Reducing Crashes with Trees

Objectives		Strategies
A	Prevent trees from growing in hazardous locations.	A1 Develop, revise, and implement planting guidelines to prevent placing trees in hazardous location.
		A2 Develop mowing and vegetation control guidelines.
B	Eliminate the hazardous condition and/or reduce the severity of the crash.	B1 Remove trees in hazardous locations.
		B2 Shield motorists from striking trees.
		B3 Modify roadside clear zone in the vicinity of trees.
		B4 Delineate trees in hazardous locations.

Following several years of research by the Michigan Department of Transportation, a *Guide to Management of Roadside Trees (5)* was distributed nationally by the Federal Highway Administration (FHWA) as Report No. FHWA-IP-86-17. This document contains detailed information on identifying and evaluating higher risk roadside environments and provides guidance for implementing roadside tree removal. It also addresses environmental issues, alternative treatments, mitigation efforts, and maintenance practices. The remainder of this section is basically a summary of the information and recommendations included in that report.

Essentially, there are two methods for addressing the issue of roadside trees. The first is to keep the motorist on the road whenever possible, while the second is to mitigate the danger inherent in leaving a roadway with trees along it.

On-roadway treatments include

- Pavement marking,
- Rumble strips,
- Signs,
- Delineators, and
- Roadway improvements.

Pavement markings are one of the most effective and least costly improvements that can be made to a roadway. Centerline and edge line markings are particularly effective for roads with heavy nighttime traffic, frequent fog, and narrow lanes. Shoulder rumble strips also can be used to warn motorists that their vehicles have crossed the edgeline and may run off the road.

The installation of advance warning signs and roadway delineators also can be used to notify motorists of sections of roadway where extra caution is advised. Typically, these will be used in advance of curves that are noticeably sharper than those immediately preceding it.

Roadway improvements such as curve reconstruction to provide increased superelevation, shoulder widening, and paving are relatively expensive countermeasures that may not be cost-effective in all cases.

Off-roadway treatments consist primarily of two options:

- Tree removal
- Shielding

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The removal of individual trees should be considered when those trees are determined to be both obstructions and in a location where they are likely to be hit. Such trees often can be identified by past crash histories at similar sites, by scars indicating previous crashes, or by field reviews. Removal of individual trees will not reduce the probability that a vehicle will leave the roadway at that point, but it should reduce the severity of any resulting crash. For example, 1V:3H and flatter slopes may be traversable, but a vehicle on a 1V:3H slope usually will reach the bottom. If numerous trees are at the toe of the slope, removal of isolated trees on the slope will not significantly reduce the risk of a crash. Similarly, if the recommended clear zone for a particular roadway is 7 m [23 ft], including the shoulder, removal of trees 6 to 7 m [20 to 23 ft] from the road will not materially change the risk to motorists if an unbroken tree line remains at 8 m [26 ft] and beyond. However, isolated trees noticeably closer to the roadway may be candidates for removal. If a tree or group of trees is in a vulnerable location but cannot be removed, a properly designed and installed traffic barrier can be used to shield them. Roadside barriers should be used only when the severity of striking the tree is greater than striking the barrier. Specific information on the selection, location, and design of roadside barriers is in Chapter 5.

REFERENCES

1. AASHTO. *A Policy on the Accommodation of Utilities within Freeway Right-of-Way*. American Association of State Highway and Transportation Officials, Washington, DC, 2005
2. AASHTO. *A Guide for Accommodating Utilities within Highway Right-of-Way*. American Association of State Highway and Transportation Officials, Washington, DC, 2005.
3. AASHTO. *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*. American Association of State Highway and Transportation Officials, Washington, DC, 2009.
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9. Ross, H. E., Jr., D. L. Sicking, and R. A. Zimmer. *National Cooperative Highway Research Program Report 350: Recommended Procedures for the Safety Evaluation of Highway Features*. NCHRP, Transportation Research Board, Washington, DC, 1993.
10. TRB. Safety Appurtenances and Utility Accommodation. In *Transportation Research Record 970*. Transportation Research Board, National Research Council, Washington, DC, 1984.

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10.2.2.3.1 Utility Poles

Utility poles are prevalent in urban environments and can pose a substantial hazard to errant vehicles and motorists. The frequency of utility pole crashes increases with daily traffic volume and the number of poles adjacent to the traveled way *(17)*. Utility poles are adjacent to urban roadways more than rural highways, and demands for operational improvements coupled with limited street right-of-ways often lead to the placement of these poles proximate to the roadway edge. In fact, utility poles are second only to trees as the object associated with the greatest number of fixed-object fatalities *(15)*. Though utility poles often are impacted directly, guy wires that stabilize the pole also can pose a hazard because vehicles can impact them directly as well.

In general, utility pole-related crashes are considered to be principally an urban hazard, with urban areas experiencing 36.9 pole crashes per 100 miles of roadway, while rural areas experience 5.2 pole crashes per 100 miles *(11)*. One study determined that the variable with the greatest ability to explain utility pole-related crashes was the average daily traffic (ADT) along the roadway *(17)*. ADT as the critical variable explains the importance of vehicle exposure in understanding run-off-the-road crashes with utility poles.

A common recommendation for addressing the utility pole safety issue is to place utilities underground and thereby remove the hazardous poles. The removal of all poles in the urban roadside environment is not practical; these poles often function as the supports for street lights and other shared utilities. However, several known utility pole hazardous locations should be avoided when feasible. Generally, utility poles should be located *(6, 10)*

- As far as possible from the active travel lanes,
- Away from access points where the pole may restrict sight distance,
- Inside a sharp horizontal curve (because errant vehicles tend to continue straight towards the outside of curves), and
- On only one side of the road.

10.2.2.3.2 Lighting and Visibility

An important issue in addressing roadside safety is the role of lighting in making potentially hazardous roadside environments visible to the road users (i.e. motor vehicle drivers, bicyclists, and pedestrians), particularly during night-time hours.

The North Carolina Department of Transportation's *Traditional Neighborhood Development (TND) Guidelines (12)* recommends that for a TND designed to accommodate "a human scale, walkable community with moderate to high residential densities and a mixed use core," more and shorter lights should be used rather than less frequent, tall, high-intensity street lights. This closer light spacing will provide adequate coverage for both pedestrian and vehicular activity. Chapter 4 briefly describes the various recommended luminaire supports.

10.2.2.3.3 Sign Posts and Roadside Hardware

The design of crashworthy sign posts is directed by AASHTO's *Manual for Assessing Safety Hardware* (MASH) *(3)* and *NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features (14)*, and substantial research has been devoted to designing these features to be crashworthy. Multiple designs for these features are included in the this edition of the *Roadside Design Guide*, and specifications for evaluating these features are contained in AASHTO's *Standard Specification and Structural Supports for Highway Signs, Luminaires, and Traffic Signals (2)*. Table 10-10 describes roadside safety strategies for utility poles, light poles, and street sign posts.

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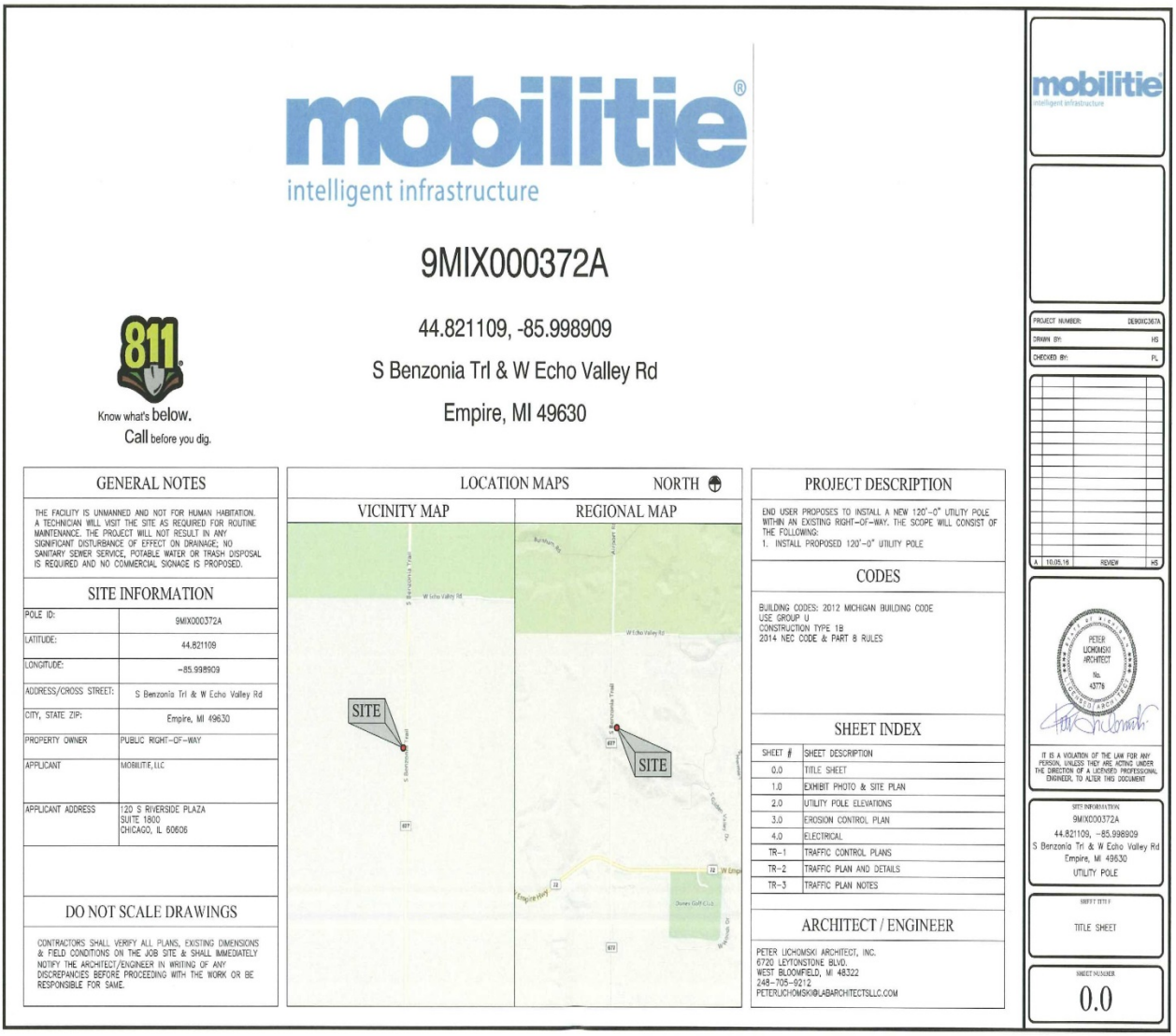
6480 Zeeb Road, Dexter, MI 48130

Exhibit C

Mobilitie, LLC Site Plans and Details



mobilitie
intelligent infrastructure

9MIX000372A

44.821109, -85.998909

S Benzonia Trl & W Echo Valley Rd

Empire, MI 49630

811 Know what's below. Call before you dig.

GENERAL NOTES

THE FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. A TECHNICIAN WILL VISIT THE SITE AS REQUIRED FOR ROUTINE MAINTENANCE. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT DISTURBANCE OF EFFECT ON DRAINAGE; NO SANITARY SEWER SERVICE, POTABLE WATER OR TRASH DISPOSAL IS REQUIRED AND NO COMMERCIAL SIGNAGE IS PROPOSED.

SITE INFORMATION

POLE ID:	9MIX000372A
LATITUDE:	44.821109
LONGITUDE:	-85.998909
ADDRESS/CROSS STREET:	S Benzonia Trl & W Echo Valley Rd
CITY, STATE ZIP:	Empire, MI 49630
PROPERTY OWNER	PUBLIC RIGHT-OF-WAY
APPLICANT	MOBILITIE, LLC
APPLICANT ADDRESS	120 S RIVERSIDE PLAZA SUITE 1800 CHICAGO, IL 60606

DO NOT SCALE DRAWINGS

CONTRACTORS SHALL VERIFY ALL PLANS, EXISTING DIMENSIONS & FIELD CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ARCHITECT/ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

LOCATION MAPS NORTH

VICINITY MAP

REGIONAL MAP

PROJECT DESCRIPTION

END USER PROPOSES TO INSTALL A NEW 120'-0" UTILITY POLE WITHIN AN EXISTING RIGHT-OF-WAY. THE SCOPE WILL CONSIST OF THE FOLLOWING:
1. INSTALL PROPOSED 120'-0" UTILITY POLE

CODES

BUILDING CODES: 2012 MICHIGAN BUILDING CODE
USE GROUP U
CONSTRUCTION TYPE 1B
2014 NEC CODE & PART 8 RULES

SHEET INDEX

SHEET #	SHEET DESCRIPTION
0.0	TITLE SHEET
1.0	EXHIBIT PHOTO & SITE PLAN
2.0	UTILITY POLE ELEVATIONS
3.0	EROSION CONTROL PLAN
4.0	ELECTRICAL
TR-1	TRAFFIC CONTROL PLANS
TR-2	TRAFFIC PLAN AND DETAILS
TR-3	TRAFFIC PLAN NOTES

ARCHITECT / ENGINEER

PETER LICHOMSKI ARCHITECT, INC.
6720 LEYTONSTONE BLVD.
WEST BLOOMFIELD, MI 48322
248-705-9212
PETERLICHOMSKI@LABARCHITECTSLLC.COM

mobilitie
intelligent infrastructure

PROJECT NUMBER: DER01C367A
DRAWN BY: HS
CHECKED BY: PL

A 10.25.16 REVIEW HS

PETER LICHOMSKI ARCHITECT No. 43776

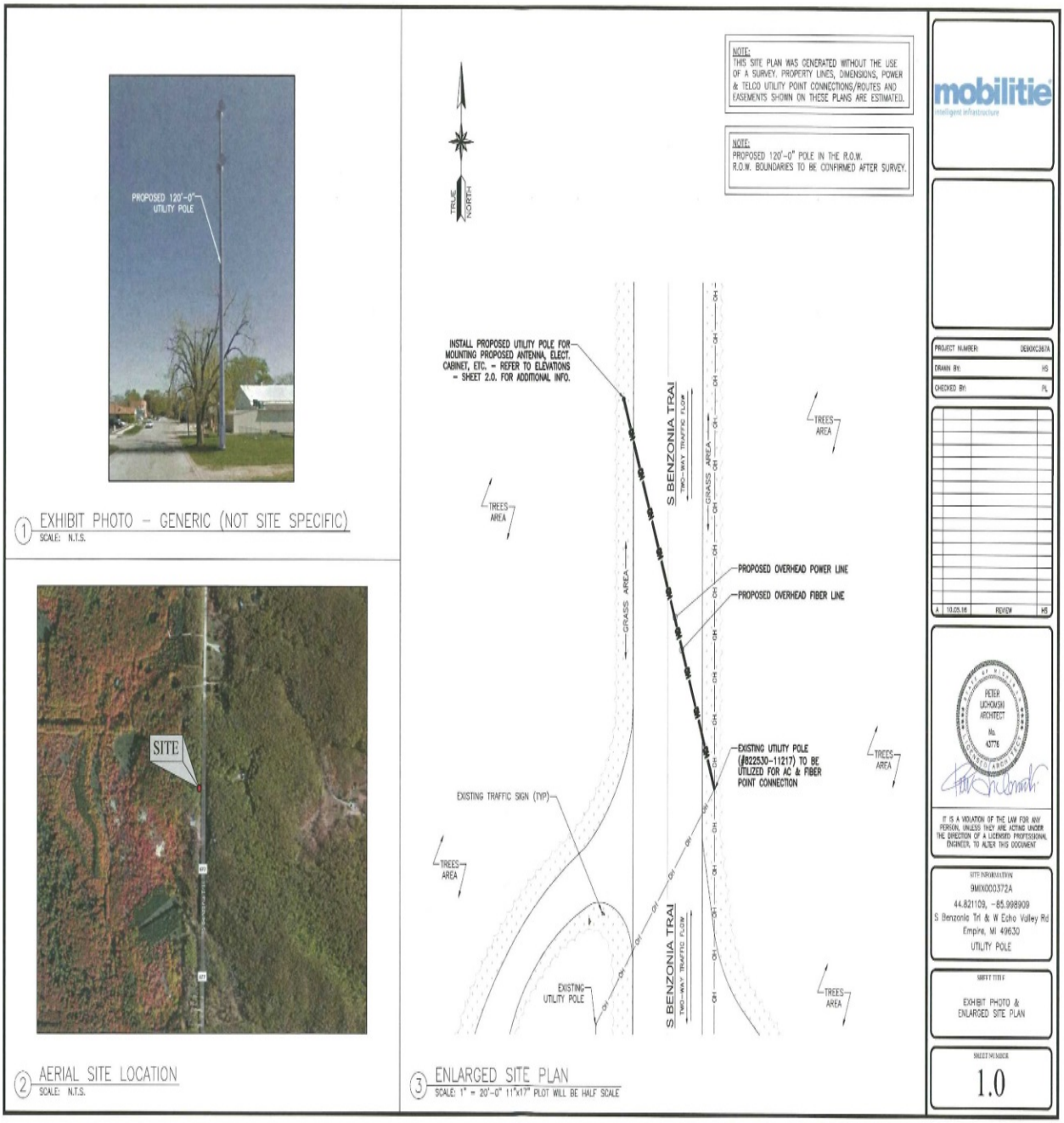
IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

SITE INFORMATION
9MIX000372A
44.821109, -85.998909
S Benzonia Trl & W Echo Valley Rd
Empire, MI 49630
UTILITY POLE

SHEET TITLE
TITLE SHEET

SHEET NUMBER
0.0

6480 Zeeb Road, Dexter, MI 48130



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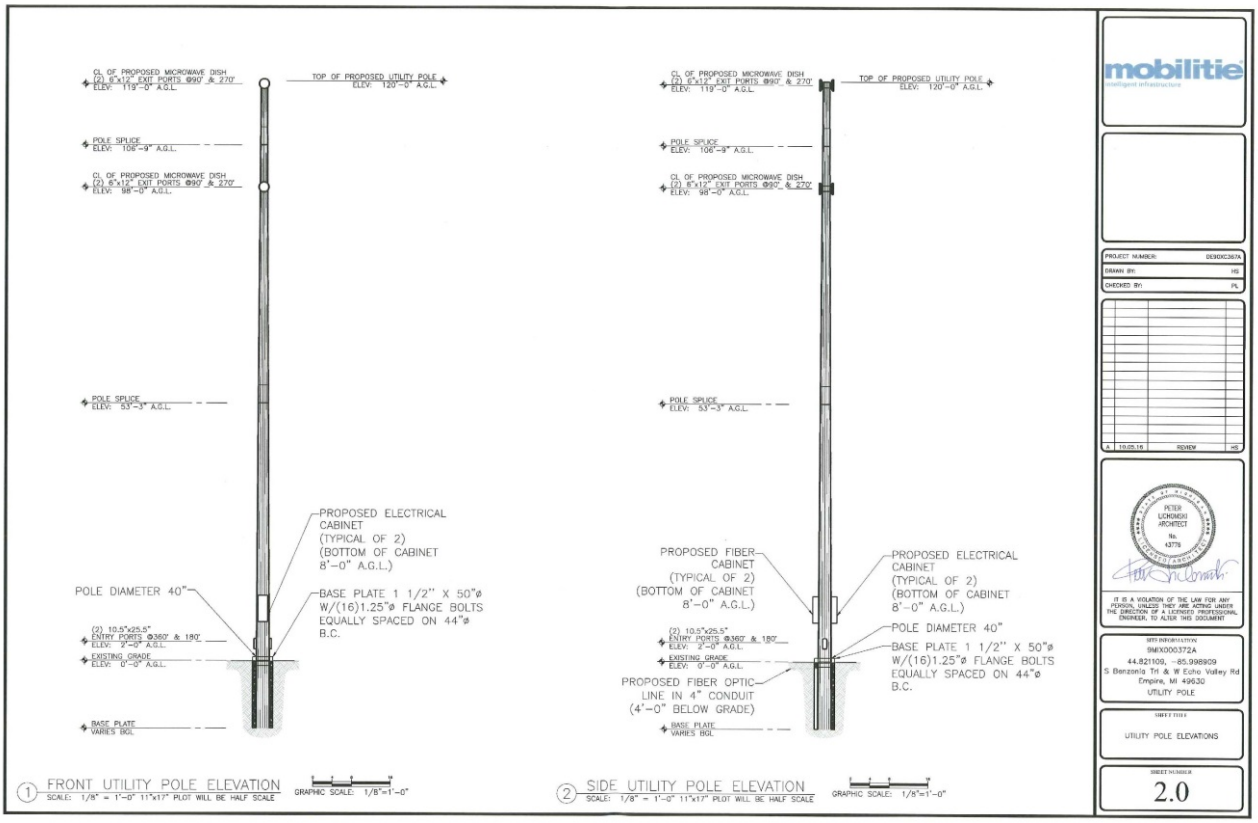
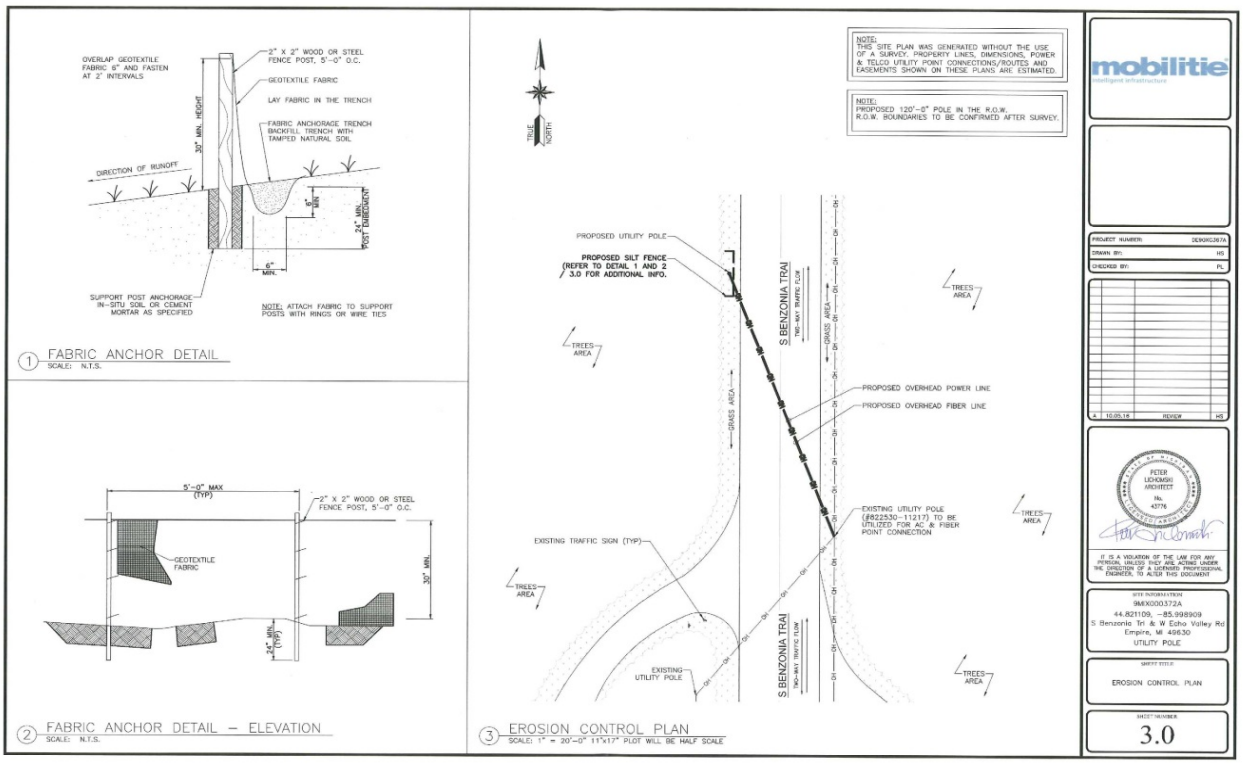
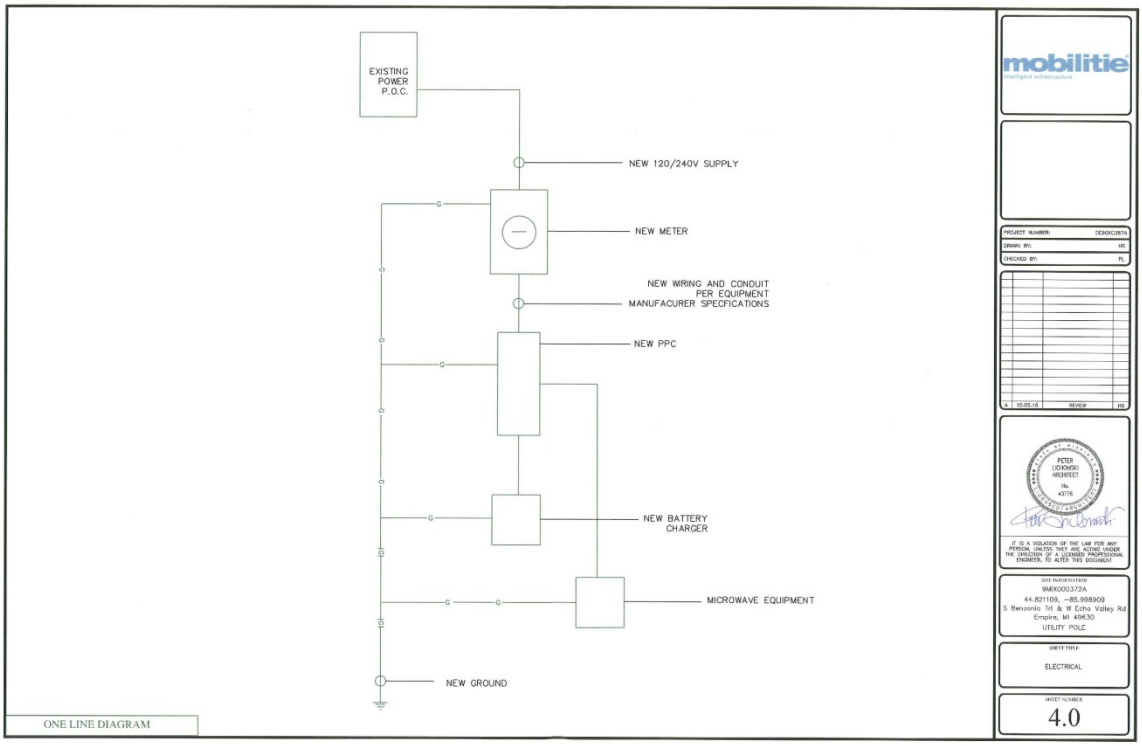
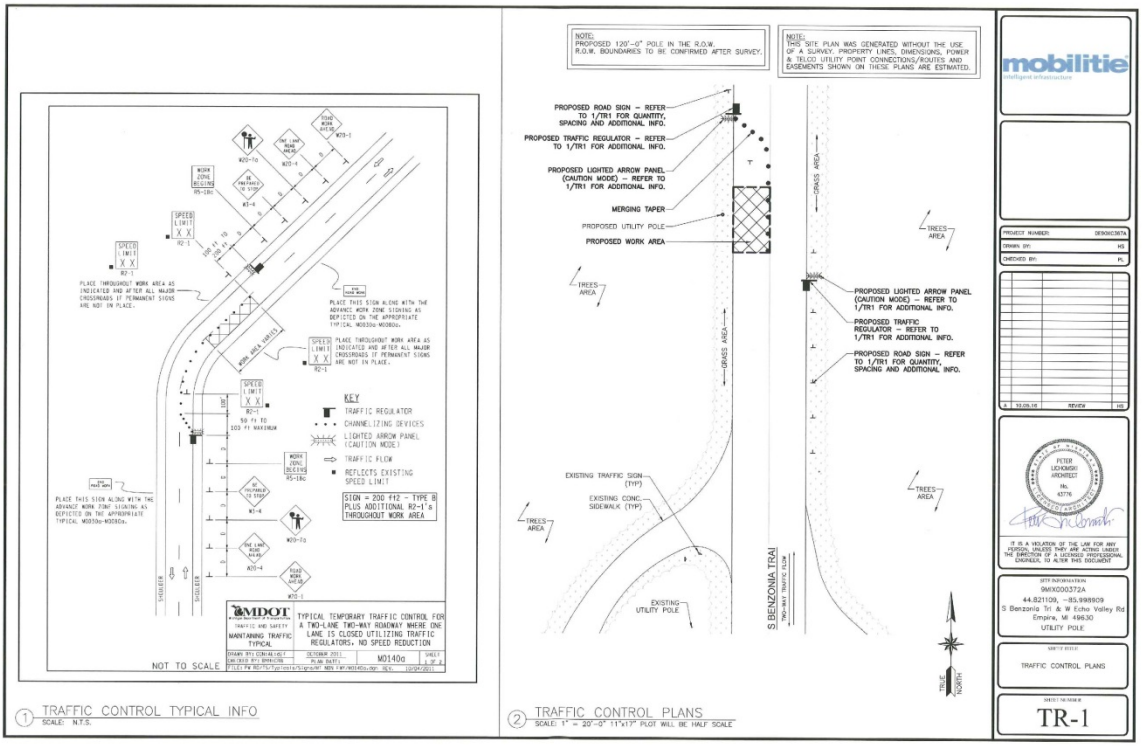


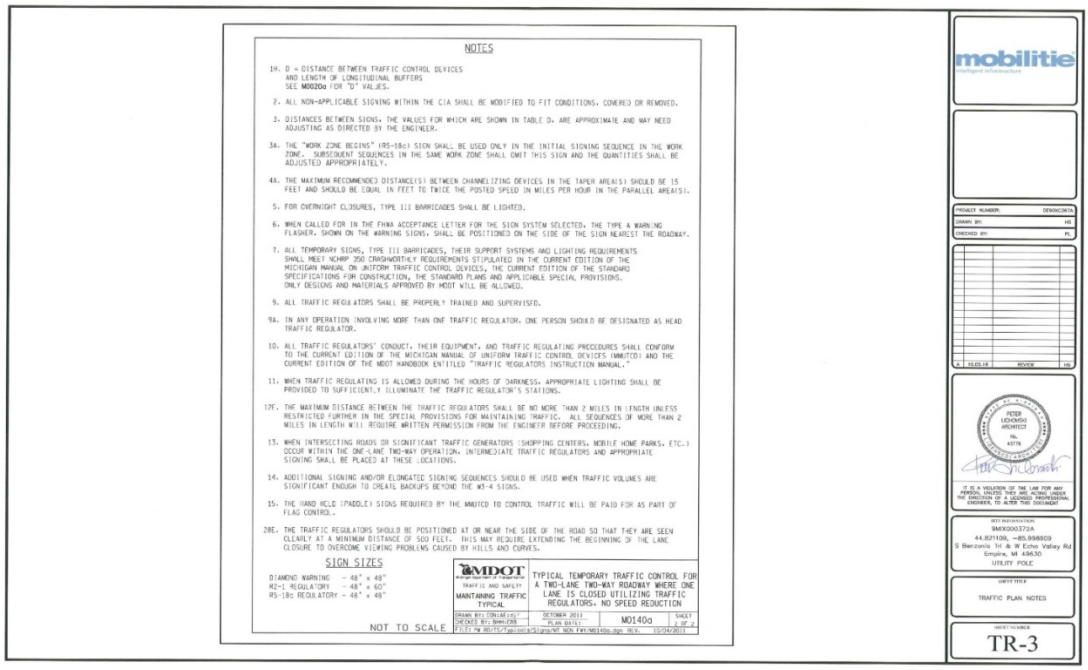


6480 Zeeb Road, Dexter, MI 48130





6480 Zeeb Road, Dexter, MI 48130



NOTES

1H. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES AND LENGTH OF LONGITUDINAL BUFFERS SEE M0020a FOR "D" VALUES.

2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.

3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.

3A. THE "WORK ZONE BEGINS" (R5-18c) SIGN SHALL BE USED ONLY IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE SHALL OMIT THIS SIGN AND THE QUANTITIES SHALL BE ADJUSTED APPROPRIATELY.

4A. THE MAXIMUM RECOMMENDED DISTANCE(S) BETWEEN CHANNELIZING DEVICES IN THE TAPER AREA(S) SHOULD BE 15 FEET AND SHOULD BE EQUAL IN FEET TO TWICE THE POSTED SPEED IN MILES PER HOUR IN THE PARALLEL AREA(S).

5. FOR OVERNIGHT CLOSURES, TYPE III BARRICADES SHALL BE LIGHTED.

6. WHEN CALLED FOR IN THE FHWA ACCEPTANCE LETTER FOR THE SIGN SYSTEM SELECTED, THE TYPE A WARNING FLASHER, SHOWN ON THE WARNING SIGNS, SHALL BE POSITIONED ON THE SIDE OF THE SIGN NEAREST THE ROADWAY.

7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.

9. ALL TRAFFIC REGULATORS SHALL BE PROPERLY TRAINED AND SUPERVISED.

9A. IN ANY OPERATION INVOLVING MORE THAN ONE TRAFFIC REGULATOR, ONE PERSON SHOULD BE DESIGNATED AS HEAD TRAFFIC REGULATOR.

10. ALL TRAFFIC REGULATORS' CONDUCT, THEIR EQUIPMENT, AND TRAFFIC REGULATING PROCEDURES SHALL CONFORM TO THE CURRENT EDITION OF THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MMUTCD) AND THE CURRENT EDITION OF THE MDOT HANDBOOK ENTITLED "TRAFFIC REGULATORS INSTRUCTION MANUAL."

11. WHEN TRAFFIC REGULATING IS ALLOWED DURING THE HOURS OF DARKNESS, APPROPRIATE LIGHTING SHALL BE PROVIDED TO SUFFICIENTLY ILLUMINATE THE TRAFFIC REGULATOR'S STATIONS.

12F. THE MAXIMUM DISTANCE BETWEEN THE TRAFFIC REGULATORS SHALL BE NO MORE THAN 2 MILES IN LENGTH UNLESS RESTRICTED FURTHER IN THE SPECIAL PROVISIONS FOR MAINTAINING TRAFFIC. ALL SEQUENCES OF MORE THAN 2 MILES IN LENGTH WILL REQUIRE WRITTEN PERMISSION FROM THE ENGINEER BEFORE PROCEEDING.

13. WHEN INTERSECTING ROADS OR SIGNIFICANT TRAFFIC GENERATORS (SHOPPING CENTERS, MOBILE HOME PARKS, ETC.) OCCUR WITHIN THE ONE-LANE TWO-WAY OPERATION, INTERMEDIATE TRAFFIC REGULATORS AND APPROPRIATE SIGNING SHALL BE PLACED AT THESE LOCATIONS.

14. ADDITIONAL SIGNING AND/OR ELONGATED SIGNING SEQUENCES SHOULD BE USED WHEN TRAFFIC VOLUMES ARE SIGNIFICANT ENOUGH TO CREATE BACKUPS BEYOND THE W3-4 SIGNS.

15. THE HAND HELD (PADDLE) SIGNS REQUIRED BY THE MMUTCD TO CONTROL TRAFFIC WILL BE PAID FOR AS PART OF FLAG CONTROL.

28E. THE TRAFFIC REGULATORS SHOULD BE POSITIONED AT OR NEAR THE SIDE OF THE ROAD SO THAT THEY ARE SEEN CLEARLY AT A MINIMUM DISTANCE OF 500 FEET. THIS MAY REQUIRE EXTENDING THE BEGINNING OF THE LANE CLOSURE TO OVERCOME VIEWING PROBLEMS CAUSED BY HILLS AND CURVES.

SIGN SIZES

DIAMOND WARNING - 48" x 48"
R2-1 REGULATORY - 48" x 60"
R5-18c REGULATORY - 48" x 48"

NOT TO SCALE

MDOT
TRAFFIC AND SAFETY
MAINTAINING TRAFFIC
TYPICAL

TYPICAL TEMPORARY TRAFFIC CONTROL FOR A TWO-LANE TWO-WAY ROADWAY WHERE ONE LANE IS CLOSED UTILIZING TRAFFIC REGULATORS. NO SPEED REDUCTION

DRAWN BY: TORN/AEG/BJF
CHECKED BY: BMH/DRR
FILE: N:\ROUTE\Typicals\Signs\MT NON FWY\M0140a.dgn
OCTOBER 2011
PLAN DATE:
M0140a
SHEET 1 OF 2
REV. 10/24/2011

mobilitie
intelligent infrastructure

PROJECT NUMBER: DEMOO367A
DRAWN BY: HS
CHECKED BY: PL

1 10.05.16 REVIEW HS

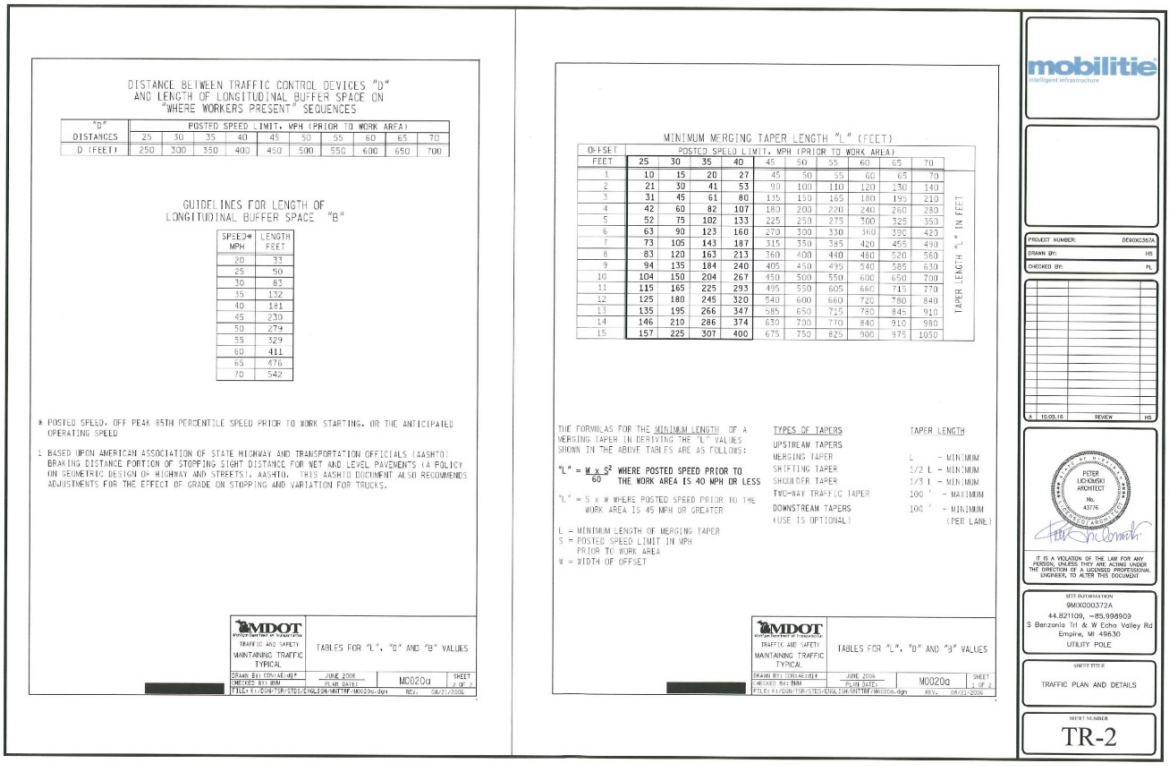
PETER LICHOWSKI ARCHITECT No. 43776

IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

SITE INFORMATION
9MIX000372A
44.821109, -85.998909
S Benzonia Trl & W Echo Valley Rd
Empire, MI 49630
UTILITY POLE

SHEET TITLE
TRAFFIC PLAN NOTES

SHEET NUMBER
TR-3



DISTANCE BETWEEN TRAFFIC CONTROL DEVICES "D" AND LENGTH OF LONGITUDINAL BUFFER SPACE ON "WHERE WORKERS PRESENT" SEQUENCES

"D" DISTANCES	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)									
	25	30	35	40	45	50	55	60	65	70
D (FEET)	250	300	350	400	450	500	550	600	650	700

GUIDELINES FOR LENGTH OF LONGITUDINAL BUFFER SPACE "B"

SPEED* MPH	LENGTH FEET
20	33
25	50
30	83
35	132
40	181
45	230
50	279
55	329
60	411
65	476
70	542

* POSTED SPEED, OFF PEAK 85TH PERCENTILE SPEED PRIOR TO WORK STARTING, OR THE ANTICIPATED OPERATING SPEED

1 BASED UPON AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) BRAKING DISTANCE PORTION OF STOPPING SIGHT DISTANCE FOR WET AND LEVEL PAVEMENTS (A POLICY ON GEOMETRIC DESIGN OF HIGHWAY AND STREETS), AASHTO. THIS AASHTO DOCUMENT ALSO RECOMMENDS ADJUSTMENTS FOR THE EFFECT OF GRADE ON STOPPING AND VARIATION FOR TRUCKS.

MDOT
TRAFFIC AND SAFETY
MAINTAINING TRAFFIC
TYPICAL

TABLES FOR "L", "D" AND "B" VALUES

DRAWN BY: TORN/AEG/BJF
CHECKED BY: BMH/DRR
FILE: N:\ROUTE\TSR\TYPES\ENGLISH\MTTFF\M0020a.dgn
JUNE 2006
PLAN DATE:
M0020a
SHEET 1 OF 2
REV. 08/21/2006

MINIMUM MERGING TAPER LENGTH "L" (FEET)

OFFSET FEET	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)									
	25	30	35	40	45	50	55	60	65	70
1	10	15	20	27	45	50	55	60	65	70
2	21	30	41	53	90	100	110	120	130	140
3	31	45	61	80	135	150	165	180	195	210
4	42	60	82	107	180	200	220	240	260	280
5	52	75	102	133	225	250	275	300	325	350
6	63	90	123	160	270	300	330	360	390	420
7	73	105	143	187	315	350	385	420	455	490
8	83	120	163	213	360	400	440	480	520	560
9	94	135	184	240	405	450	495	540	585	630
10	104	150	204	267	450	500	550	600	650	700
11	115	165	225	293	495	550	605	660	715	770
12	125	180	245	320	540	600	660	720	780	840
13	135	195	266	347	585	650	715	780	845	910
14	146	210	286	374	630	700	770	840	910	980
15	157	225	307	400	675	750	825	900	975	1050

TAPER LENGTH "L" IN FEET

THE FORMULAS FOR THE MINIMUM LENGTH OF A MERGING TAPER IN DERIVING THE "L" VALUES SHOWN IN THE ABOVE TABLES ARE AS FOLLOWS:

$L = \frac{W \times S^2}{60}$ WHERE POSTED SPEED PRIOR TO THE WORK AREA IS 40 MPH OR LESS

$L = S \times W$ WHERE POSTED SPEED PRIOR TO THE WORK AREA IS 45 MPH OR GREATER

L = MINIMUM LENGTH OF MERGING TAPER
S = POSTED SPEED LIMIT IN MPH PRIOR TO WORK AREA
W = WIDTH OF OFFSET

TYPES OF TAPERS	TAPER LENGTH
UPSTREAM TAPERS	
MERGING TAPER	L - MINIMUM
SHIFTING TAPER	1/2 L - MINIMUM
SHOULDER TAPER	1/3 L - MINIMUM
TWO-WAY TRAFFIC TAPER	100 ' - MAXIMUM
DOWNSTREAM TAPERS (USE IS OPTIONAL)	100 ' - MINIMUM (PER LANE)

MDOT
TRAFFIC AND SAFETY
MAINTAINING TRAFFIC
TYPICAL

TABLES FOR "L", "D" AND "B" VALUES

DRAWN BY: TORN/AEG/BJF
CHECKED BY: BMH/DRR
FILE: N:\ROUTE\TSR\TYPES\ENGLISH\MTTFF\M0020a.dgn
JUNE 2006
PLAN DATE:
M0020a
SHEET 2 OF 2
REV. 08/21/2006

mobilitie
intelligent infrastructure

PROJECT NUMBER: DEMOO367A
DRAWN BY: HS
CHECKED BY: PL

1 10.05.16 REVIEW HS

PETER LICHOWSKI ARCHITECT No. 43776

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SITE INFORMATION
9MIX000372A
44.821109, -85.998909
S Benzonia Trl & W Echo Valley Rd
Empire, MI 49630
UTILITY POLE

SHEET TITLE
TRAFFIC PLAN AND DETAILS

SHEET NUMBER
TR-2

The Mobilitie, LLC proposal is to place a rigid steel pole, 120’ in height, 5-6 foot in diameter with a concrete foundation extending approximately 20 feet below the surface (Mobilitie,LLC Utility Pole Elevation, plans sheets 1 - 8).

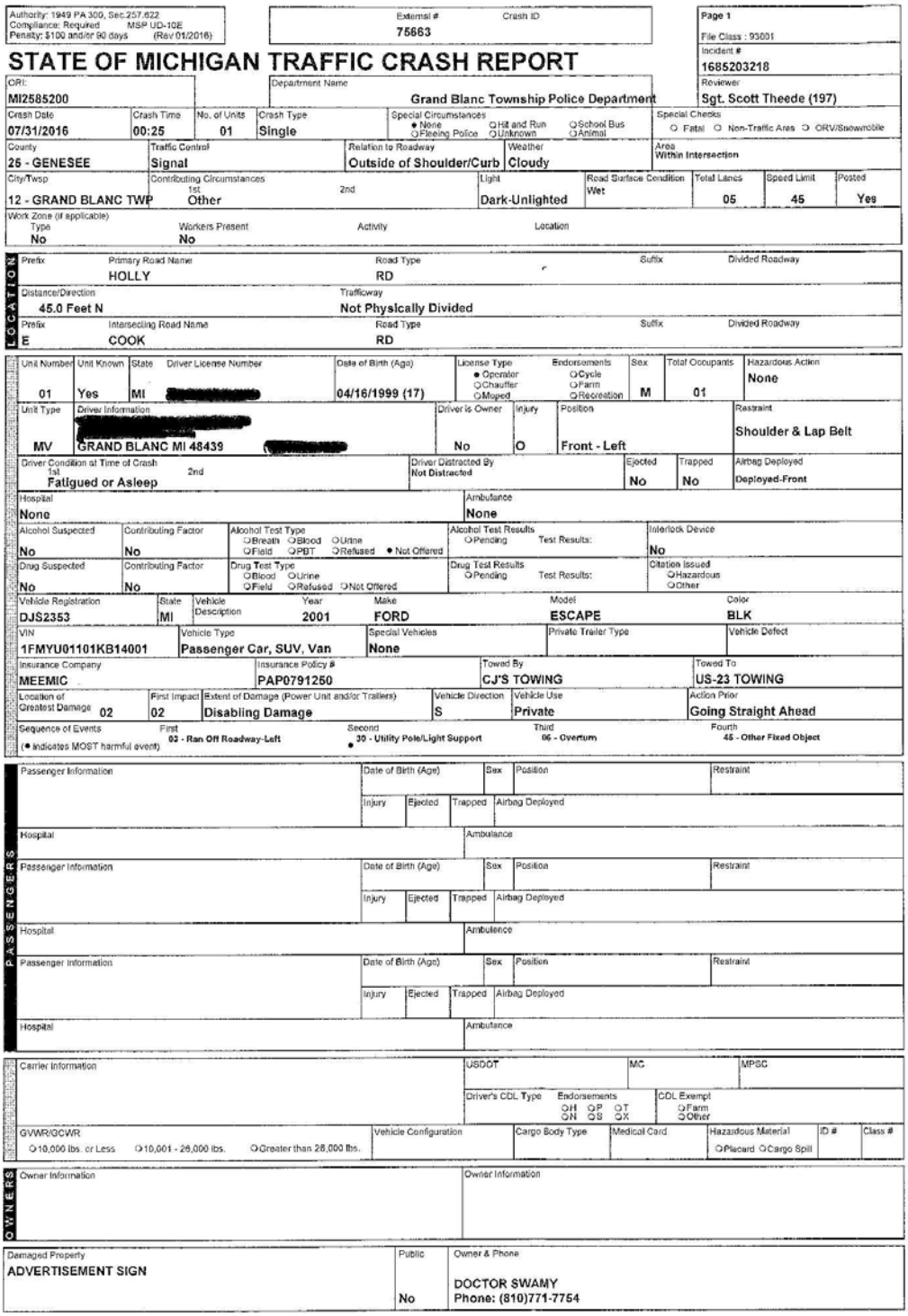
6480 Zeeb Road, Dexter, MI 48130

Exhibit D

Genesee County Crash with ACD.Net Pole Photographs

These design criteria are important because in real world experience, we know that accidents do happen which involve collisions with these roadside obstacles. Many produce fatal results, particularly with unguarded or improperly guarded obstacles in the right of way. Below are photographs and the accident report of just such an accident involving a communication pole placed in violation of the specific permit siting authorization granted by the Genesee County Road Commission and, subsequently revoked as a result of such violations.

6480 Zeeb Road, Dexter, MI 48130



Authority: 1949 PA 300, Sec.257.622 Compliance: Required MSP UD-10E Penalty: $100 and/or 90 days (Rev 01/2016)

External # 75663 Crash ID

Page 1 File Class : 93001 Incident # 1685203218 Reviewer Sgt. Scott Theede (197)

STATE OF MICHIGAN TRAFFIC CRASH REPORT

ORI	Department Name	Crash Date	Crash Time	No. of Units	Crash Type	Special Circumstances	Special Checks
MI2585200	Grand Blanc Township Police Department	07/31/2016	00:25	01	Single	● None ○Hit and Run ○School Bus ○Fleeing Police ○Unknown ○Animal	○ Fatal ○ Non-Traffic Area ○ ORV/Snowmobile

County	Traffic Control	Relation to Roadway	Weather	Area
25 - GENESEE	Signal	Outside of Shoulder/Curb	Cloudy	Within Intersection

City/Twsp	Contributing Circumstances 1st	2nd	Light	Road Surface Condition	Total Lanes	Speed Limit	Posted
12 - GRAND BLANC TWP	Other		Dark-Unlighted	Wet	05	45	Yes

Work Zone (if applicable) Type: No | Workers Present: No | Activity | Location

LOCATION

Prefix	Primary Road Name	Road Type	Suffix	Divided Roadway
	HOLLY	RD		

Distance/Direction: 45.0 Feet N | Trafficway: Not Physically Divided

Prefix	Intersecting Road Name	Road Type	Suffix	Divided Roadway
E	COOK	RD		

Unit Number	Unit Known	State	Driver License Number	Date of Birth (Age)	License Type	Endorsements	Sex	Total Occupants	Hazardous Action
01	Yes	MI	[redacted]	04/16/1999 (17)	● Operator ○Chauffer ○Moped	○Cycle ○Farm ○Recreation	M	01	None

Unit Type	Driver Information	Driver is Owner	Injury	Position	Restraint
MV	[redacted] GRAND BLANC MI 48439 [redacted]	No	O	Front - Left	Shoulder & Lap Belt

Driver Condition at Time of Crash 1st	2nd	Driver Distracted By	Ejected	Trapped	Airbag Deployed
Fatigued or Asleep		Not Distracted	No	No	Deployed-Front

Hospital: None | Ambulance: None

Alcohol Suspected	Contributing Factor	Alcohol Test Type	Alcohol Test Results	Interlock Device
No	No	○Breath ○Blood ○Urine ○Field ○PBT ○Refused ● Not Offered	○Pending Test Results:	No

Drug Suspected	Contributing Factor	Drug Test Type	Drug Test Results	Citation Issued
No	No	○Blood ○Urine ○Field ○Refused ○Not Offered	○Pending Test Results:	○Hazardous ○Other

Vehicle Registration	State	Vehicle Description	Year	Make	Model	Color
DJS2353	MI		2001	FORD	ESCAPE	BLK

VIN	Vehicle Type	Special Vehicles	Private Trailer Type	Vehicle Defect
1FMYU01101KB14001	Passenger Car, SUV, Van	None		

Insurance Company	Insurance Policy #	Towed By	Towed To
MEEMIC	PAP0791250	CJ'S TOWING	US-23 TOWING

Location of Greatest Damage	First Impact	Extent of Damage (Power Unit and/or Trailers)	Vehicle Direction	Vehicle Use	Action Prior
02	02	Disabling Damage	S	Private	Going Straight Ahead

Sequence of Events (● indicates MOST harmful event): First: 03 - Ran Off Roadway-Left | Second: ● 30 - Utility Pole/Light Support | Third: 06 - Overturn | Fourth: 45 - Other Fixed Object

PASSENGERS

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint	Injury	Ejected	Trapped	Airbag Deployed	Hospital	Ambulance

OWNERS

Carrier Information	USDOT	MC	MPSC	Driver's CDL Type	Endorsements	CDL Exempt
					○H ○P ○T ○N ○S ○X	○Farm ○Other

GVWR/GCWR	Vehicle Configuration	Cargo Body Type	Medical Card	Hazardous Material	ID #	Class #
○10,000 lbs. or Less ○10,001 - 26,000 lbs. ○Greater than 26,000 lbs.				○Placard ○Cargo Spill		

Owner Information	Owner Information

Damaged Property	Public	Owner & Phone
ADVERTISEMENT SIGN	No	DOCTOR SWAMY Phone: (810)771-7754

Unit Number | Unit Known | State | Driver License Number | Date of Birth(Age) | License Type ○Operator ○Chauffer ○Moped | Endorsements ○Cycle ○Farm ○Recreation | Sex | Total Occupants | Hazardous Action

Unit Type | Driver Information | Driver is Owner | Injury | Position | Restraint

Driver Condition at Time of Crash 1st 2nd | Driver Distracted By | Ejected | Trapped | Airbag Deployed

Hospital | Ambulance

Alcohol Suspected | Contributing Factor | Alcohol Test Type Breath Blood Urine Field PBT Refused Not Offered | Alcohol Test Results Pending Test Results: | Interlock Device

Drug Suspected | Contributing Factor | Drug Test Type Blood Urine Field Refused Not Offered | Drug Test Results Pending Test Results: | Citation Issued Hazardous Other

Vehicle Registration | State | Vehicle Description | Year | Make | Model | Color

VIN | Vehicle Type | Special Vehicles | Private Trailer Type | Vehicle Defect

Insurance Company | Insurance Policy # | Towed By | Towed To

Location of Greatest Damage | First Impact | Extent of Damage (Power Unit and/or Trailers) | Vehicle Direction | Vehicle Use | Action Prior

Sequence of Events (● indicates MOST harmful event) | First | Second | Third | Fourth

PASSENGERS

Passenger Information | Date of Birth (Age) | Sex | Position | Restraint
Injury | Ejected | Trapped | Airbag Deployed
Hospital | Ambulance

Passenger Information | Date of Birth (Age) | Sex | Position | Restraint
Injury | Ejected | Trapped | Airbag Deployed
Hospital | Ambulance

Passenger Information | Date of Birth (Age) | Sex | Position | Restraint
Injury | Ejected | Trapped | Airbag Deployed
Hospital | Ambulance

Carrier Information | USDOT | MC | MPSC
Driver's CDL Type | Endorsements ○H ○P ○T ○N ○S ○X | CDL Exempt ○Farm ○Other
GVWR/GCWR ○10,000 lbs. or Less ○10,001 - 26,000 lbs. ○Greater than 26,000 lbs. | Vehicle Configuration | Cargo Body Type | Medical Card | Hazardous Material ○Placard ○Cargo Spill | ID # | Class #

OWNERS

Owner Information | Owner Information

Witness Information | Witness Information

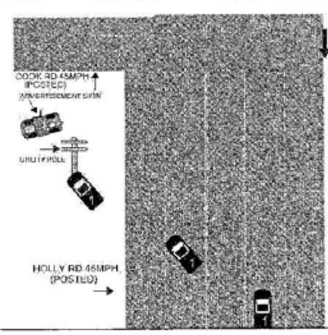
Investigated at Scene	Reported Date (Time)	1st Investigator Name (Badge)	2nd Investigator Name (Badge)	Photos
Yes	07/31/2016 (00:28)	Off. Bill Kilbourn (204)		No

Narrative

VEH #1 WAS TRAVELING S/B ON HOLLY RD NEAR COOK RD. DRIVER #1 SAID THAT HE FELL ASLEEP AND THE NEXT THING HE KNEW, HE WAS OFF THE ROAD FLIPPING OVER. VEH #1 LEFT THE ROADWAY TO THE LEFT HIT A UTILITY POLE, FLIPPED OVER AND HIT AN ADVERTISEMENT SIGN.

OFFICER NOTE: I WAS UNABLE TO IDENTIFY THE OWNER OF UTILITY POLE. CONSUMERS WAS CALLED TO SCENE AND WAS ALSO UNABLE TO ID UNILITY POLE.

Diagram



PUURI ENGINEERING,LLC

6480 Zeeb Road, Dexter, MI 48130

Exhibit E

Costs of Providing and Maintaining a Safe Roadside with CSP Tower

Estimated Installation and Maintenance Costs
To Provide a safe Roadside with a CSP Tower

Estimated Cost of Providing a Safe Roadside with a CSP Tower

Work Item	Estimated Quantity	Units	Cost
Storm Sewer Elliptical	80	feet	$1,200
Manhole	1	each	$2,000
Manhole Cover & Frame	1	each	$1,000
Culvert End Protection	2	each	$4,000
Rock Riprap w/Fabric	60	sq. yds.	$3,600
Edge Drain	200	feet	$2,000
Sand Backfill, CIP	30	cu. yds.	$600
Embankment, CIP	200	cu.yds.	$4,000
Guardrail	200	feet	$5,000
Guardrail Endings	2	each	$6,000
Topsoil	400	sq. yds.	$4,000
Seeding	40	lbs.	$200
Fertilizer	400	lbs.	$400
Mulch	2000	lbs.	$400
Traffic Control	1	Lump Sum	$5,000
Project Cleanup	1	Lump Sum	$2,000
Total			**$41,400**

Estimated Increased Annual Maintenance Cost (20% of Installation)

Work Item	Estimated Quantity	Units
Guardrail Repairs	1	once per year
Guardrail weed spraying	1	once per year
Storm Sewer Cleanout	1	once per year
Manhole Cleanout	1	once per year
Boom Arm Mowing	1	twice per year
Total		**$8,280.0**

S. Puuri
3/6/2017

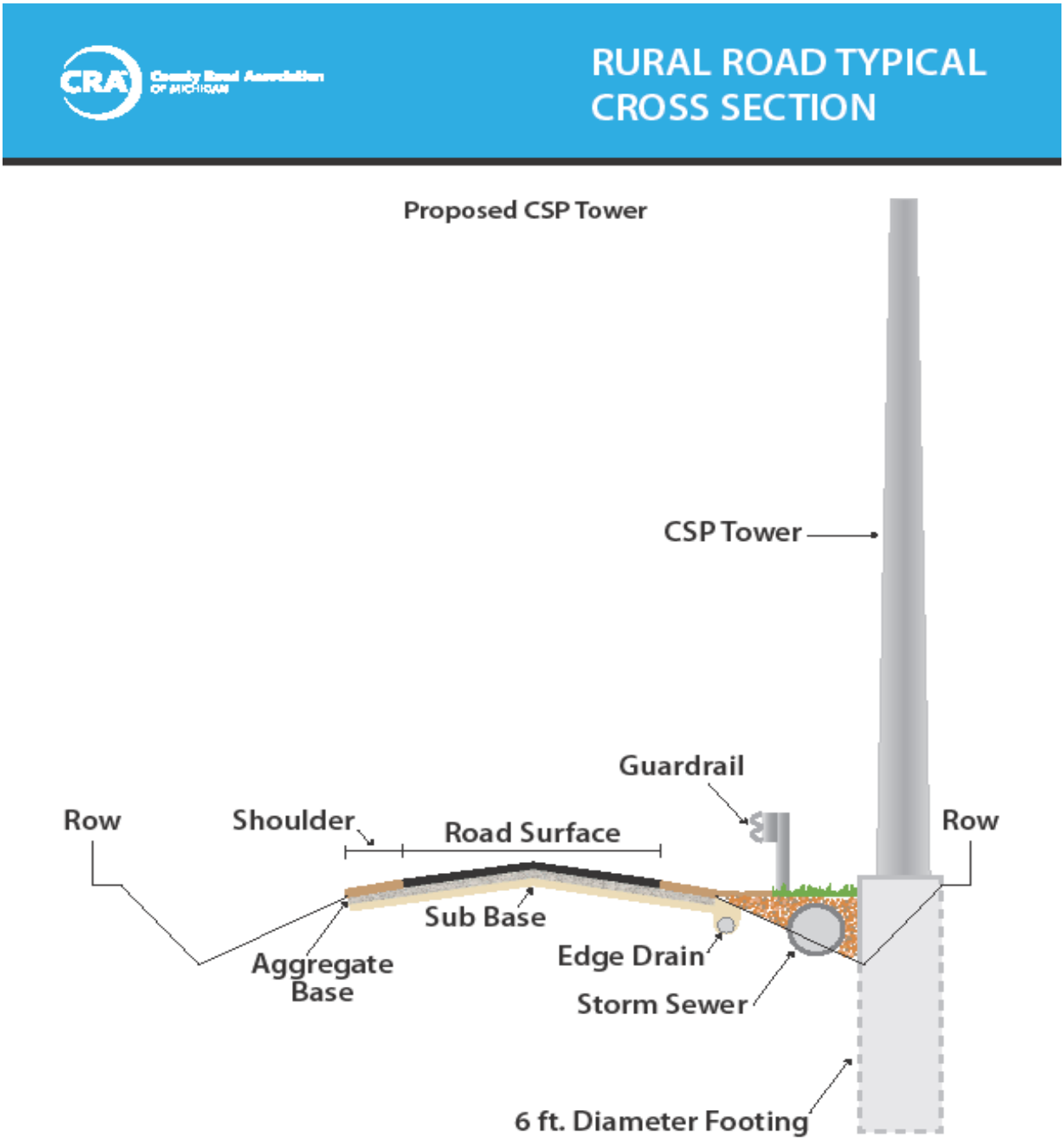
NOTES

- All of these costs **sh**ould be borne by the applicant including the maintenance costs.
- These costs do not reflect the inspection costs during and post **construction or the annual** inspection costs to assure that the drainage and guardrail systems are performing as planned. These costs reflect only the average bid prices based on MDOT average unit prices during 2015, these would be typical small project unit prices for materials and installation of the work listed.
- The maintenance costs are a rough approximation of typical extra **repair and maintenance** work that a road agency would anticipate to assure that these additional structures (not including the tower) in the ROW are performing as planned. No cost has been included for use of the road right of way. Also every guardrail crash would need to be repaired, I estimate one/year just to show this should be an anticipated regular cost.

6480 Zeeb Road, Dexter, MI 48130

Exhibit F

Rural Road Cross Section



6480 Zeeb Road, Dexter, MI 48130

Exhibit G

Rural Road Plan View

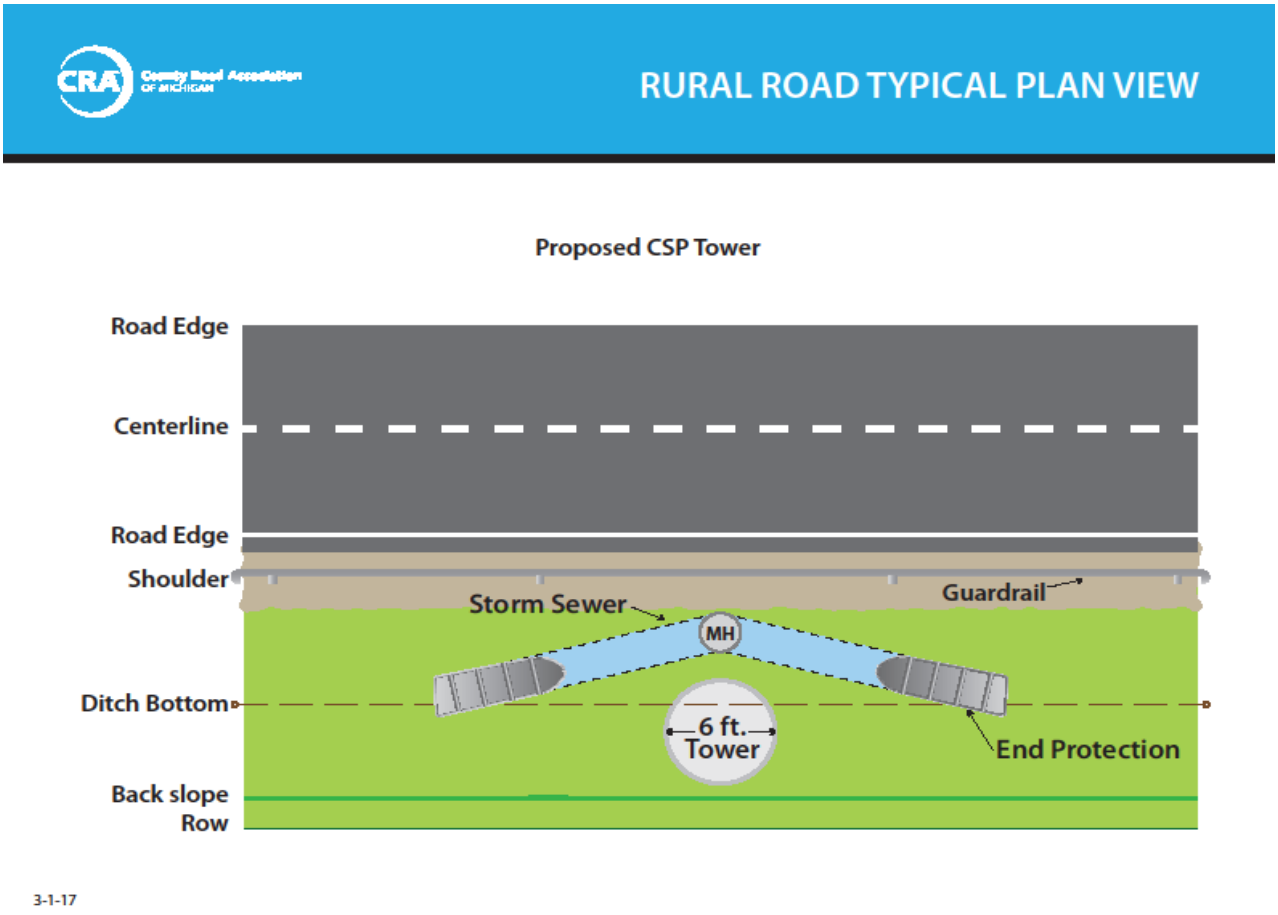


Exhibit 5
Proposal for Tower from Mobilitie to Monroe, MI, and Response of City

Mobilitie, LLC
120 S. Riverside Plaza, Suite 1800
Chicago, IL 60606

June 24, 2016

Monroe City Engineering Dept.
Patrick Lewis
Engineering Director
120 E. 1st St.
Monroe, MI 48161

RE: Mobilitie, LLC's Permit Application Submission

Dear Mr. Lewis:

Please find enclosed Mobilitie, LLC's ("Mobilitie") Right of Way Permit Application (the "application") for its proposed new utility infrastructure facility in the City of Monroe (the "City"). Along with the attached Application, please also find construction drawings, insurance certificate, and traffic plans.

Mobilitie is a limited liability company that is registered by the Michigan Public Service Commission. To meet the growing demand for connectivity, Mobilitie is deploying a hybrid transport network that provides high-speed, high-capacity bandwidth in order to facilitate the next generation of devices and data-driven services. This network can support a variety of technologies and services that require connectivity to the internet, including, but not limited to, driverless and connected vehicles (commercial, personal and agricultural), remote weather stations and mobile service providers. These transport utility poles and facilities are not dedicated to any particular customer, and, to the extent capacity on the structures is available, are available to be used by other entities, including the City.

Based on our initial research, Applicant is submitting the Applications in accordance with Chapter 625-24 of Monroe City's Municipal Code. For the benefit of both parties, Applicant formally requests the City to identify a single point of contact to streamline the application communications.

We are excited to work with the City. If you have questions please contact me at (312) 638-5301. Thank you for your attention to this matter.

Respectfully submitted,

Mark Deering
Network Real Estate Specialist

Enclosures:
1. Application
2. Copy of CAP Registration
3. Set of Drawings
4. Certificate of Insurance

CITY OF MONROE
Engineering Department

Fee Amount	App. No.
Cash/Check	Permit No.
Receipt No.	Issuance Date

APPLICATION AND PERMIT TO CONSTRUCT, OPERATE, USE AND/OR MAINTAIN CERTAIN IMPROVEMENTS WITHIN PUBLIC RIGHTS-OF-WAY AND OTHER PUBLICLY-OWNED PLACES UNDER CITY CONTROL

If a contractor is to perform the construction entailed in this permit and is supplying the deposit, he will fill out the information block provided, and thereby assumes responsibility, along with the applicant, for any provisions this application and permit which apply to him.

Mobilitie, LLC / Mark Deering 5/3/16
Applicant' s Name (Property Owner, Corp., Utility Co., Etc.) Date

120 S. Riverside, Ste 1800
Applicant's Mailing Address

Chicago IL 60606 312-638-5301
City State ZIP Phone

Mark Deering
Applicant's Signature (If other than Property Owner, give title)

Faith Technologies 5/3/2016
Contractor's Name (Individual, Company, Etc.) Date

11086 Strang Line Road
Contractor's Mailing Address

Lenexa KS 66215 913-281-0841
City State ZIP Phone

Project Manager
Contractor's Signature (If other than Contractor, give title)

The above-named applicant hereby makes application for a permit to Construct, Operate, Use, and/or Maintain certain improvements within a public place.

The exact location is as follows: Latitude: 41.912787, Longitude -83.402015
Northern side of West 5th Street. Near the intersection of Cass St & W. 5th St.

For a period commencing 12/1/2016 and ending 12/31/2016 : detailed description of the desired facility and/or activity is as follows:
Install a transport utility pole in the public right-of-way. See construction drawings.

The above-stated intentions are to be carried out in the manner applied for and in accordance with plans, specifications, and statements attached hereto and filed with the **City of Monroe Engineering Department** hereinafter referred to as the DEPARTMENT.

THIS PERMIT OBLIGATES THE APPLICANT TO THE FOLLOWING CONDITIONS:

1. Give telephone or written notice to the Engineering Department of the City of Monroe at least 48 hours prior to commencement of operations covered by this permit.
2. In any and all operations under this permit, meet all applicable requirements of the City of Monroe as set forth in Monroe Code Chapter 625.
3. Take, provide and maintain all necessary precautions to prevent injury or damage to persons and property from operations covered by this permit and use safety devices which are in accordance with applicable Federal and State requirements.
4. Save harmless the City of Monroe against any and all claims for damages and losses of any kind, including actual attorney fees arising from operations covered by this permit, and, upon request, furnish proof of insurance coverage naming the City of Monroe as an additional insured for the term of this permit for $1,000,000 personal injury and $500,000 property damage for operations covered by this permit.
5. Upon request of the Department, immediately remove, cease operation and surrender this permit or alter or relocate, at applicant's expense, the facility for which this permit is granted. Upon failure to do so, the Department shall take the necessary action and the applicant shall reimburse the City for its costs in doing same.
6. Nothing in this permit shall be construed to grant any right whatsoever to any public utilities whatsoever except as to the consent herein specifically given, not to impair anywise any existing rights granted in accordance with the constitution or laws of this State.
7. Give notice to public utilities in accordance with Act 53, PA 1974 and comply with all other provisions of said act. Call **"MISS DIG"** at least 72 hours before excavating by dialing 1-800-482-7171.
8. Promptly reimburse the City of Monroe for any inspection costs incurred as a result of activities covered by this permit.
9. At the option of the Department, deposit cash, performance bond, or a check in the sum of _____ acceptable to the Department to guarantee the faithful performance of the conditions of the permit.
10. Comply with the requirements of Act 347, PA 1972 controlling soil erosion and sedimentation.

Attached to Application:	
Plans _____	Bond _____
Proof of Insurance_____	Other_____

APPROVED

By:_____
Authorized Signature

NOTE: This permit does not relieve applicant from meeting any applicable requirements of law or of other public bodies or agencies.

Regulated Telephone Interexchange Carriers and Competitive Access Providers Operating in Michigan as of August 19, 2015

Note: If your company's email address is not listed or corrections need to be made to this list, please contact Julie Ginevan at: ginevanj@michigan.gov

Company Name and Address	Contact Information	CAP	IXC
LakeNet LLC 21713 Roosevelt Rd.	Christopher Fabien Phone: Fax: Email: chris@lakenetmi.com	☑	☐
Level 3 Communications, LLC 4625 W. 86th St Suite 500 Indianapolis, IN 46268	Pamela Hollick Phone: (317) 713-8977 Fax: Email: Pamela.Hollick@level3.com	☐	☑
Lightspeed Communications LLC 4942 Dawn Avenue East Lansing, MI 48823	Jason Schreiber Phone: (517) 252-4341 Fax: Email:	☑	☐
ManagedWay Company 24275 Northwestern Hwy Ste 100 Southfield, MI 48075	Reese Serra Phone: (888) 745-6948 Fax: Email: rserra@managedway.com	☑	☐
Matrix Telecom, Inc., dba Trinsic Communications 433 East Las Colinas Blvd Ste. 400 Irving, TX 75039	Leslie Ellis Phone: (972) 910-1411 Fax: (866) 418-9750 Email: regulatory@matrixbt.com	☑	☑
MCI Communications Services, Inc., dba Verizon Busine 3939 Blue Spruce Dr. Dewitt, MI 48820	David Vehslage Phone: (517) 668-0626 Fax: (517) 668-1018 Email: david.vehslage@verizon.com	☐	☑
MCImetro Access Transmission Services LLC, dba Veriz 3939 Blue Spruce Dr. Dewitt, MI 48820	David Vehslage Phone: (517) 668-0626 Fax: (517) 668-1018 Email: david.vehslage@verizon.com	☑	☑
Michigan Network Services LLC 1677 W. Hamlin Rd. Rochester Hills, MI 48309	Amanda Robinson Phone: Fax: Email:	☑	☐
Midwest Communications Services, Inc. 7255 Tower Road Battle Creek, MI 49014	Larry Powell Phone: (269) 963-7173 Fax: Email: larrymcs@voyager.net	☑	☐
Mobilitie, LLC 660 Newport Center Dr. Ste. 200 Newport Beach, CA 92660	Mark Askelson Phone: (949) 999-4545 Fax: (989) 266-8905 Email:	☑	☐
Neo Network Development Inc. 1547 Palos Verdes #298 Walnut Creek, CA 94597	Anita Taff-Rice Phone: (415) 699-7885 Fax: (925) 274-0988 Email:	☑	☐

MOINV-3 OP ID: NM

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 05/04/2016

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Silverstone Insurance Services Jetton & Assoc Ins Svs Inc P.O. Box 1200 (Lic #0C04829) Rancho Cucamonga,, CA 91729-1200 Brent Jetton, AAI, CIC Phone: 909-980-4211 Fax: 909-980-4785	CONTACT NAME: PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS:
INSURED Mobilitie LLC 120 S Riverside Plaza #1800 Chicago, IL 60606	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : Federal Insurance Company — 20281 INSURER B : Great American E&S Ins Co — 37532 INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS		
A	GENERAL LIABILITY X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY PROJECT X LOC			36036868 CONTRACTUAL LIABILITY	11/11/2015	11/11/2016	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ $ $ $ $ $	1,000,000 1,000,000 10,000 1,000,000 2,000,000 2,000,000
A	AUTOMOBILE LIABILITY X ANY AUTO ALL OWNED AUTOS SCHEDULED AUTOS X HIRED AUTOS X NON-OWNED AUTOS			73591570	11/11/2015	11/11/2016	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ $ $ $	1,000,000
A	X UMBRELLA LIAB X OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $			79897229	11/11/2015	11/11/2016	EACH OCCURRENCE AGGREGATE	$ $	9,000,000 9,000,000
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		71749062	11/11/2015	11/11/2016	X WC STATU-TORY LIMITS OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ $ $	1,000,000 1,000,000 1,000,000
B	Pollution Liab			PRE315985701	02/09/2016	02/09/2017	Aggregate		5,000,000
A	Property			36036868	11/11/2015	11/11/2016	See Below		

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

If required by written contract or agreement City of Monroe is an additional insured with respects to general liability

CERTIFICATE HOLDER

CITMONR

City of Monroe
120 East First Street
Monroe, MI 48161

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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mobilitie®
intelligent infrastructure

9MIX000133A

41.912765, -83.402014

W 5th St & Cass St

Monroe, MI 48161

811 Know what's below. Call before you dig.

GENERAL NOTES

THE FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. A TECHNICIAN WILL VISIT THE SITE AS REQUIRED FOR ROUTINE MAINTENANCE. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT DISTURBANCE OF EFFECT ON DRAINAGE; NO SANITARY SEWER SERVICE, POTABLE WATER OR TRASH DISPOSAL IS REQUIRED AND NO COMMERCIAL SIGNAGE IS PROPOSED.

SITE INFORMATION

POLE ID:	9MIX000133A
LATITUDE:	41.912765
LONGITUDE:	-83.402014
ADDRESS/CROSS STREET:	W 5th St & Cass St
CITY, STATE ZIP:	Monroe, MI 48161
PROPERTY OWNER	PUBLIC RIGHT-OF-WAY
APPLICANT	MOBILITIE
Applicant Address	120 S RIVERSIDE PLAZA, SUITE 1800 CHICAGO, IL 60606

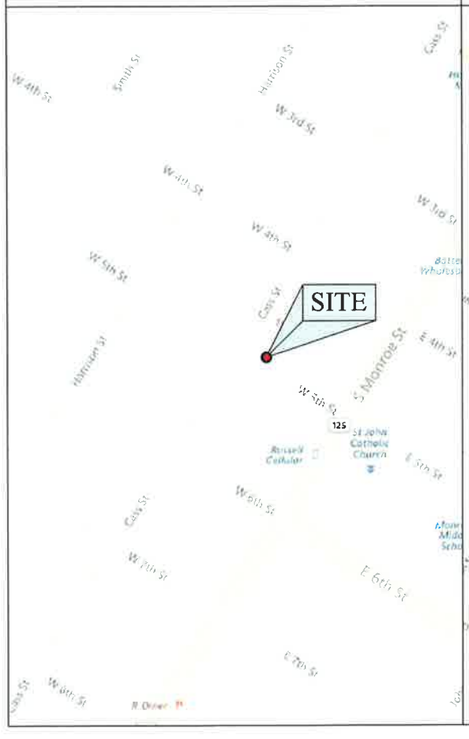
DO NOT SCALE DRAWINGS

CONTRACTORS SHALL VERIFY ALL PLANS, EXISTING DIMENSIONS & FIELD CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ARCHITECT/ENGINNER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

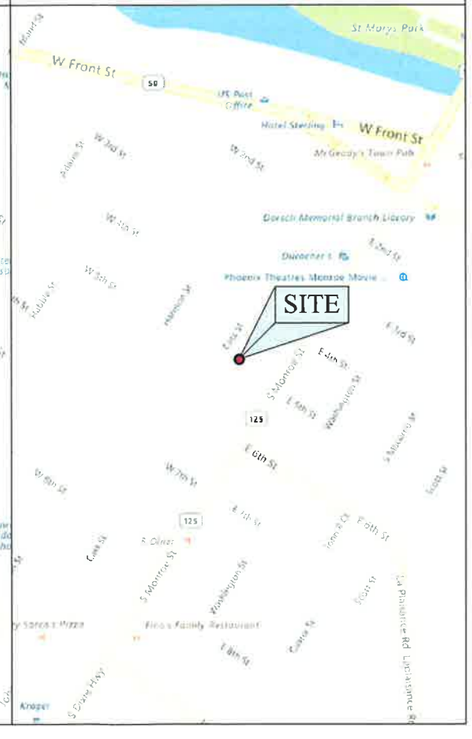
LOCATION MAPS

NORTH

VICINITY MAP



REGIONAL MAP



PROJECT DESCRIPTION

END USER PROPOSES TO INSTALL A NEW 100'-0" UTILITY POLE WITHIN AN EXISTING RIGHT-OF-WAY. THE SCOPE WILL CONSIST OF THE FOLLOWING:

1. INSTALL PROPOSED 100'-0" UTILITY POLE

CODES

BUILDING CODES: 2012 MICHIGAN BUILDING CODE
USE GROUP U
CONSTRUCTION TYPE 1B
2014 NEC CODE & PART 8 RULES

SHEET INDEX

ARCHITECT / ENGINEER

PETER LICHOMSKI, ARCHITECT
6720 LEYTONSTONE BLVD.
WEST BLOOMFIELD, MI 48322
248-705-9212
PETERLICHOMSKI@LABARCHITECTSLLC.COM

mobilitie®
intelligent infrastructure

PROJECT NUMBER:	DE90XC128A
DRAWN BY:	TOM
CHECKED BY:	PL

A	08.16.16	REVIEW	TOM

STATE OF MICHIGAN
PETER LICHOMSKI
ARCHITECT
No. 43776
LICENSED ARCHITECT

IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

SITE INFORMATION
9MIX000133A
41.912765, -83.402014
W 5th St & Cass St
Monroe, MI 48161
UTILITY POLE

SHEET TITLE
TITLE SHEET

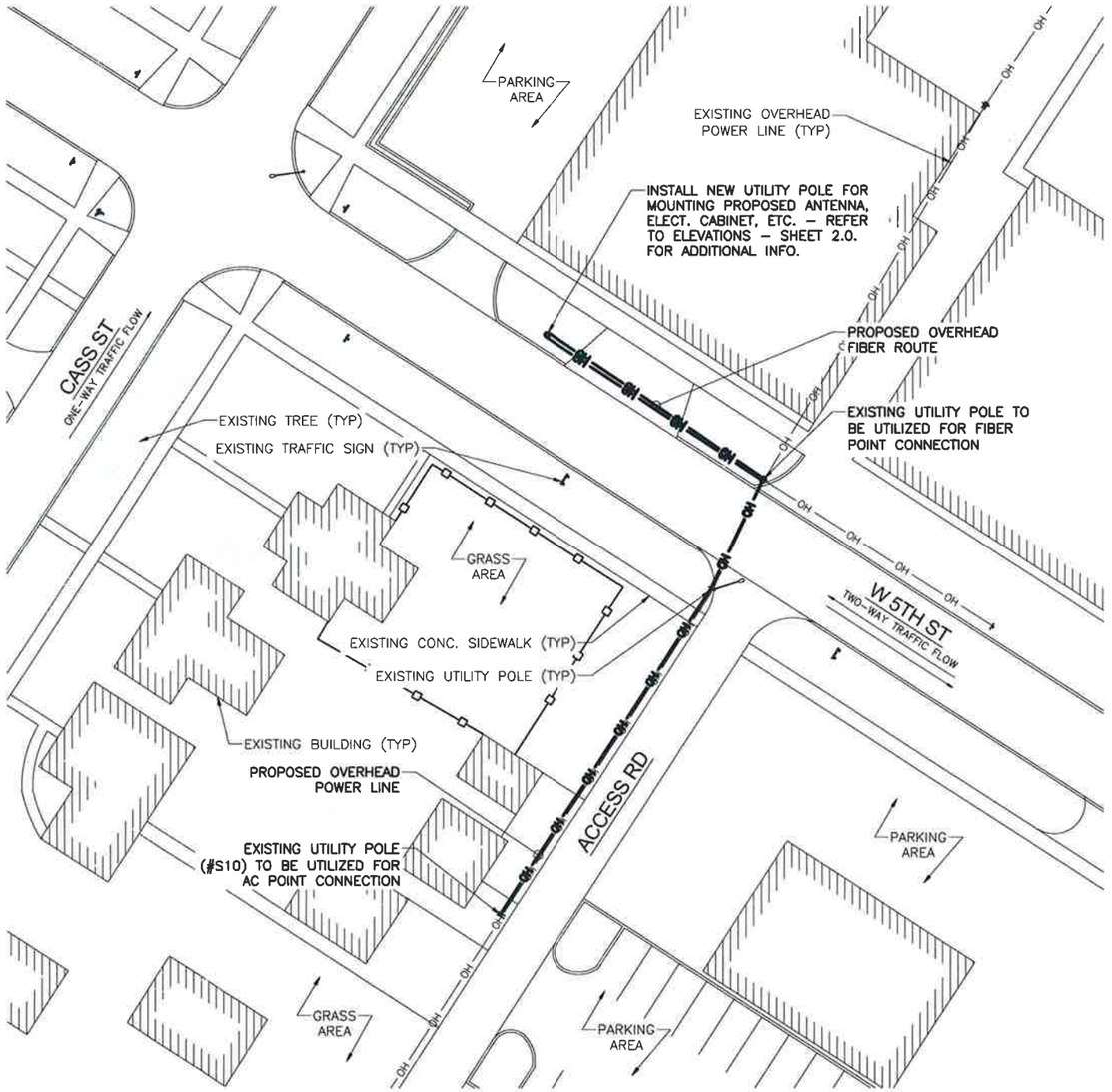
SHEET NUMBER
0.0

1 EXHIBIT PHOTO – GENERIC (NOT SITE SPECIFIC)
SCALE: N.T.S.

2 AERIAL SITE LOCATION
SCALE: N.T.S.

NOTE:
THIS SITE PLAN WAS GENERATED WITHOUT THE USE OF A SURVEY. PROPERTY LINES, POWER & TELCO UTILITY PINT CONNECTIONS/ROUTES AND EASEMENTS SHOWN ON THESE PLANS ARE ESTIMATED.

NOTE:
PROPOSED 100'-0" POLE IN THE R.O.W.
R.O.W. BOUNDARIES TO BE CONFIRMED AFTER SURVEY



3 ENLARGED SITE PLAN
SCALE: 1" = 20'-0"

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intelligent infrastructure

PROJECT NUMBER:	DE90XC128A
DRAWN BY:	TOM
CHECKED BY:	PL

A	06.16.16	REVIEW	TOM

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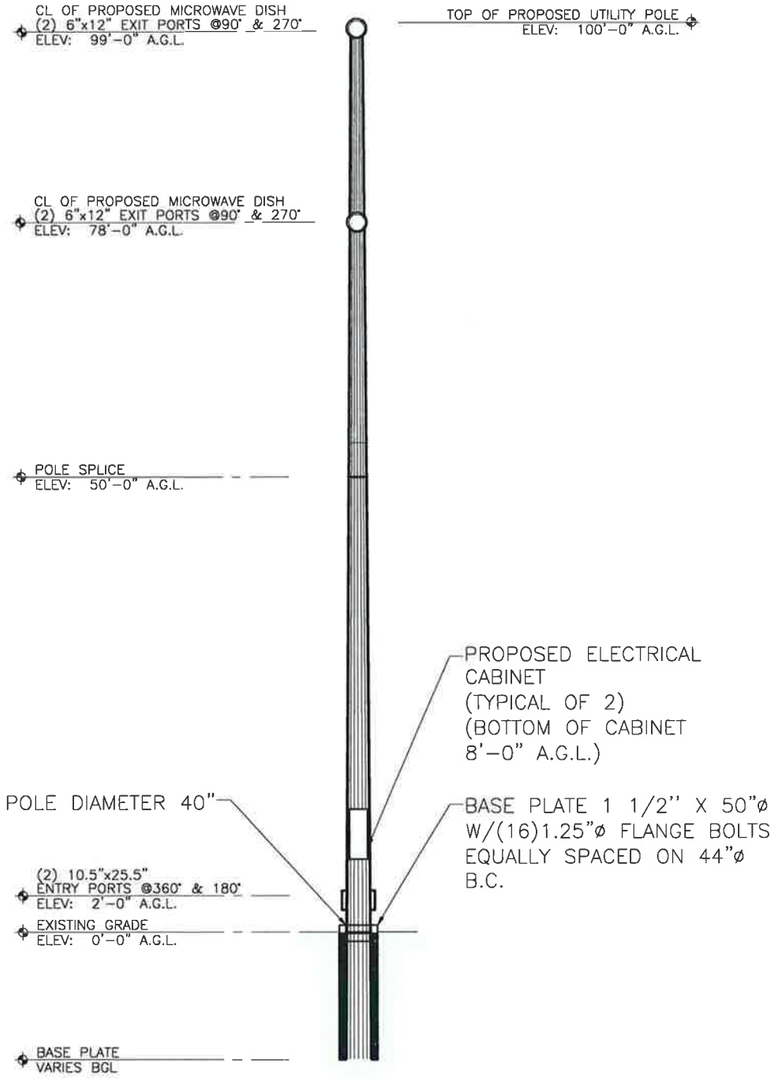
SITE INFORMATION
9MIX000133A
41.912765, -83.402014
W 5th St & Cass St
Monroe, MI 48161
UTILITY POLE

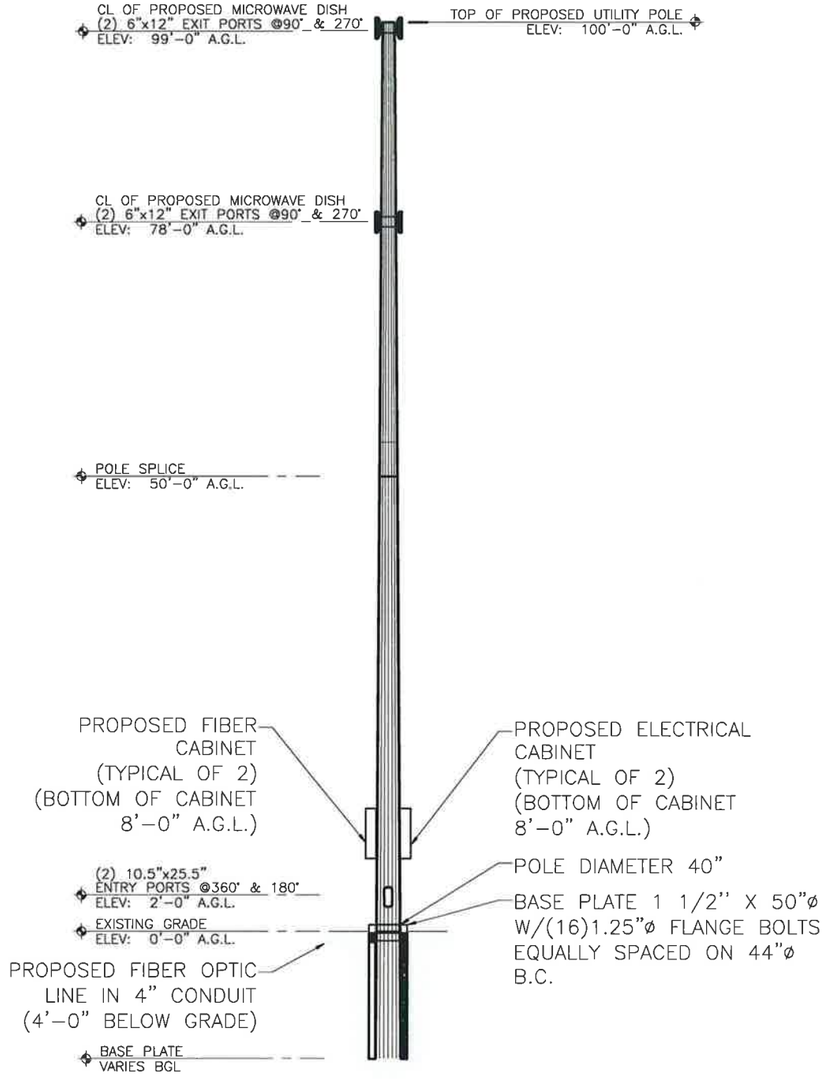
SHEET TITLE
EXHIBIT PHOTO &
ENLARGED SITE PLAN

SHEET NUMBER
1.0



1 FRONT UTILITY POLE ELEVATION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8"=1'-0"



1 SIDE UTILITY POLE ELEVATION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8"=1'-0"

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intelligent infrastructure

PROJECT NUMBER:	DE90XC128A
DRAWN BY:	TOM
CHECKED BY:	PL

A	06.16.16	REVIEW	TOM

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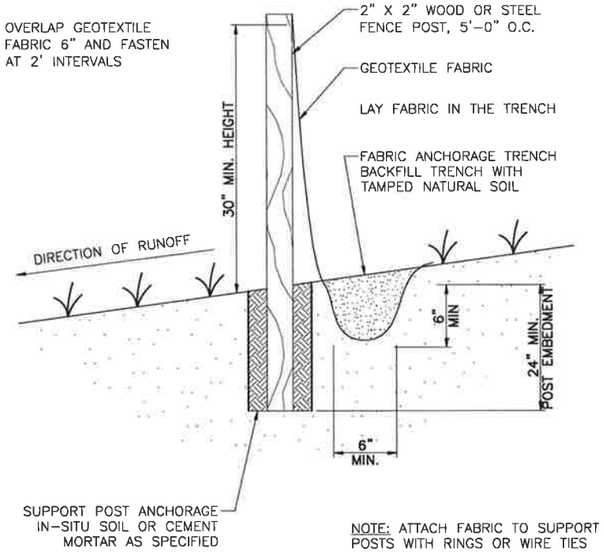
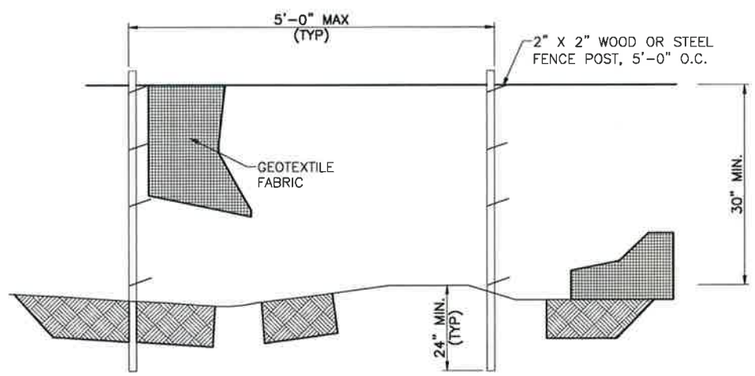
SITE INFORMATION
9MIX000133A
41.912765, -83.402014
W 5th St & Cass St
Monroe, MI 48161
UTILITY POLE

SHEET TITLE
UTILITY POLE ELEVATIONS

SHEET NUMBER
2.0



1 FABRIC ANCHOR DETAIL
SCALE: N.T.S.

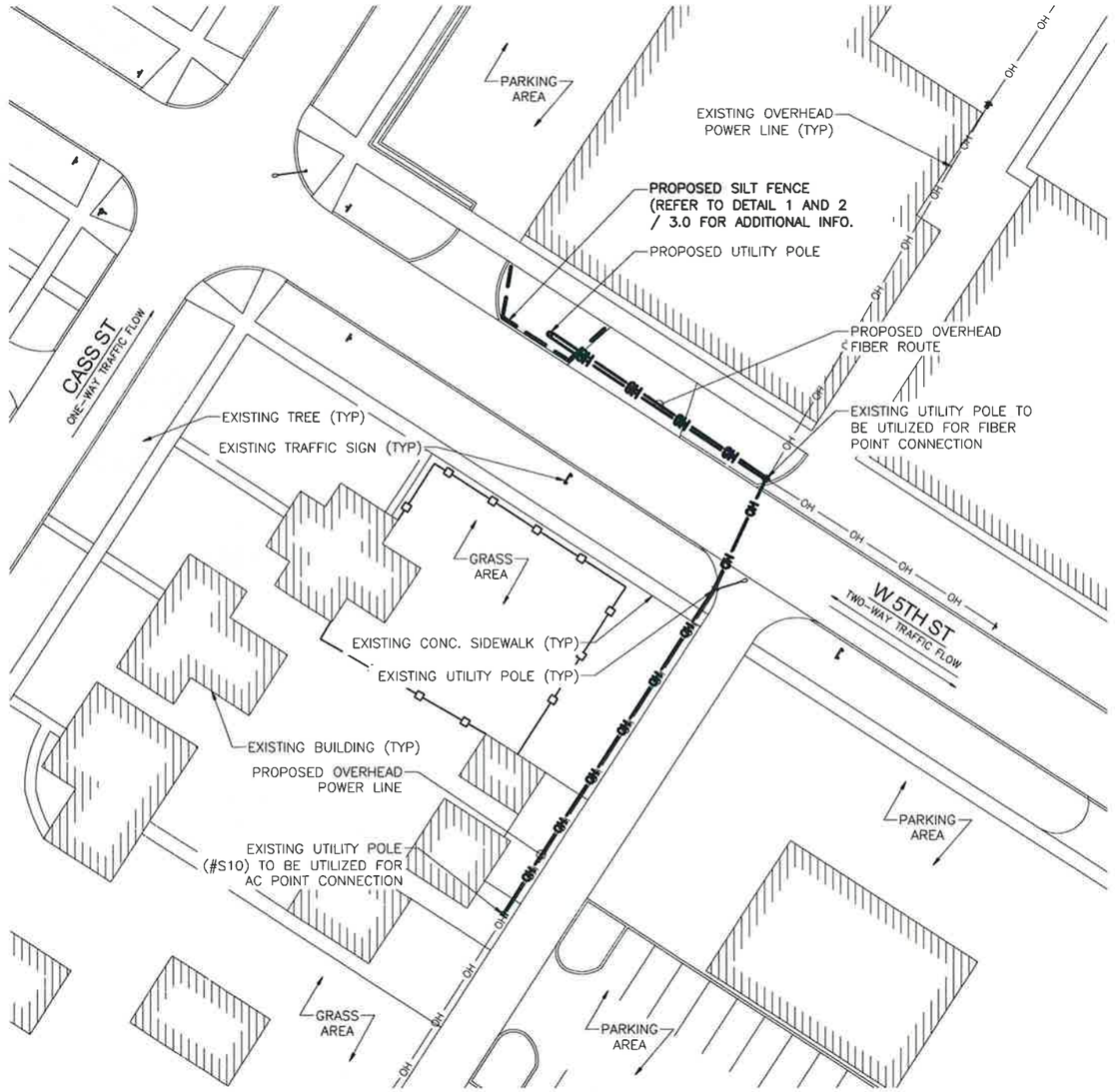


2 FABRIC ANCHOR DETAIL - ELEVATION
SCALE: N.T.S.

TRUE NORTH

NOTE:
THIS SITE PLAN WAS GENERATED WITHOUT THE USE OF A SURVEY. PROPERTY LINES, POWER & TELCO UTILITY PINT CONNECTIONS/ROUTES AND EASEMENTS SHOWN ON THESE PLANS ARE ESTIMATED.

NOTE:
PROPOSED 100'-0" POLE IN THE R.O.W.
R.O.W. BOUNDARIES TO BE CONFIRMED AFTER SURVEY



3 EROSION CONTROL PLAN
SCALE: 1" = 20'-0"

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PROJECT NUMBER:	DE90XC128A
DRAWN BY:	TOM
CHECKED BY:	PL

A	06.16.16	REVIEW	TOM

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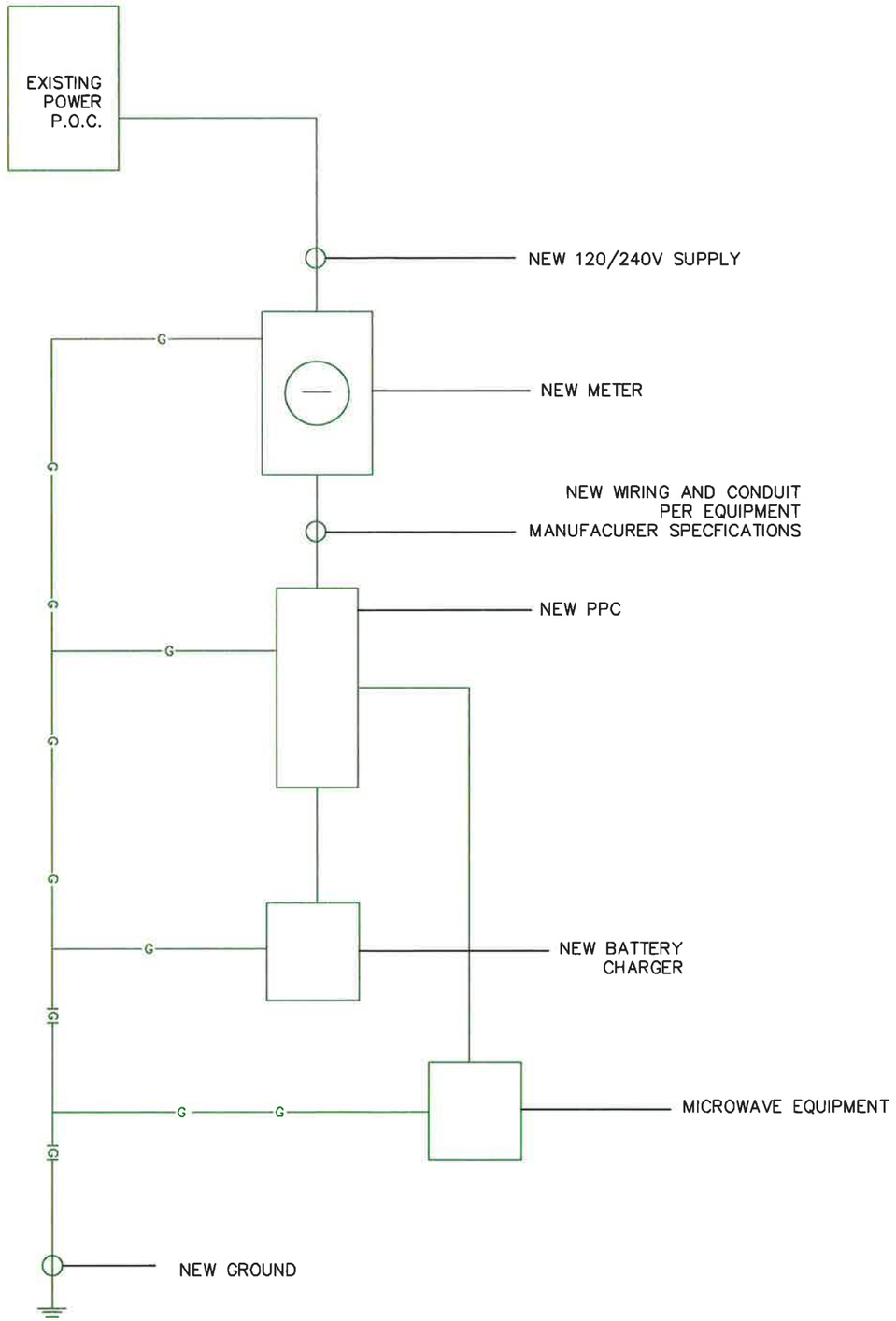
SITE INFORMATION
9MIX000133A
41.912765, -83.402014
W 5th St & Cass St
Monroe, MI 48161
UTILITY POLE

SHEET TITLE
EROSION CONTROL PLAN

SHEET NUMBER
3.0



ONE LINE DIAGRAM

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PROJECT NUMBER:	DE90XC128A
DRAWN BY:	TOM
CHECKED BY:	PL

A	06.16.16	REVIEW	TOM

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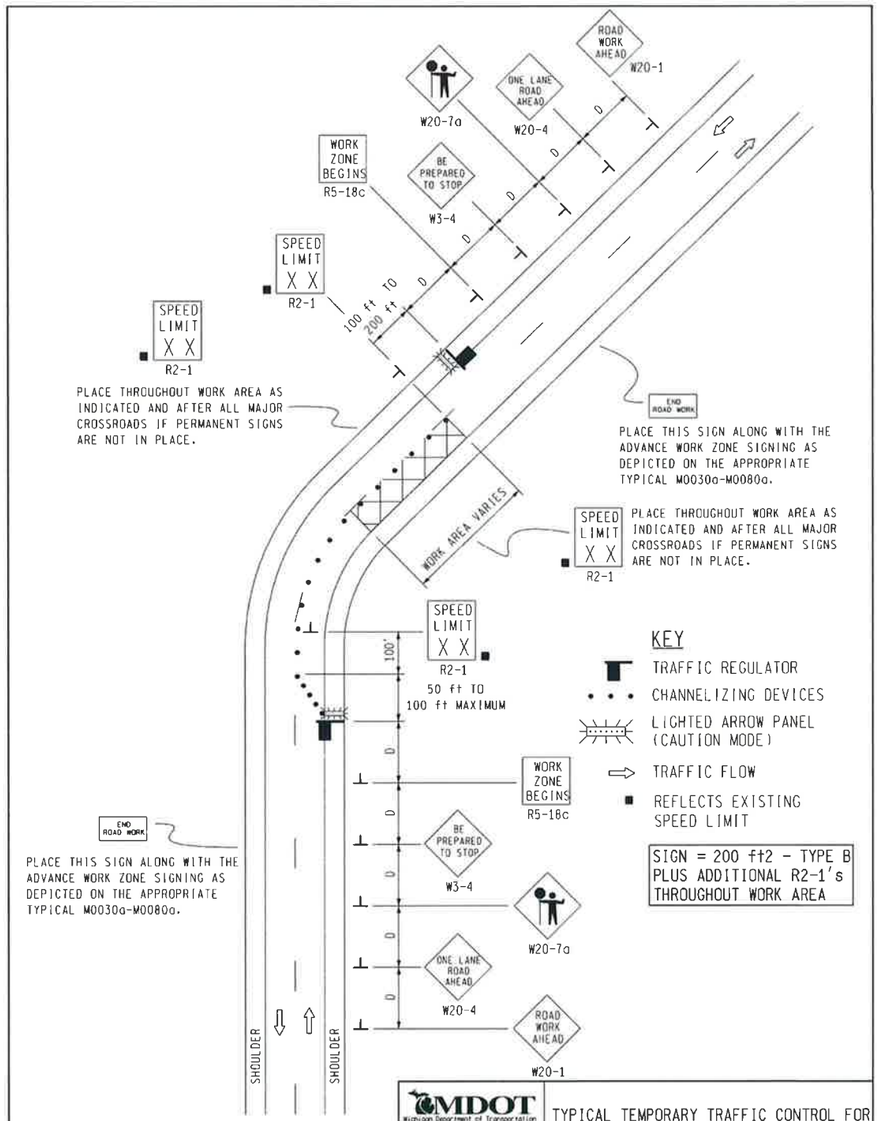
SITE INFORMATION
9MIX000133A
41.912765, −83.402014
W 5th St & Cass St
Monroe, MI 48161
UTILITY POLE

SHEET TITLE
ELECTRICAL

SHEET NUMBER
4.0



1 TRAFFIC CONTROL TYPICAL INFO
SCALE: N.T.S.

NOTE:
PROPOSED 100'-0" POLE IN THE R.O.W.
R.O.W. BOUNDARIES TO BE CONFIRMED AFTER SURVEY

NOTE:
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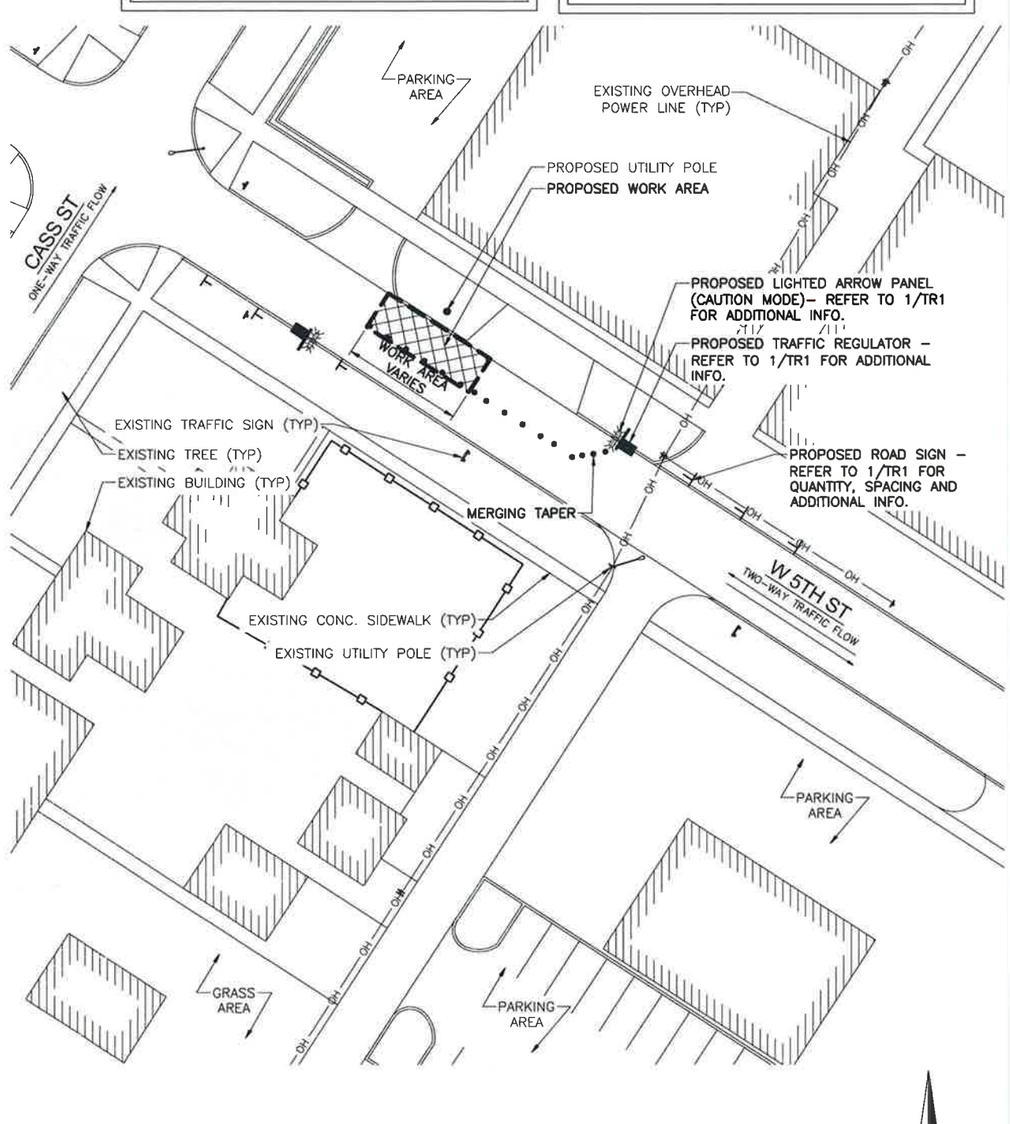

2 TRAFFIC CONTROL PLANS
SCALE: 1" = 20'-0"

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PROJECT NUMBER:	DE90XC128A
DRAWN BY:	TOM
CHECKED BY:	PL

A	06.16.16	REVIEW	TOM

IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

SITE INFORMATION
TRAFFIC CONTROL PLANS
MI0013-A
41.912765, -83.402014
W 5th St & Cass St
Monroe, MI 48161
UTILITY POLE

SHEET TITLE
TRAFFIC CONTROL PLANS

SHEET NUMBER
TR-1

DISTANCE BETWEEN TRAFFIC CONTROL DEVICES "D" AND LENGTH OF LONGITUDINAL BUFFER SPACE ON "WHERE WORKERS PRESENT" SEQUENCES

"D" DISTANCES	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)									
	25	30	35	40	45	50	55	60	65	70
D (FEET)	250	300	350	400	450	500	550	600	650	700

GUIDELINES FOR LENGTH OF LONGITUDINAL BUFFER SPACE "B"

SPEED* MPH	LENGTH FEET
20	33
25	50
30	83
35	132
40	181
45	230
50	279
55	329
60	411
65	476
70	542

* POSTED SPEED, OFF PEAK 85TH PERCENTILE SPEED PRIOR TO WORK STARTING, OR THE ANTICIPATED OPERATING SPEED

1 BASED UPON AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) BRAKING DISTANCE PORTION OF STOPPING SIGHT DISTANCE FOR WET AND LEVEL PAVEMENTS (A POLICY ON GEOMETRIC DESIGN OF HIGHWAY AND STREETS), AASHTO. THIS AASHTO DOCUMENT ALSO RECOMMENDS ADJUSTMENTS FOR THE EFFECT OF GRADE ON STOPPING AND VARIATION FOR TRUCKS.

MDOT Michigan Department of Transportation	TABLES FOR "L", "D" AND "B" VALUES		
TRAFFIC AND SAFETY MAINTAINING TRAFFIC TYPICAL			
DRAWN BY: CON:AE:djf	JUNE 2006	M0020a	SHEET 2 OF 2
CHECKED BY: BMW	PLAN DATE:		
FILE: K:/DGN/TSR/STDS/ENGLISH/MNTTRF/M0020a.dgn	REV. 08/21/2006		

MINIMUM MERGING TAPER LENGTH "L" (FEET)

OFFSET FEET	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)									
	25	30	35	40	45	50	55	60	65	70
1	10	15	20	27	45	50	55	60	65	70
2	21	30	41	53	90	100	110	120	130	140
3	31	45	61	80	135	150	165	180	195	210
4	42	60	82	107	180	200	220	240	260	280
5	52	75	102	133	225	250	275	300	325	350
6	63	90	123	160	270	300	330	360	390	420
7	73	105	143	187	315	350	385	420	455	490
8	83	120	163	213	360	400	440	480	520	560
9	94	135	184	240	405	450	495	540	585	630
10	104	150	204	267	450	500	550	600	650	700
11	115	165	225	293	495	550	605	660	715	770
12	125	180	245	320	540	600	660	720	780	840
13	135	195	266	347	585	650	715	780	845	910
14	146	210	286	374	630	700	770	840	910	980
15	157	225	307	400	675	750	825	900	975	1050

TAPER LENGTH "L" IN FEET

THE FORMULAS FOR THE MINIMUM LENGTH OF A MERGING TAPER IN DERIVING THE "L" VALUES SHOWN IN THE ABOVE TABLES ARE AS FOLLOWS:

$L = \frac{W \times S^2}{60}$ WHERE POSTED SPEED PRIOR TO THE WORK AREA IS 40 MPH OR LESS

"L" = S x W WHERE POSTED SPEED PRIOR TO THE WORK AREA IS 45 MPH OR GREATER

L = MINIMUM LENGTH OF MERGING TAPER
S = POSTED SPEED LIMIT IN MPH PRIOR TO WORK AREA
W = WIDTH OF OFFSET

TYPES OF TAPERS	TAPER LENGTH
UPSTREAM TAPERS	
MERGING TAPER	L - MINIMUM
SHIFTING TAPER	1/2 L - MINIMUM
SHOULDER TAPER	1/3 L - MINIMUM
TWO-WAY TRAFFIC TAPER	100 ' - MAXIMUM
DOWNSTREAM TAPERS (USE IS OPTIONAL)	100 ' - MINIMUM (PER LANE)

MDOT Michigan Department of Transportation	TABLES FOR "L", "D" AND "B" VALUES		
TRAFFIC AND SAFETY MAINTAINING TRAFFIC TYPICAL			
DRAWN BY: CON:AE:djf	JUNE 2006	M0020a	SHEET 1 OF 2
CHECKED BY: BMW	PLAN DATE:		
FILE: K:/DGN/TSR/STDS/ENGLISH/MNTTRF/M0020a.dgn	REV. 08/21/2006		

mobilitie
intelligent infrastructure

PROJECT NUMBER:	DE90XC126A
DRAWN BY:	TOM
CHECKED BY:	PL

A	06.16.16	REVIEW	TOM

IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

SITE INFORMATION
9MIX000133A
41.912765, -83.402014
W 5th St & Cass St
Monroe, MI 48161
UTILITY POLE

SHEET TITLE
TRAFFIC PLAN AND DETAILS

SHEET NUMBER
TR-2

NOTES

1H. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES
AND LENGTH OF LONGITUDINAL BUFFERS
SEE M0020a FOR "D" VALUES.

2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.

3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.

3A. THE "WORK ZONE BEGINS" (R5-18c) SIGN SHALL BE USED ONLY IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE SHALL OMIT THIS SIGN AND THE QUANTITIES SHALL BE ADJUSTED APPROPRIATELY.

4A. THE MAXIMUM RECOMMENDED DISTANCE(S) BETWEEN CHANNELIZING DEVICES IN THE TAPER AREA(S) SHOULD BE 15 FEET AND SHOULD BE EQUAL IN FEET TO TWICE THE POSTED SPEED IN MILES PER HOUR IN THE PARALLEL AREA(S).

5. FOR OVERNIGHT CLOSURES, TYPE III BARRICADES SHALL BE LIGHTED.

6. WHEN CALLED FOR IN THE FHWA ACCEPTANCE LETTER FOR THE SIGN SYSTEM SELECTED, THE TYPE A WARNING FLASHER, SHOWN ON THE WARNING SIGNS, SHALL BE POSITIONED ON THE SIDE OF THE SIGN NEAREST THE ROADWAY.

7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHLY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.

9. ALL TRAFFIC REGULATORS SHALL BE PROPERLY TRAINED AND SUPERVISED.

9A. IN ANY OPERATION INVOLVING MORE THAN ONE TRAFFIC REGULATOR, ONE PERSON SHOULD BE DESIGNATED AS HEAD TRAFFIC REGULATOR.

10. ALL TRAFFIC REGULATORS' CONDUCT, THEIR EQUIPMENT, AND TRAFFIC REGULATING PROCEDURES SHALL CONFORM TO THE CURRENT EDITION OF THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MMUTCD) AND THE CURRENT EDITION OF THE MDOT HANDBOOK ENTITLED "TRAFFIC REGULATORS INSTRUCTION MANUAL."

11. WHEN TRAFFIC REGULATING IS ALLOWED DURING THE HOURS OF DARKNESS, APPROPRIATE LIGHTING SHALL BE PROVIDED TO SUFFICIENTLY ILLUMINATE THE TRAFFIC REGULATOR'S STATIONS.

12E. THE MAXIMUM DISTANCE BETWEEN THE TRAFFIC REGULATORS SHALL BE NO MORE THAN 2 MILES IN LENGTH UNLESS RESTRICTED FURTHER IN THE SPECIAL PROVISIONS FOR MAINTAINING TRAFFIC. ALL SEQUENCES OF MORE THAN 2 MILES IN LENGTH WILL REQUIRE WRITTEN PERMISSION FROM THE ENGINEER BEFORE PROCEEDING.

13. WHEN INTERSECTING ROADS OR SIGNIFICANT TRAFFIC GENERATORS (SHOPPING CENTERS, MOBILE HOME PARKS, ETC.) OCCUR WITHIN THE ONE-LANE TWO-WAY OPERATION, INTERMEDIATE TRAFFIC REGULATORS AND APPROPRIATE SIGNING SHALL BE PLACED AT THESE LOCATIONS.

14. ADDITIONAL SIGNING AND/OR ELONGATED SIGNING SEQUENCES SHOULD BE USED WHEN TRAFFIC VOLUMES ARE SIGNIFICANT ENOUGH TO CREATE BACKUPS BEYOND THE W3-4 SIGNS.

15. THE HAND HELD (PADDLE) SIGNS REQUIRED BY THE MMUTCD TO CONTROL TRAFFIC WILL BE PAID FOR AS PART OF FLAG CONTROL.

28E. THE TRAFFIC REGULATORS SHOULD BE POSITIONED AT OR NEAR THE SIDE OF THE ROAD SO THAT THEY ARE SEEN CLEARLY AT A MINIMUM DISTANCE OF 500 FEET. THIS MAY REQUIRE EXTENDING THE BEGINNING OF THE LANE CLOSURE TO OVERCOME VIEWING PROBLEMS CAUSED BY HILLS AND CURVES.

SIGN SIZES

DIAMOND WARNING - 48" x 48"
R2-1 REGULATORY - 48" x 60"
R5-18c REGULATORY - 48" x 48"

NOT TO SCALE

MDOT Michigan Department of Transportation
TRAFFIC AND SAFETY
MAINTAINING TRAFFIC TYPICAL

TYPICAL TEMPORARY TRAFFIC CONTROL FOR A TWO-LANE TWO-WAY ROADWAY WHERE ONE LANE IS CLOSED UTILIZING TRAFFIC REGULATORS, NO SPEED REDUCTION

DRAWN BY: CON:AE:djf	OCTOBER 2011	M0140a	SHEET 2 OF 2
CHECKED BY: BMM:CRB	PLAN DATE:		
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0140a.dgn REV. 10/04/2011			

mobilitie
intelligent infrastructure

PROJECT NUMBER:	DE90XC128A
DRAWN BY:	TOM
CHECKED BY:	PL

A	06.16.16	REVIEW	TOM

IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

SITE INFORMATION
9MIX000133A
41.912765, -83.402014
W 5th St & Cass St
Monroe, MI 48161
UTILITY POLE

SHEET TITLE
TRAFFIC PLAN NOTES

SHEET NUMBER
TR-3

KITCH DRUTCHAS WAGNER VALITUTTI & SHERBROOK

A PROFESSIONAL CORPORATION
ATTORNEYS AND COUNSELORS
ONE WOODWARD AVENUE, SUITE 2400
DETROIT, MICHIGAN 48226-5485
(313) 965-7900
FAX (313) 965-7403
INTERNET ADDRESS: http://www.kitch.com

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2379 WOODLAKE DRIVE, SUITE 400
OKEMOS, MICHIGAN 48864-6032
(517) 381-4426
FAX: (517) 381-4427

TOWNE SQUARE DEVELOPMENT
10 S. MAIN STREET, SUITE 200
MT. CLEMENS, MICHIGAN 48043-7903
(586) 463-9770
FAX: (586) 463-8994

OLD CITY HALL
220 WEST WASHINGTON, SUITE 500
MARQUETTE, MICHIGAN 49855-4344
(906) 228-0001
FAX: (906) 228-0003

405 MADISON AVENUE, SUITE 1500
TOLEDO, OHIO 43604-1235
(419) 243-4006
FAX: (419) 243-7333

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CHICAGO, ILLINOIS 60602-4252
(312) 332-7901
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DANIEL A. POLLARD
VICTOR A. MCCOY
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MARIO CUSUMANO (2)
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OF COUNSEL
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WILLIAM D. SERWER
ABRAHAM SINGER
STUART TRAGER (10)

(1) ALSO ADMITTED IN OHIO
(2) ONLY ADMITTED IN ILLINOIS
(3) ALSO ADMITTED IN WASHINGTON, D.C.
(4) ALSO ADMITTED IN NEW YORK
(5) ALSO ADMITTED IN FLORIDA
(6) ALSO ADMITTED IN IOWA
(7) ALSO ADMITTED IN ILLINOIS
(8) ALSO ADMITTED IN ARKANSAS
(9) ONLY ADMITTED IN OHIO
(10) MTT JUDGE RETIRED
(11) ADMITTED IN ILLINOIS & INDIANA
(12) ALSO ADMITTED IN INDIANA
(13) ALSO LICENSED AS A FOREIGN LEGAL CONSULATANT IN CANADA
(14) ONLY ADMITTED IN CANADA
(15) ALSO LICENSED AS A FOREIGN LEGAL CONSULATANT IN MICHIGAN

August 8, 2016

Mark Deering
Mobilitie, LLC
120 S. Riverside Plaza, Ste. 1800
Chicago, IL 60606

Re: Mobilitie LLC's Right of Way Submission

Dear Mr. Deering:

Please be advised that the undersigned is special counsel for the City of Monroe.

The City of Monroe is in possession of your submitted documents purporting to seek permission to install a 100' "transport utility pole in the public right of way." Based on the longitude and latitude provided on the application, the pole would be located in front of 60 W. 5th St in Monroe.

The documents submitted are not consistent, accurate or complete. The materials you submitted (at Sheet 0.0) include a "Project Description" that describes the scope of work as only involving installation of a 100' utility pole. Sheet 2.0 is consistent with that description, as it includes no pole attachments or any engineering that would suggest

that overhead wiring will be associated with what you call a utility pole; the Exhibit photo on Sheet 1.0 also shows no overhead wiring. However, Sheet 1.0 suggests that overhead fiber optics will run from the pole along an existing pole line and that an overhead power line will be placed on what you describe as the "access road." None of the sheets other than 0.0 appear to have been reviewed by an engineer, and none purports to be based on an actual site inspection or a review of the right of way boundaries. The inconsistency in the documents makes it difficult to provide a response, but we will do our best, reserving the right to raise additional issues should you choose to pursue these applications.

Your cover letter says that the application was submitted pursuant to Section 625.24 of the Monroe City Code, which addresses excavations in the rights of way. You did not submit the application pursuant to Michigan's Metro Act, which is addressed in Section 651-1 of the Monroe City Code, nor did you submit an application for placement of a wireless facility under applicable federal, state or local law. The Monroe City Code contains provisions applicable to placement of wireless facilities in Section 720-78.

Access to the rights of way for placement of telecommunications wires, if allowed at all, would either require a Metro Act Application or a local franchise. You would need to submit an application under the Metro Act or seek other authorizations if (as the plans suggest) you do intend to install overhead wires. In addition, a local franchise would at least be required for anything not covered by the Metro Act, which would include any wireless facility (wireless facilities are not covered by the Metro Act) and other related structures. The proposed "utility pole" appears to be a wireless facility not unlike wireless DAS or Small Cell networks and facilities related thereto. The supporting structure would be a tower under applicable FCC rules. Therefore, in addition to complying with Section 625.24, you actually would need to submit an application for a wireless facility following the requirements of the City Code.

Taking your submission at face value, it is therefore not possible for us to further process your submission as it is **incomplete** due to the absence of the applicable submissions required under the City Code and Charter, or to the extent it applies, the Metro Act and implementing provisions of the City Code.

In addition, even if you could submit an application for the work without the materials described above, the company's submission would be incomplete for reasons including but not limited to the following: a lack of detail on the project description (and inconsistencies between the description and the drawings); the absence of engineering, including the absence of drawings based on actual surveys showing property boundaries and utility lines; and the absence of submissions based on the facility that is proposed, as opposed to submissions that contain generic photos that are not site specific (we note that the photo on Sheet 1.0 is the same photo used by Mobilitie to seek authorization for 120' poles in other communities, so the picture is not only not site

specific – it is a misrepresentation of the proposed facility). If, as some sheets suggest, wiring will be placed underground, information about trenching and restoration will need to be provided, and if, as would appear you must cut a driveway, additional information will also be required. Each of the sheets should be signed and sealed appropriately; the sheets you submitted are not. The submission did not include required fees.

Given the ambiguous nature of the information provided in your submission, in addition to not being able to discern the physical details of what is proposed, nor the precise proposed locations, we also cannot determine with any exactitude, the applicable regulatory requirements that may apply. The following engineering requirements appear to apply. You should submit:

1. Topographic survey including dimensions of right-of-way width, locations of existing utilities, dimensions of proposed facilities from adjacent utilities, curb lines, and other appropriate features that can be used as reference points. Any proposed facilities must be located a minimum of 3 feet horizontally from existing utilities, or greater depending on the relative depths.

2. Profile view indicating the depth of existing utilities, any crossings, etc. Minimum 18" vertical separation from any existing utilities will be required.

3. Foundation details must be provided of the pole and associated structures to determine any potential conflicts with existing utilities and / or roadway features.

Of course, the drawings should be consistent. We would of course expect to review the safety of the proposed structure as part of the permitting or at the time of construction.

The foregoing would apply without regard to the location of the tower proposed. However, the proposed site is located within the Old Village Historic District (#82002854) in the National Register of Historic Places, and in front of an historically significant structure. A document showing the boundaries of the district is attached.

Listed in 1982, the district includes residential and commercial architecture dating from the mid-19th that is representative of all major architectural styles constructed in Michigan from that point through the 20th century. The Old Village nomination contained one of the largest groupings of historic resources submitted for designation in the state of Michigan. In addition to its impacts on the structures on property immediately adjoining the proposed tower, the proposed tower will be in direct line of sight with St. John the Baptist Catholic Church. The church was constructed in the Romanesque Revival style prevalent during the second half of the 19th century. Completed in 1874, St. John's was listed on the Michigan State Register of Historic Sites in 1998. Within a little more than a block's distance is Memorial Place. Located on Monroe Street, the park commemorates the Kentucky soldiers that fought and died at the Battle of the River Raisin in January 1813. We suspect that the tower, which is extraordinarily tall

and unlike other facilities in the rights of way, will be visible from many locations within the district.

Work in this area on wireless facilities necessarily implicates Section 106 review under guidelines established in the National Historic Preservation Act of 1966 (NHPA); and the National Environmental Policy Act (NEPA). It may also implicate the Historic Sites Act of 1935; archaeological monitoring for inadvertent finds during excavation projects; and the requirements and obligations established and delineated by the Antiquities Act of 1906; the Archaeological and Historic Preservation Act, as amended (1960); the Archaeological Resources Protection Act of 1979; and the Native American Graves and Repatriation Act (1990). You have also chosen to place the structure near a roadway that is designated as a state historic heritage route, and that will implicate duties of the Michigan Department of Transportation.

We believe it highly likely that the proposed placement would require a full environmental impact report, but there is no indication that Mobilitie, or the architect who reviewed the plans, has taken any steps to comply with, or even identify the company's obligations under federal or state laws. This is of grave concern: we fear the submission was designed to ignore the requirements applicable to wireless facilities in the rights of way within or affecting historical districts. In addition, the City is very likely to exercise its authority under Section 383 of the City Code should you opt to pursue placement of the tower as proposed.

In summary, the submission under Section 625 is incomplete, for reasons stated above. It is, in fact, so defective and raises such significant issues, that we believe the best course for Mobilitie is to withdraw the submission.

Please let us know if you intend to withdraw the application within five business days of the date of this letter. If you do not do so, the City will need to take appropriate steps to protect itself. This may include, but is not limited to, filing a complaint at the Federal Communications Commission that will show what you submitted, and its impacts on a district listed in the National Register of Historic Places.

Should you choose to pursue the application under Section 625, you also would need to file additional materials and pay the fees required under that section. In addition to the applicability of Monroe Code Section 625, Article (Excavations), the City of Monroe, as appropriate, will be reviewing future submittals for consistency also with Chapter 651 (Telecommunications) and Chapter 720 (Zoning), Section 78 (Wireless telecommunications towers and antennas). While these sections may not apply in their entirety given the type of facility being contemplated, some additional provisions may also govern, as suggested above. We would expect to receive these materials promptly, along with applicable fees. As indicated above, you will also need to seek a franchise from the City.

Out of an abundance of caution, to the extent that Mobilitie contends that the application *was* submitted pursuant to the Metro Act, we hereby determine that it does not comply with the requirements of that Act, and indeed, that the Act is not applicable to all or most of the installations – and certainly not the "utility pole" set out in the Project Description.

Further, to the extent that Mobilitie contends that it has submitted this application under Section 332(c)(7) or state law governing placement of new wireless facilities, it should provide all the materials identified in this letter along with the materials required in the City Code provisions cited above, so that the City is in a position to comply with any deadlines Mobilitie may believe applies. We would need that material within 21 days of the date of this letter.

After withdrawal, or after disposition of the submission, the City is also happy to discuss other alternative sites that do not impact the rights of way, and do not raise the same safety and other concerns. There may be other municipal properties in the immediate area that may fulfill Mobilitie's needs.

On behalf of the City of Monroe,

KITCH DRUTCHAS WAGNER
VALITUTTI & SHERBROOK

_____

Michael J. Watza
(313) 965-7983
mike.watza@kitch.com

Exhibit 6
Proposal for Tower from Mobilitie to Centerville, GA., and Response of City

Network Utility Technologies of Georgia, LLC

March 8, 2016

Network Utility Technologies of Georgia, LLC
Interstate Transport and Broadband, LLC
925B Peachtree St. NE Suite 710
Atlanta, GA 30309

CITY OF DUBLIN
Engineering Department
Attention: Royce J. Hall
100 S Church St
Dublin, GA 31040
Phone Number: 478-277-503

RE: Application of Network Utility Technologies of Georgia, LLC to Construct, Maintain, and Operate its Lines and Facilities in Dublin, GA, Lauren County – #9GAX001111

PURSUANT TO PARAGRAPH (2) OF SUBSECTION (b) OF CODE SECTION 46-5-1- OF THE OFFICIAL CODE OF GEORGIA ANNOTATED, THE MUNICIPAL AUTHORITY SLAUREN NOTIFY THE APPLIANT OF ANY DEFICIANCIES IN THIS APPLIATION WITHIN 15 BUSINESS DAYS OF RECIEPT OF THIS APPLICATION; SUCH NOTICE SLAUREN SPECIFICALLY IDENTIFY ALL APPLICATION DEFICIENCIES. IF NO SUCH NOTIFICATION IS GIVEN WITHIN 15 BUSINESS DAYS OF THE RECEIPT OF AN APPLICATION, SUCH APPLICATION SLAUREN BE DEEMED COMPLETE

Dear To Whom It May Concern:

Principal Office:

Network Utility Technologies of Georgia, LLC
925B Peachtree St. NE Suite 710
Atlanta, Georgia 30309

Local Agent:

Chad Caudill
Interstate Transport and Broadband, LLC
925B Peachtree St. NE Suite 710
Atlanta, GA 30309

Certification of Authority:

Network Utility Technologies of Georgia, LLC has certification from the Georgia Public Service Commission that it is authorized to provide backhaul transport services in Georgia pursuant to CLEC Certificate L-0493 and IXC Certificate X-1101, copies of which are forthcoming.

Proof of Insurance:

Copies of which are forthcoming.

Description of Service Area:

Network Utility Technologies of Georgia, LLC service area is the Lauren County. If Network Utility Technologies of Georgia, LLC or Interstate Transport and Broadband, LLC modifies its service area as identified in this application it sLauren notify Lauren County of such changes at least 20 days prior to the effective date of such change. Such notification sLauren contain a geographic description of the new service area to be provided within the Lauren County of the Lauren County.

Description of Services to be Provided:

Under its CLEC and IXC certificates, Network Utility Technologies of Georgia, LLC is a backhaul transport provider. If Network Utility Technologies of Georgia, LLC modifies its provisioned services identified in this application it sLauren notify the Lauren County of such changes at least 20 days prior to the effective date of such change. Such notification sLauren contain a description of the new services to be provided within the Lauren County of the Lauren County.

Compliance Agreement:

Network Utility Technologies of Georgia, LLC sLauren comply with all applicable federal, state, and local laws and regulations, including municipal ordinances and regulations, regarding the placement and maintenance of facilities in the public rights of way that are reasonable, nondiscriminatory, and applicable to all users of the public rights of way, including the requirements of Chapter 9 of Title 25, the "Georgia Utility Facility Protection Act."

Statement Concerning Payment of Compensation to the Lauren County:

Network Utility Technologies of Georgia, LLC acknowledges that the payment of due compensation to the Lauren County as defined in O.C.G.A. § 46-5-1(b)(9) would be required for Network Utility Technologies of Georgia, LLC to have the right to construct, maintain, and operate its lines upon the right of way of the Lauren County. In filing this application Network Utility Technologies of Georgia, LLC seeks to provide the Lauren County with the information necessary to determine the amount of due compensation that would have to be paid and represents to the Lauren County that O.C.G.A. § 46-5-1 does not prevent the filing of an application.

Network Utility Technologies of Georgia, LLC agrees that its obligation to comply with all applicable federal, state, and local laws and regulations, including municipal ordinances and regulations, regarding the placement and maintenance of facilities in the public rights of way that are reasonable, nondiscriminatory, and applicable to all users of the public rights of way, including the requirements of Chapter 9 of Title 25, the "Georgia Utility Facility Protection Act" would cause the due compensation to become payable once the Lauren County has made a determination of the amount that complies with O.C.G.A. § 46-5-1.

Facilities to be Installed:

The facilities to be installed in the right of way of the Lauren County are as set forth in Exhibit "B."

Please find the enclosed Network Utility Technologies of Georgia, LLC's ("NUTG") application for right of way use agreement and building permit application for the proposed new utility infrastructure facility in your Lauren County. Along with the attached permit application, you will also find construction drawings and photo simulations for each facility.

NUTG is a public utility company regulated by the Georgia Public Service Commission to provide telephone related services, such as facilities based competitive local exchange and interexchange services. To meet the growing demand for connectivity, NUTG is deploying a hybrid transport network that provides high-speed, high-capacity bandwidth in order to facilitate the next generation of devices and data-driven services. This network can support a variety of technologies and services that require connectivity to the internet, including, but not limited to, driverless and

connected vehicles (commercial, personal and agricultural), remote weather stations and mobile service providers. These transport utility poles and facilities are not dedicated to any particular customer, and, to the extent capacity on the structures is available, are available to be used by other entities.

Based on our initial research, NUTG is submitting the application in accordance with the Lauren County. NUTG plans to construct the applied for utility infrastructure within the next 18 months and formally requests the County to identify a single point of contact to streamline the application communications for the benefit of both parties.

NUTG's hybrid transport network is an industry changing approach that seeks to improve backhaul connectivity for the County's residents. We are excited to work with Lauren County and are available to answer questions. If you have questions please contact me at (678) 778 – 6505.

Thank you for your attention to this matter.

Application made on this 8 day of March, 2016,

Respectfully submitted,

Thomas Heick
Network Real Estate Permitting Manager

Chad Caudill
Agent for Network Utility Technologies of Georgia, LLC

RIGHT OF WAY UTILIZATION APPLICATION

Date Submitted		Submitted By	Thomas Heick

JURISDICTION INFORMATION

Jurisdiction Name	Laurens County						
Address	32.537216, -82.908211	City	Dublin	State	GA	Zip Code	31021
Jurisdiction Contact		Phone Number					

APPLICANT INFORMATION

Applicant Name	Network Utility Technologies of Georgia, LLC			Utility ID			
Address	925 B Peachtree St. NE, Suite 710						
City	Atlanta		State	GA	Zip Code	30309	
Applicant Contact	Thomas Heick	Phone Number	678-778-6505	Email	thomas.heick@itbuility.com		

Name		Phone Number	

SITE INFORMATION

Cascade ID	AT90XCMAVB			Interstate Transport and Broadband, LLC ID			
Latitude	32.537216	Longitude	-82.908211	Site Type (Urban, Rural, etc.)			
Address		City	Dublin	State	GA	Zip Code	31021

End useer proposes to installl a new 120' Utility Pole within an existing Right-Of-Way. The scope will consist of the following- Install proposed 120' untility pole

Est. Cost of Work	$4,050

GENERAL CONTRACTOR

Contractor Name	TBD			License Number	
Contact Name		Phone Number		Email	
Address					
City		State		Zip Code	

ELECTRICAL CONTRACTOR

Contractor Name	TBS			License Number	
Contact Name		Phone Number		Email	
Address					
City		State		Zip Code	

ARCHITECTURE / ENGINEERING

Contractor Name	JACOBS ENGINEERING GROUP, LLC			License Number	
Contact Name	KARL KRATINA	Phone Number	678-460-1416	Email	
Address					
City		State		Zip Code	

POWER AND BACKHAUL

Power Provided By	UTILITY CO. DIRECT ☐	NONE ☐	AERIAL ☐	TRENCHING ☐	BORE ☐	OTHER ☐	
Utility Provider							
Address				City		State	Zip Code
Telco/Interconnect Requirements	UE ☐	MICROWAVE ☐	FIBER OPTICS ☐	LICENSED ☐	OTHER ☐		
Provider							

PERMIT ISSUANCE

Permit Number		Permit Number	
Permit Fee		Permit Fee	

9GAX001111

32.537216,−82.908211

Dublin, GA 31021

811
Know what's **below.**
Call before you dig.

GENERAL NOTES

THE FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. A TECHNICIAN WILL VISIT THE SITE AS REQUIRED FOR ROUTINE MAINTENANCE. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT DISTURBANCE OF EFFECT ON DRAINAGE; NO SANITARY SEWER SERVICE, POTABLE WATER OR TRASH DISPOSAL IS REQUIRED AND NO COMMERCIAL SIGNAGE IS PROPOSED.

SITE INFORMATION

POLE ID:	9GAX001111
LATITUDE:	32.537216
LONGITUDE:	−82.908211
ADDRESS/CROSS STREET:	
CITY, STATE ZIP:	Dublin, GA 31021
PROPERTY OWNER	PUBLIC RIGHT−OF−WAY
APPLICANT	Network Technology Authority IL, LLC
APPLICANT ADDRESS	925B Peachtree St. NE, Suite 710 Atlanta,GA 30309

DO NOT SCALE DRAWINGS

CONTRACTORS SHALL VERIFY ALL PLANS, EXISTING DIMENSIONS & FIELD CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ARCHITECT/ENGINNER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

LOCATION MAPS NORTH

VICINITY MAP

REGIONAL MAP

PROJECT DESCRIPTION

END USER PROPOSES TO INSTALL A NEW UTILITY POLE WITHIN AN EXISTING RIGHT−OF−WAY. THE SCOPE WILL CONSIST OF THE FOLLOWING:

1. INSTALL PROPOSED 120' UTILITY POLE

CODES

2015 INTERNATIONAL BUILDING CODE
2014 NATIONAL ELECTRICAL CODE

SHEET INDEX

SHEET #	SHEET DESCRIPTION
0.0	TITLE SHEET
1.0	EXHIBIT PHOTO & SITE PLAN
2.0	UTILITY POLE ELEVATIONS
3.0	ELECTRICAL

ENGINEER

INTERSTATE TRANSPORT AND BROADBAND

Network Utility Technologies of Georgia, LLC

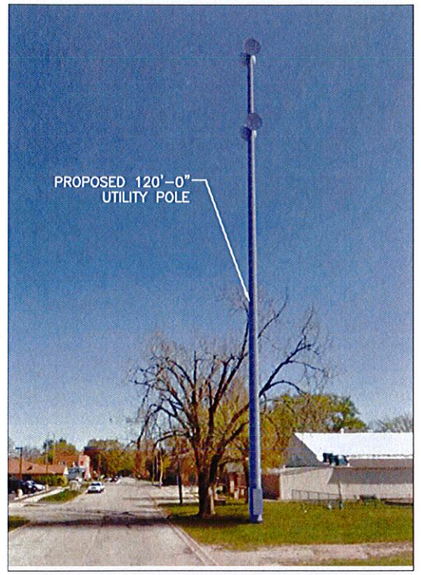
PROJECT NUMBER:
DRAWN BY: ----
CHECKED BY: ----

IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

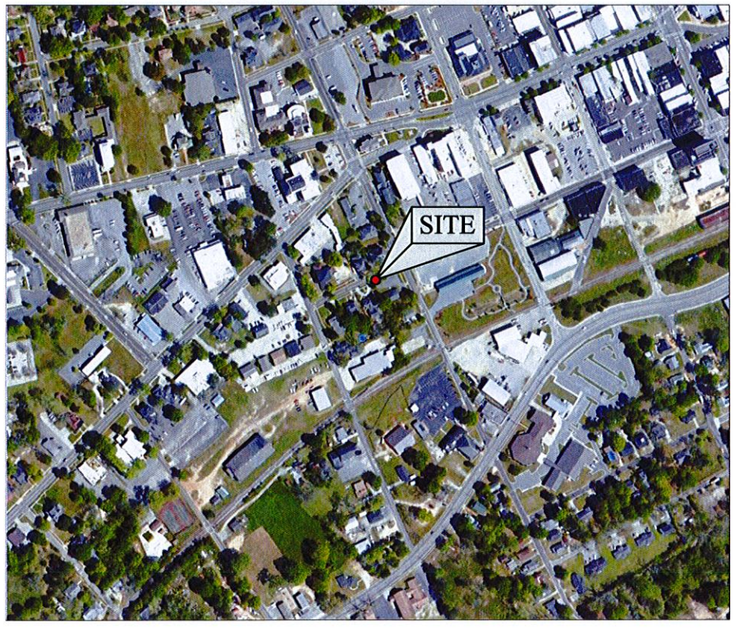
SITE INFORMATION
9GAX001111
32.537216,−82.908211
Dublin, GA 31021
UTILITY POLE

SHEET TITLE
TITLE SHEET

SHEET NUMBER
0.0



1 EXHIBIT PHOTO – GENERIC (NOT SITE SPECIFIC)
SCALE: N.T.S.



2 AERIAL SITE LOCATION
SCALE: N.T.S.

NOTE:
THIS SITE PLAN WAS GENERATED WITHOUT THE USE OF A SURVEY. PROPERTY LINES, POWER & TELCO UTILITY PINT CONNECTIONS/ROUTES AND EASEMENTS SHOWN ON THESE PLANS ARE ESTIMATED.

TRUE NORTH

NOTE:
PROPOSED 120'0" POLE IN THE R.O.W.
R.O.W. BOUNDARIES TO BE CONFIRMED AFTER SURVEY

3 ENLARGED SITE PLAN
SCALE: N.T.S.

INTERSTATE TRANSPORT AND BROADBAND

Network Utility Technologies of Georgia, LLC

PROJECT NUMBER:
DRAWN BY: ----
CHECKED BY: ----

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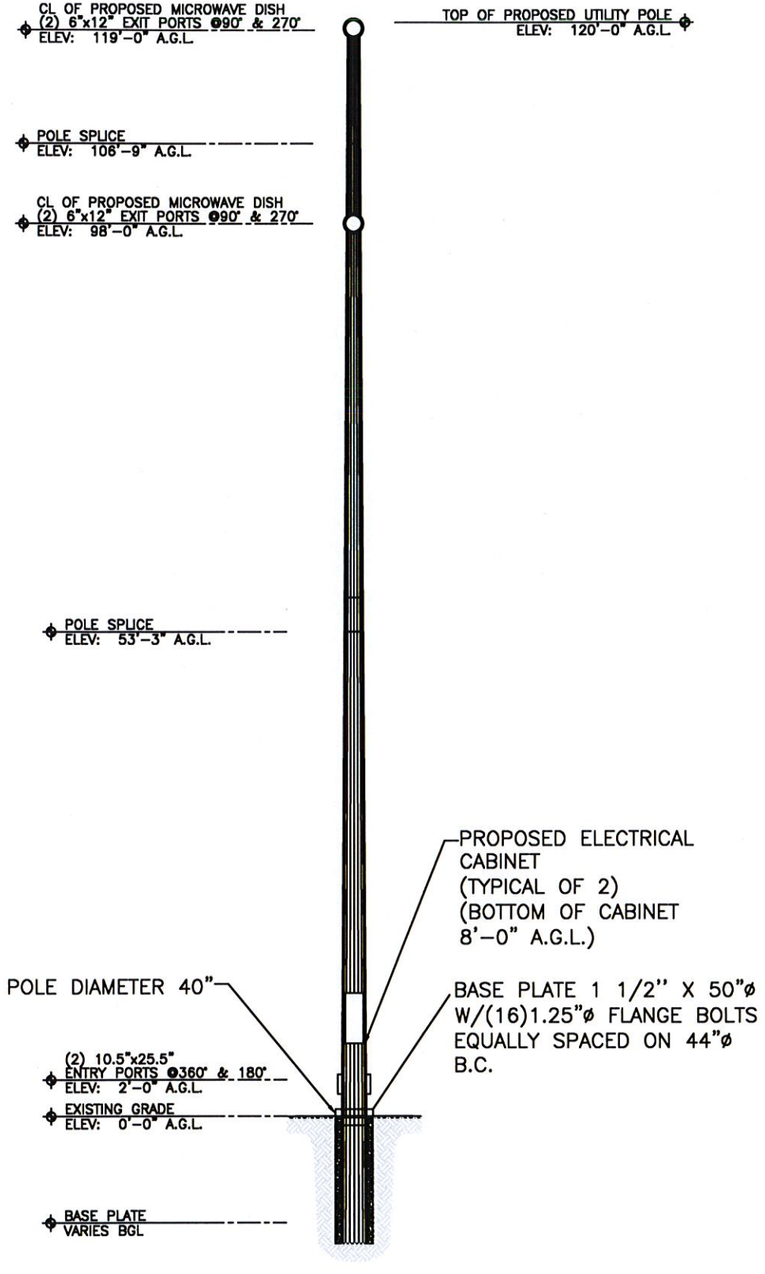
SITE INFORMATION
9GAX001111
32.537216,-82.908211
Dublin, GA 31021
UTILITY POLE

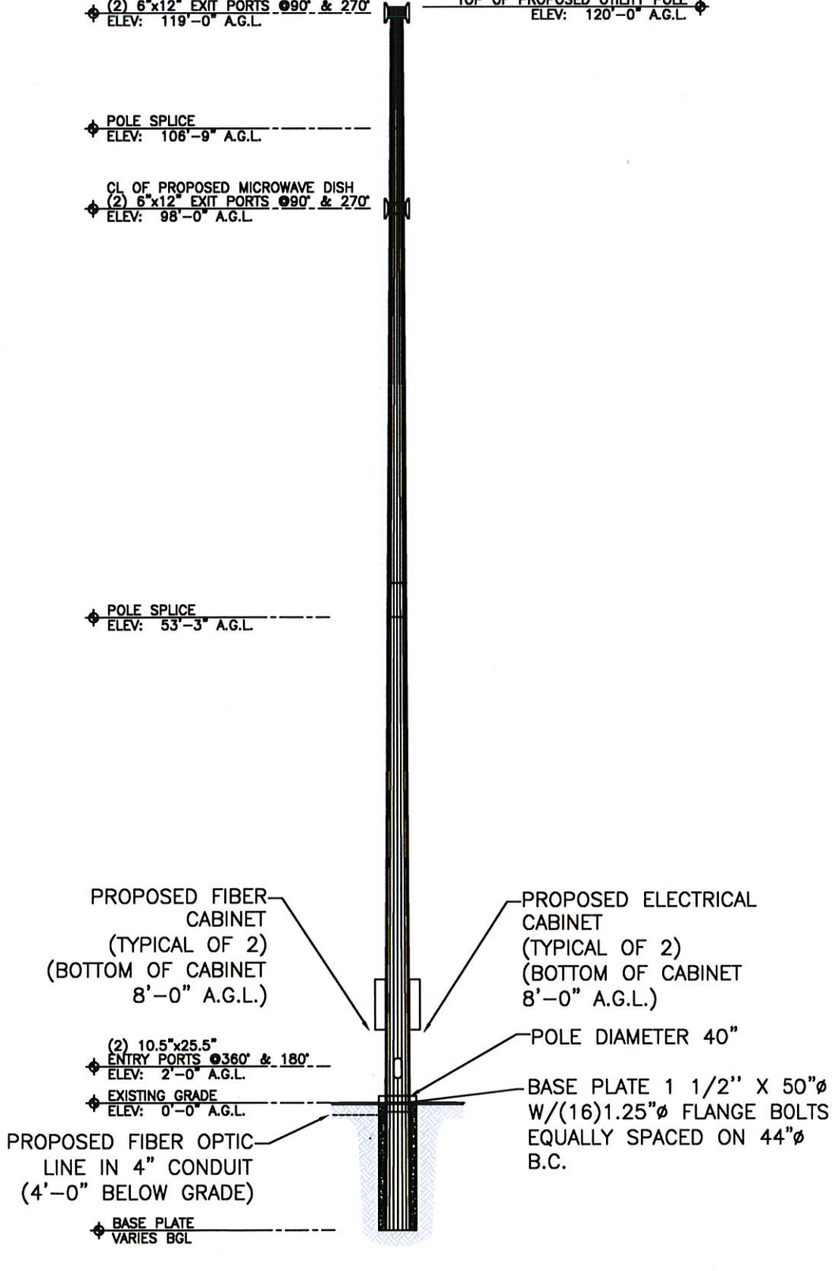
SHEET TITLE
EXHIBIT PHOTO &
ENLARGED SITE PLAN

SHEET NUMBER
1.0



1 FRONT UTILITY POLE ELEVATION
SCALE: 0.010399

GRAPHIC SCALE: 1/8"=1'-0"



1 SIDE UTILITY POLE ELEVATION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8"=1'-0"

INTERSTATE
TRANSPORT AND BROADBAND

Network Utility Technologies of Georgia, LLC

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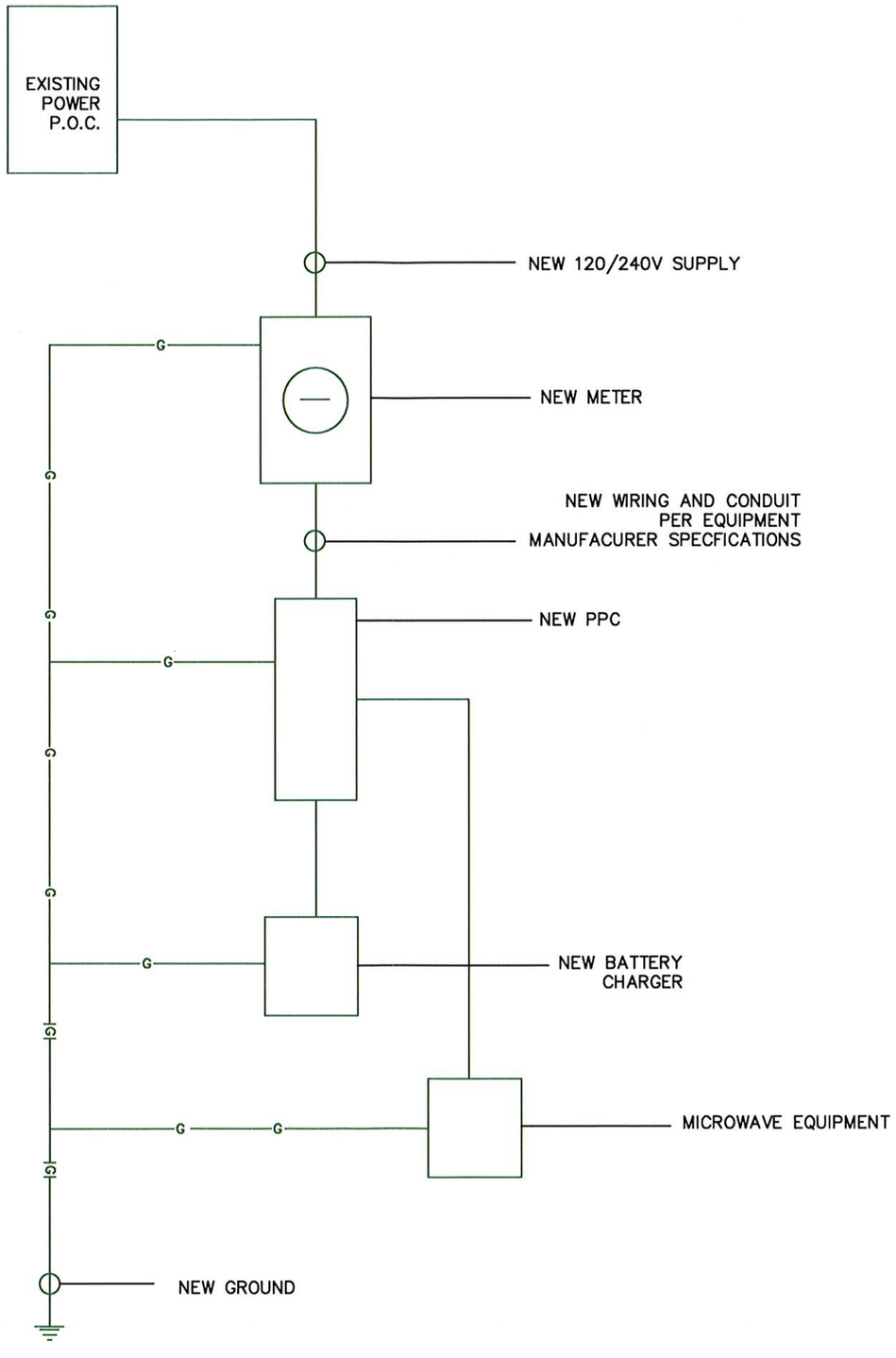
32.537216,-82.908211
Dublin, GA 31021
UTILITY POLE

SHEET TITLE
UTILITY POLE ELEVATIONS

SHEET NUMBER
2.0



ONE LINE DIAGRAM

INTERSTATE TRANSPORT AND BROADBAND

Network Utility Technologies of Georgia, LLC

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9GAX001111
32.537216,-82.908211
Dublin, GA 31021
UTILITY POLE

SHEET TITLE
ELECTRICAL

SHEET NUMBER
3.0

Governor's All-Star City

* * * *

CITY OF CENTERVILLE

300 East Church Street
Centerville, Georgia 31028-1099
Phone: (478) 953-4734 Fax: (478) 953-4797

JOHN R. HARLEY
MAYOR

Mike Brumfield
Dir of Operations

Krista Bedingfield
City Clerk

Rebecca L. Tydings
City Attorney

Members
Of
Council

Cameron W. Andrews
Post 1

Randall Wright
Post 2

J. Micheal Evans
Post 3

Edward D. Armijo
Post 4

Chad Caudill, Local Agent
Interstate Transport and Broadband, LLC
925B Peachtree St. NE, Suite 710
Atlanta, GA 30309

Network Utility Technologies of Georgia, LLC
Interstate Transport and Broadband, LLC
925B Peachtree St., NE, Suite 710
Atlanta, GA 30309

March 14, 2016 sent via overnight delivery, signature required

Dear Mr. Caudill:

Rejection of application and Notice of Incompleteness

On March 7, 2016, the City of Centerville responded to a letter from Network Utility Technologies of Georgia, Inc. (hereinafter "NUTG") dated February 26, 2016. That letter purported to be an application demanding rights in public property. The City of Centerville requested that you withdraw the improperly submitted document by March 10, 2016.

Having received no further correspondence from NUTG, the City of Centerville hereby rejects the purported application since it is not a proper application submitted under Georgia law. Those application provisions are only available to "[a]ny telephone company chartered by the law of this or any other state . . ."

To the extent that the City is required by Georgia law to respond to an application, even if submitted with false information as part of a demand for property, this letter also serves as a Notice of Incompleteness both because NUTG and the proposed facilities are not eligible for consent, and for the reasons specified in the attachment.

Finally, the City of Centerville would alert you that there are other issues created by your application both as to compensation and to placement that are not part of the completeness assessment. Should NUTG ever submit a complete and proper application, we would be happy to discuss those issues with you.

Sincerely,

Rebecca L. Tydings

Rebecca L. Tydings, City Attorney

Governor's All-Star City

* * * *

CITY OF CENTERVILLE

300 East Church Street
Centerville, Georgia 31028-1099
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(A) The name, address, and telephone number of a principal office and local agent of such telegraph or telephone company;	Incomplete. We note that while an entity is listed as an agent, that entity was not registered with the State and therefore could not be the agent. Likewise, no telephone company had been registered to do business in the state, and therefore the application failed to include a proper identification of a company that may apply.
(B) Proof of certification from the Georgia Public Service Commission of such telegraph or telephone company to provide telecommunications services in this state;	Incomplete. No proof provided
(C) Proof of insurance or self-insurance of such telegraph or telephone company adequate to defend and cover claims of third parties and of municipal authorities;	Incomplete. No proof provided.
(D) A description of the telegraph or telephone company's service area, which description shall be sufficiently detailed so as to allow a municipal authority to respond to subscriber inquiries. For the purposes of this paragraph, a telegraph or telephone company may, in lieu of or as supplement to a written description, provide a map on 8 1/2 by 11 inch paper that is clear and legible and that fairly depicts the service area within the boundaries of the municipal authority. If such service area is less than the boundaries of an entire municipal authority, the map shall describe the boundaries of the geographic area to be served in clear and concise terms;	Incomplete. We note that description lacks sufficient detail to allow response to subscriber inquiries, and does not otherwise comply with the requirements of the law.

Governor's All-Star City

* * * *

CITY OF CENTERVILLE

300 East Church Street
Centerville, Georgia 31028-1099
Phone: (478) 953-4734 Fax: (478) 953-4797

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Post 4

(E) A description of the services to be provided;	Incomplete. We note the description is insufficiently vague, for example, appearing to suggest applicant will provide services that would require DSRC licenses that there is no indication it would possess.
(F) An affirmative declaration that the telegraph or telephone company shall comply with all applicable federal, state, and local laws and regulations, including municipal ordinances and regulations, regarding the placement and maintenance of facilities in the public rights of way that are reasonable, nondiscriminatory, and applicable to all users of the public rights of way, including the requirements of Chapter 9 of Title 25, the "Georgia Utility Facility Protection Act"; and	Complete, except (as noted above) company had not complied with law requiring it to obtain authorizations, statement was false; see also last paragraph of cover letter, which notes that different compensation than is proposed appears to be required given the materials in the purported application.
(G) A statement in bold type at the top of the application as follows: "Pursuant to paragraph (2) of subsection (b) of Code Section 46-5-1 of the Official Code of Georgia Annotated, the municipal authority shall notify the applicant of any deficiencies in this application within 15 business days of receipt of this application."	Incomplete. Statement appears on first page of cover letter, not on the purported application.
(If an application is incomplete, the municipal authority shall notify the telegraph or telephone company within 15 business days of the receipt of such application; such notice shall specifically identify all application deficiencies. If no such notification is given within 15 business days of the receipt of an application, such application shall be deemed complete.	Purported application received by City of Centerville on 03/02/2016. City's initial response letter dated 03/07/16; received by NUTG on 03/08/2016. City's rejection letter and notice of incompleteness dated 03/14/2016; sent UPS overnight for delivery on 03/15/2016.

Exhibit 7
Proposal for Tower from Mobilitie to Laurel, MD.

SITE ID: 9MDB001751
WA90XSDB5B
MAIN ST &
4TH ST
LAUREL, MD 20707

RECEIVED
CITY OF LAUREL, MARYLAND
JUN 30 2016
DEPARTMENT OF ECONOMIC & COMMUNITY DEVELOPMENT

GENERAL NOTES

THE FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. A TECHNICIAN WILL VISIT THE SITE AS REQUIRED FOR ROUTINE MAINTENANCE. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT DISTURBANCE OF EFFECT ON DRAINAGE; NO SANITARY SEWER SERVICE, POTABLE WATER OR TRASH DISPOSAL IS REQUIRED AND NO COMMERCIAL SIGNAGE IS PROPOSED.

SITE INFORMATION

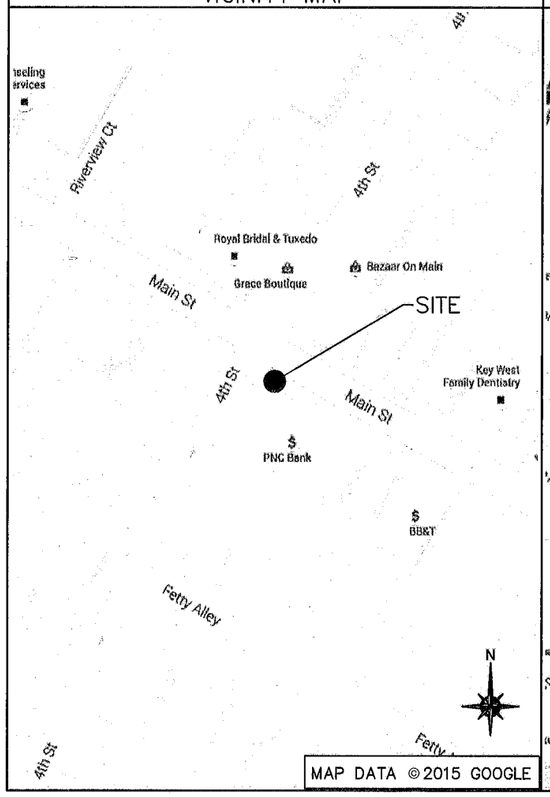
PROPERTY OWNER:	PUBLIC RIGHT-OF-WAY
ADDRESS/CROSS ST:	MAIN ST & 4TH ST
APPLICANT:	TECHNOLOGY MD NETWORK COMPANY, LLC
APPLICANT ADDRESS:	925B PEACHTREE ST. NE, SUITE 710 ATLANTA, GA 30309 PHONE: (312) 638-5400
LATITUDE:	39° 6' 20.91" N (39.105807)
LONGITUDE:	76° 50' 52.13" W (-76.847814)
LAT/LONG TYPE:	NAD 83
GROUND ELEVATION:	± 170' AMSL
COUNTY:	PRINCE GEORGE'S COUNTY
JURISDICTION:	CITY OF LAUREL

BEFORE SCALING:

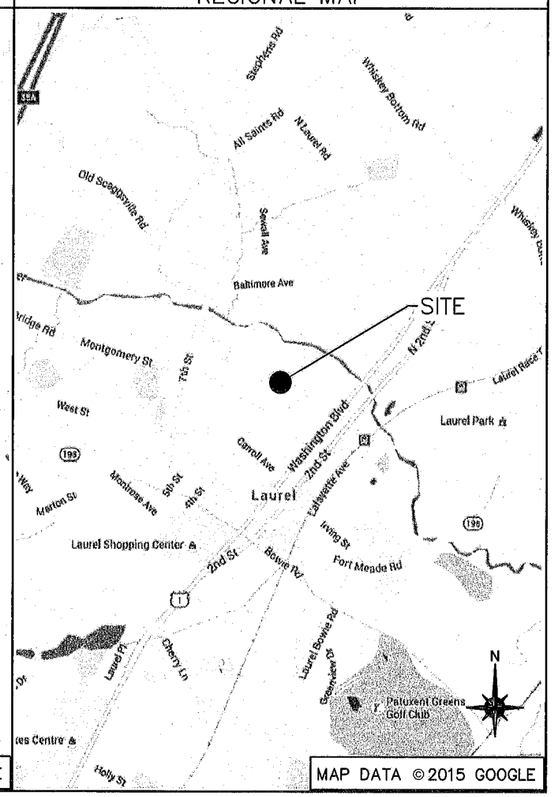
CONTRACTORS SHALL VERIFY ALL PLANS, EXISTING DIMENSIONS & FIELD CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ARCHITECT/ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

LOCATION MAPS

VICINITY MAP



REGIONAL MAP



DIG ALERT

811 Know what's below. Call before you dig.

TWO WORKING DAYS BEFORE YOU DIG

PROJECT DESCRIPTION

END USER PROPOSES TO INSTALL EQUIPMENT ON A PROPOSED WOOD UTILITY POLE WITHIN AN EXISTING RIGHT-OF-WAY. THE SCOPE WILL CONSIST OF THE FOLLOWING:

- INSTALL PROPOSED BACKHAUL TRANSPORT EQUIPMENT ON A PROPOSED WOOD UTILITY POLE

CODES

2015 INTERNATIONAL BUILDING CODE
2014 NATIONAL ELECTRICAL CODE

DRAWING INDEX

SHEET NO:	SHEET TITLE
0.0	TITLE SHEET
1.0	SITE PLAN & EXHIBIT PHOTO
2.0	POLE ELEVATIONS
2.1	POLE ELEVATIONS
3.0	ANTENNA & EQUIPMENT MOUNTING DETAILS
3.1	ANTENNA & EQUIPMENT DETAILS
4.0	ELECTRICAL DETAILS
5.0	GROUNDING DETAILS
GN-1	GENERAL NOTES
GN-2	GENERAL NOTES
6.0	TRAFFIC CONTROL PLAN
6.1	TYPICAL PEDESTRIAN / WORKER SAFETY PLAN

ARCHITECT/ENGINEER

JACOBS ENGINEERING GROUP, INC.
5449 BELLS FERRY ROAD
ACWORTH, GA 30102
CONTACT: KARL KRATINA
PROJECT MANAGER
TEL: (678) 460-1416
FAX: (770) 701-2501

TECHNOLOGY MD
NETWORK COMPANY, LLC

INTERSTATE TRANSPORT AND BROADBAND

PROJECT NO:	ER600201
DRAWN BY:	M. DULLATE
CHECKED BY:	L. BUCK

A	06.23.16	FOR REVIEW

PRELIMINARY

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WA90XSDB5B
9MDB001751
MAIN ST &
4TH ST
LAUREL, MD 20707
UTILITY POLE

SHEET TITLE
TITLE SHEET

SHEET NUMBER
0.0

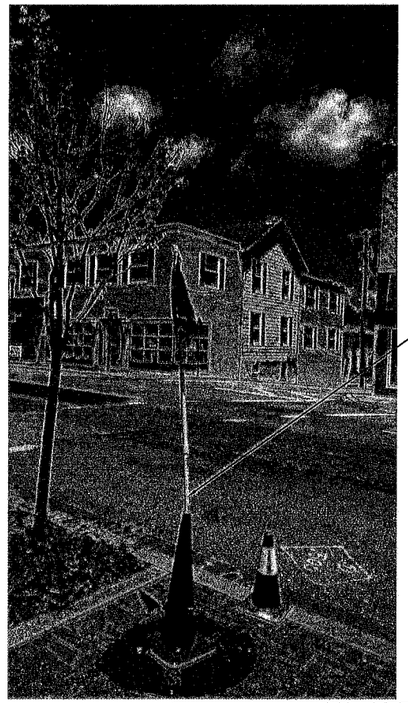


EXHIBIT PHOTO

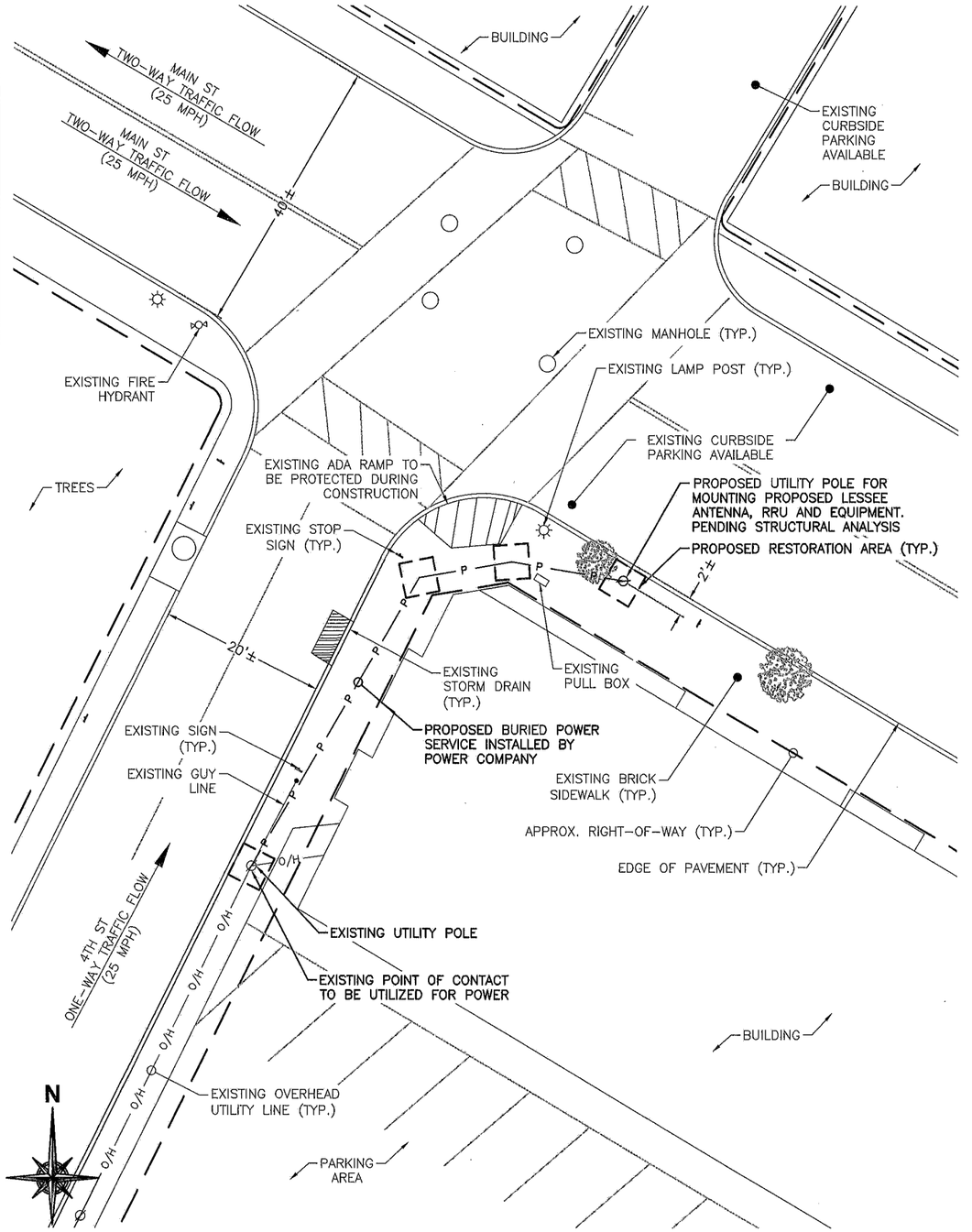
SCALE: NOT TO SCALE

1

AERIAL SITE LOCATION

SCALE: NOT TO SCALE

2



NOTE:
THIS SITE PLAN WAS GENERATED WITHOUT THE USE OF A SURVEY. PROPERTY LINES, POWER & TELCO UTILITY POINT CONNECTIONS/ROUTES AND EASEMENTS SHOWN ON THESE PLANS ARE ESTIMATED. ALL ITEMS AND DIMENSIONS SHOULD BE VERIFIED IN THE FIELD.

ENLARGED SITE PLAN

SCALE: 1"=20'-0" (1"=10'-0" ON 22"x34" SHEET)

3

TECHNOLOGY MD NETWORK COMPANY, LLC

INTERSTATE TRANSPORT AND BROADBAND

PROJECT NO:	ER600201
DRAWN BY:	M. DULLATE
CHECKED BY:	L. BUCK

A	06.23.16	FOR REVIEW

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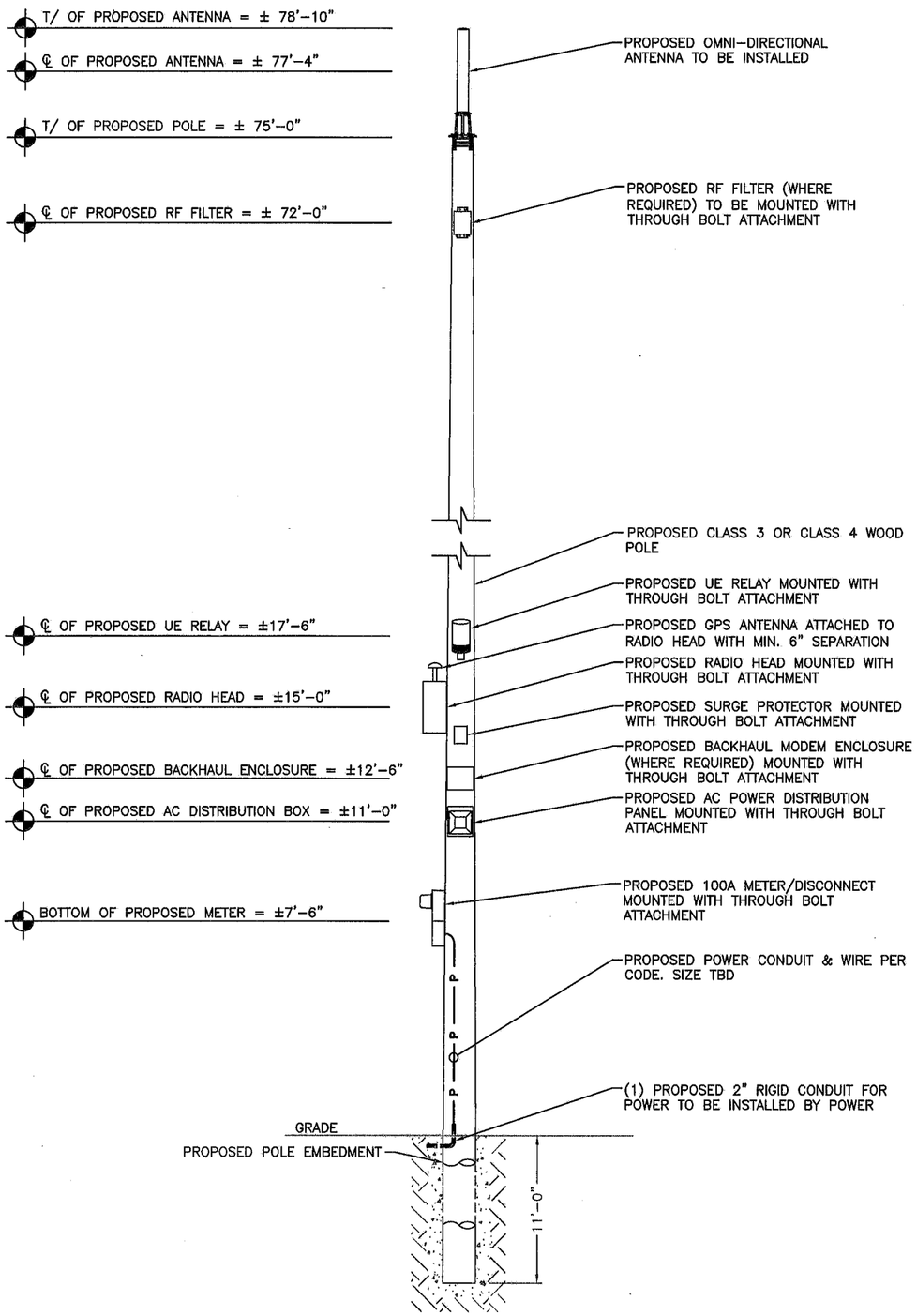
WA90XSDB5B
9MDB001751
MAIN ST &
4TH ST
LAUREL, MD 20707
UTILITY POLE

SHEET TITLE

SITE PLAN & EXHIBIT PHOTO

SHEET NUMBER

1.0



NOTE:
PROJECT SCOPE OF WORK DOES NOT INCLUDE A STRUCTURAL EVALUATION OF THIS POLE OR STRUCTURE. NEW EQUIPMENT SHOWN ON THIS PLAN HAVE NOT BEEN EVALUATED TO VERIFY THE POLE OR STRUCTURE HAS THE CAPACITY TO ADEQUATELY SUPPORT THE EQUIPMENT. PRIOR TO ANY INSTALLATION, A STRUCTURAL EVALUATION OF THE POLE OR STRUCTURE SHOULD BE PERFORMED.

NOTES:

1. ALL HARDWARE SHALL BE STAINLESS STEEL.
2. ALL CABLES SHALL BE SECURED TO POLE EVERY 36" OR LESS.
3. LIGHTNING RODS SHALL BE INCLUDED AS REQUIRED.
4. STRUCTURAL BACKFILL TO BE COMPACTED IN 8" MAXIMUM LAYERS TO 95% OF CONTENT IN ACCORDANCE WITH ASTM D698. ADDITIONALLY, STRUCTURAL BACKFILL MUST HAVE A MINIMUM COMPACTED UNIT WEIGHT OF 100 POUNDS PER CUBIC FOOT (16kN/m3)

BAND 41 (2500MHz) EQUIPMENT CHART			
QUANTITY	DESCRIPTION	DIMENSIONS (HxWxD)	WEIGHT
1	MOUNTED ANTENNA	35.4" X 4.7" DIAMETER	11 LBS
1	MOUNTED RADIO	20.1" X 9.1" X 8.9"	55.1 LBS
1	GPS ANTENNA	0.8" X 2.6" DIAMETER	0.3 LBS
1	AC DISTRIBUTION	9.25" X 9.5" X 3.81"	14 LBS
1	MOUNTED RELAY	13.0" X 7.9" DIAMETER	9.9 LBS
1	SURGE PROTECTOR	6.44" X 4.69" X 3.5"	TBD
1	REJECT FILTER	13.6" X 8.1" X 2.4"	7.7 LBS

PROPOSED FRONT POLE ELEVATIONS

SCALE: 1" = 5'

1

TECHNOLOGY MD
NETWORK COMPANY, LLC

INTERSTATE TRANSPORT AND BROADBAND

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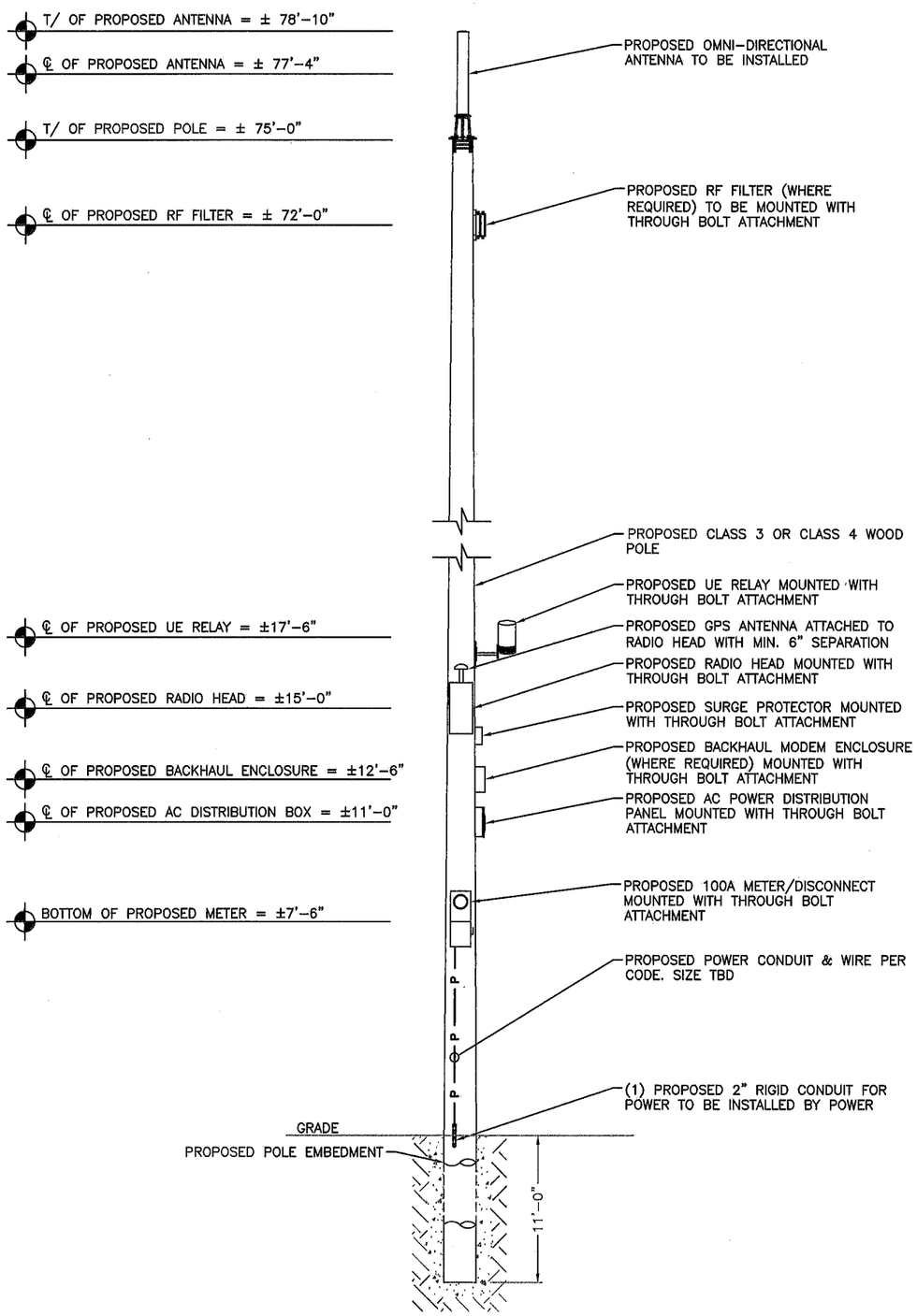

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PROPOSED SIDE POLE ELEVATIONS

SCALE: 1" = 5'

1

TECHNOLOGY MD
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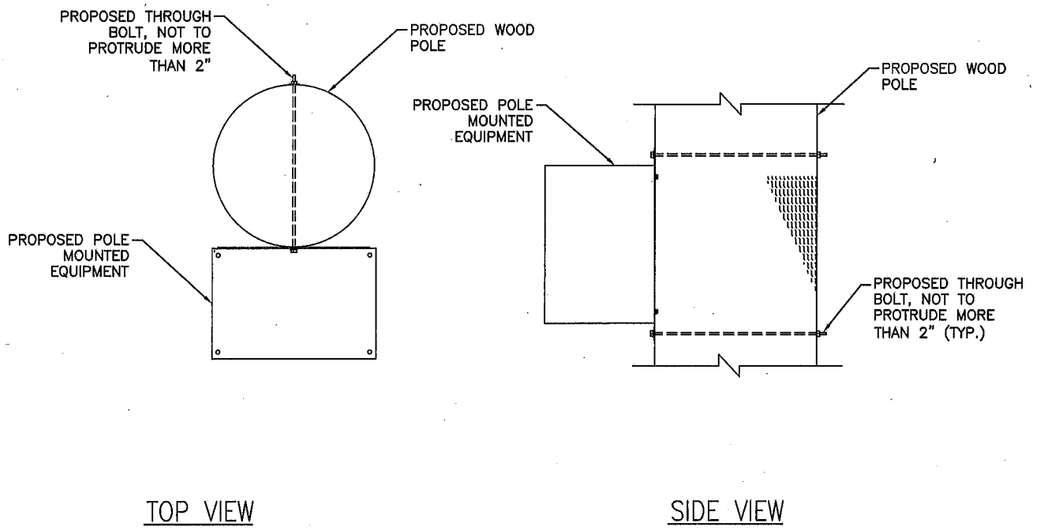
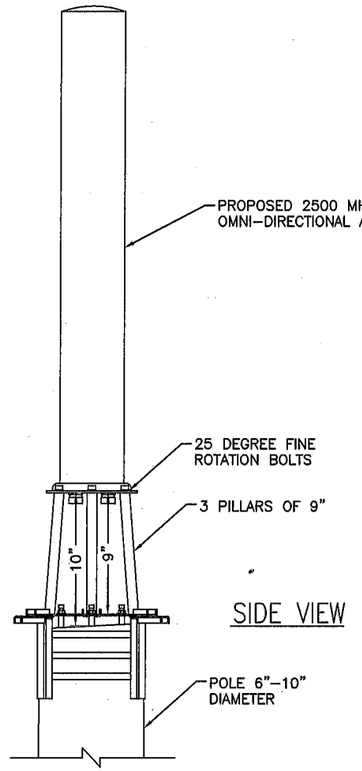


EQUIPMENT MOUNTING DETAIL

SCALE: NOT TO SCALE

1



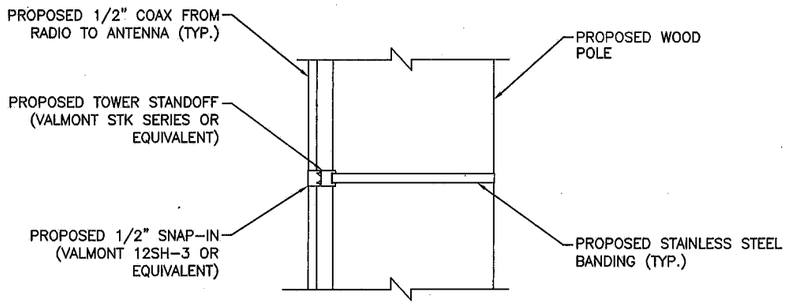
NOTE:

1. MOUNTING BRACKET ACCOMMODATES POLE SIZES FROM 3" TO 10" DIAMETER.
2. JACOBS HAS NOT PERFORMED A STRUCTURAL EVALUATION FOR THE MOUNTING BRACKET. REFER TO THE MANUFACTURER FOR ADDITIONAL INFORMATION.

ANTENNA MOUNTING DETAIL

SCALE: NOT TO SCALE

3

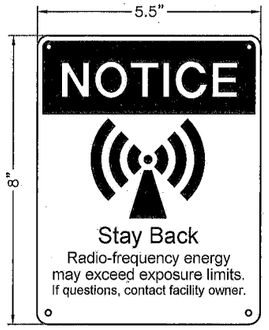


NOTE:
SPACE SNAP-INS PER CABLE MANUFACTURER'S SPECIFICATIONS

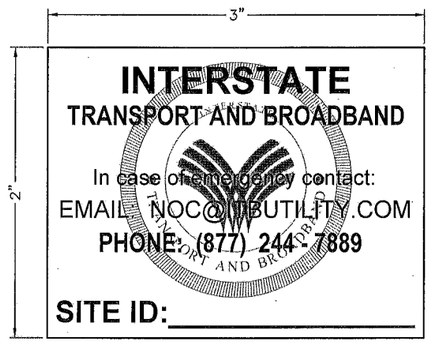
CABLE MOUNTING DETAIL

SCALE: NOT TO SCALE

2



ANTENNA SIGNAGE:
ON WOOD POLES – SIGN ON ALUMINUM WITH SS SCREW TO THE POLE
ON METAL POLES – ADHESIVE VINYL OR PLACARD STRAPPED WITH SS TIES
ON CONCRETE / COMPOSITE – PLACARD STRAPPED WITH SS TIES
SIGN PLACEMENT:
AFFIX TO THE STRUCTURE 3-4' BELOW THE COMMERCIAL RF ANTENNA(S)
SIZE APPROX. 8" x 5.5"



OWNER / OPERATOR NOTE:
SITE ID LABEL TO BE AFFIXED WITH TZeS241 LABELING TAPE OR EQUIVALENT BLACK ON WHITE LABELING TAPE OF AT LEAST 18mm WIDTH WITH EXTRA-STRENGTH ADHESIVE. USE ANY COMPATIBLE P-TOUCH LABEL MAKER. TEXT SHOULD BE PRINTED IN ALL CAPS WITH A MINIMUM HEIGHT OF 1/2".

POLE MOUNTED SIGNS

SCALE: NOT TO SCALE

4

TECHNOLOGY MD NETWORK COMPANY, LLC

INTERSTATE TRANSPORT AND BROADBAND

PROJECT NO:	ER600201
DRAWN BY:	M. DULLATE
CHECKED BY:	L. BUCK

A	06.23.16	FOR REVIEW

PRELIMINARY

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WA90XSDB5B
9MDB001751
MAIN ST &
4TH ST
LAUREL, MD 20707
UTILITY POLE

SHEET TITLE

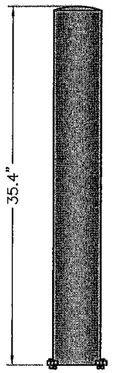
ANTENNA & EQUIPMENT MOUNTING DETAILS

SHEET NUMBER

3.0

PLASMA SB SC-800 OMNI (B41)

SCALE N.T.S. | 1



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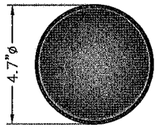
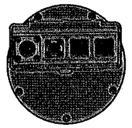


PLAN



BOTTOM

MANUFACTURER: PLASMA
MODEL: SC-800
HEIGHT: 35.4 IN
DIAMETER: 4.7 IN Ø
WEIGHT: 11 LBS

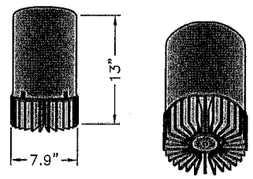
Plasma Antennas

MOUNTED RELAY

SCALE N.T.S. | 4

MANUFACTURER: AIRSPAN
MODEL: iR460
(OR APPROVED EQUAL)
HEIGHT: 13 IN
DIAMETER: 7.9 IN Ø
WEIGHT: 9.9 LBS

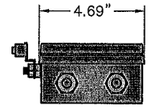
Airspan



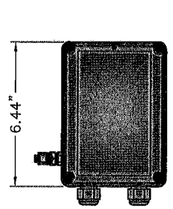
ELEVATION

TRANSTECTOR ALPU-ORT

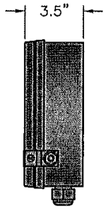
SCALE N.T.S. | 7



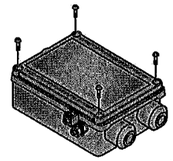
PLAN



FRONT



SIDE



ISOMETRIC

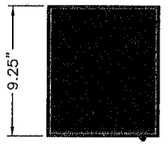
MANUFACTURER: TRANSTECTOR SYSTEMS
MODEL: ALPU-ORT
HEIGHT: 6.44 IN
WIDTH: 4.69 IN
DEPTH: 3.5 IN
WEIGHT: TBD

TRANSTECTOR

RAYCAP RSTAC-3112-P-120

SCALE N.T.S. | 10

PLAN



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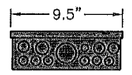


BOTTOM

MANUFACTURER: RAYCAP
MODEL: RSTAC-3112-P-120
HEIGHT: 9.25 IN
WIDTH: 9.5 IN
DEPTH: 3.81 IN
WEIGHT: 14

Raycap

AIRSPAN AH 4000 (B41)

SCALE N.T.S. | 2

PLAN

FRONT SIDE BOTTOM

MANUFACTURER: AIRSPAN
MODEL: AH 4000 (B41)
(OR APPROVED EQUAL)
HEIGHT: 20.1 IN
WIDTH: 9.1 IN
DEPTH: 8.9 IN
WEIGHT: 55.1 LBS

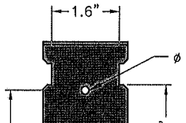
Airspan

NOT USED

SCALE N.T.S. | 5

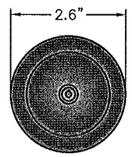
TALLYSMAN GPS ANTENNA

SCALE N.T.S. | 8



ELEVATION

ELEVATION ATTACHMENT



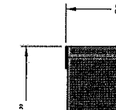
PLAN

MANUFACTURER: TALLYSMAN
MODEL: TW3010/TW3012
HEIGHT: 0.8 IN
DIAMETER: 2.6 IN
WEIGHT: 0.3 LBS

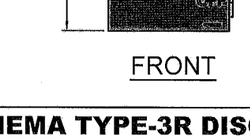
Tallysman

MILBANK METER SOCKET

SCALE N.T.S. | 11



PLAN



ELEVATION SIDE

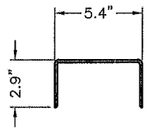
MANUFACTURER: MILBANK
MODEL: U7021-RL-TG
(OR APPROVED EQUAL)
HEIGHT: 15.5 IN
WIDTH: 8 IN
DEPTH: 4.33 IN
WEIGHT: TBA

AIRSPAN WALL MOUNTING

SCALE N.T.S. | 3

FRONT

SIDE



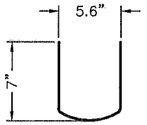
PLAN

MANUFACTURER: AIRSPAN
PART#: 402-00-230
(OR APPROVED EQUAL)
HEIGHT: 16.7 IN
WIDTH: 5.4 IN
DEPTH: 2.9 IN
WEIGHT: 2 LBS

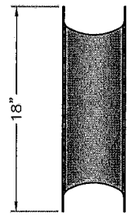
Airspan

AIRSPAN SUN SHIELD

SCALE N.T.S. | 6



PLAN



FRONT

SIDE

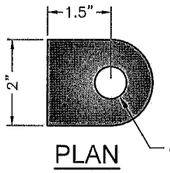
ISOMETRIC

MANUFACTURER: AIRSPAN
MODEL: 402-00-133
(OR APPROVED EQUAL)
HEIGHT: 18 IN
WIDTH: 5.6 IN
DEPTH: 7 IN
WEIGHT: 2 LBS

Airspan

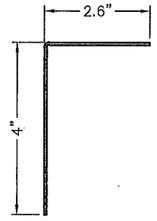
TALLYSMAN GPS MOUNTING

SCALE N.T.S. | 9



PLAN

FRONT



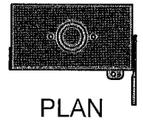
SIDE

MANUFACTURER: TALLYSMAN
MODEL: 23-0040-0-RI
HEIGHT: 4 IN
WIDTH: 2 IN
DEPTH: 2.6 IN

Tallysman

NEMA TYPE-3R DISCONNECT

SCALE N.T.S. | 12



PLAN

FRONT SIDE

MANUFACTURER: TBA
MODEL: TYPE-3R DISCONNECT
(OR APPROVED EQUAL)
HEIGHT: 9.9 IN
WIDTH: 8.8 IN
DEPTH: 4.5 IN
WEIGHT: TBA

TECHNOLOGY MD NETWORK COMPANY, LLC

INTERSTATE TRANSPORT AND BROADBAND

PROJECT NO:	ER600201
DRAWN BY:	M. DULLATE
CHECKED BY:	L. BUCK

A	06.23.16	FOR REVIEW

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9MDB001751
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UTILITY POLE

SHEET TITLE

ANTENNA & EQUIPMENT DETAILS

SHEET NUMBER

3.1

UTILITY NOTES:

WORK INCLUDES:
THESE NOTES AND ACCOMPANYING DRAWINGS COMPLEMENT THE PROVISIONS AND INSTALLATIONS BY THE ELECTRICAL CONTRACTOR, OF ALL LABOR, MATERIALS AND EQUIPMENT REQUIRED TO INSTALL THE ELECTRICAL WORK COMPLETE IN CONNECTION WITH THIS UTILITY SITE AND SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

1. THE PROVISIONS, INSTALLATION AND CONNECTION OF A GROUNDING ELECTRODE SYSTEM COMPLETE WITH SECONDARY GROUNDING, AND CONNECTIONS TO THE INCOMING ELECTRICAL DISTRIBUTION EQUIPMENT.
2. THE PROVISION AND INSTALLATION OF AN OVERHEAD ELECTRICAL SERVICE OR UNDERGROUND ELECTRICAL SERVICE AND ALL ASSOCIATED WIRE AND CONDUIT AS REQUIRED AND/OR INDICATED ON PLANS.
3. THE PROVISION AND INSTALLATION OF CONDUIT AND CONNECTIONS FOR LOCAL FIBER SERVICE.
4. THE FURNISHING AND INSTALLATION OF THE ELECTRICAL SERVICE ENTRANCE CONDUCTORS, CONDUITS, METER SOCKET, AND CONNECTIONS TO THE SERVICE EQUIPMENT.
5. ALL CONDUITS SHOULD BE LEFT WITH NYLON PULL CORD FOR FUTURE USE.
6. EXCAVATION, TRENCHING, AND BACKFILLING FOR CONDUIT(S), CABLE(S) AND EXTERNAL GROUNDING SYSTEM.

CODES, PERMITS AND FEES:

1. ALL REQUIRED PERMITS, LICENSES, INSPECTIONS AND APPROVALS SHALL BE SECURED AND ALL FEES FOR SAME PAID BY CONTRACTOR.
2. THE INSTALLATION SHALL COMPLY WITH ALL APPLICABLE CODES: STATE, LOCAL AND NATIONAL AND THE DESIGN, PERFORMANCE CHARACTERISTICS AND METHODS OF CONSTRUCTION OF ALL ITEMS AND EQUIPMENT SHALL BE IN ACCORDANCE WITH THE LATEST ISSUE OF THE VARIOUS APPLICABLE STANDARD SPECIFICATIONS OF THE FOLLOWING AUTHORITIES:

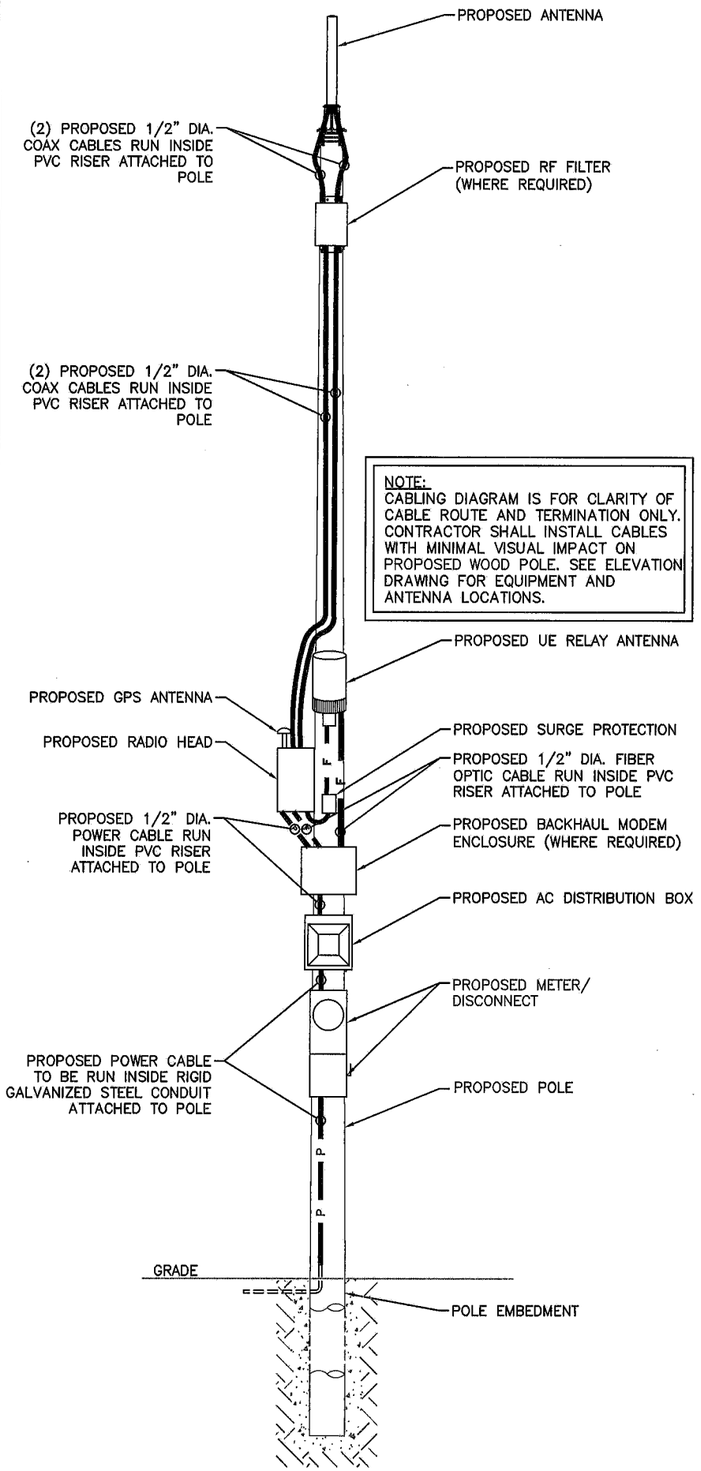
N.E.C.	NATIONAL ELECTRICAL CODE
A.N.S.I.	AMERICAN NATIONAL STANDARDS INSTITUTE
I.E.E.E.	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
A.S.T.M.	AMERICAN SOCIETY FOR TESTING MATERIALS
N.E.M.A.	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
U.L.	UNDERWRITERS LABORATORIES, INC.
N.F.P.A.	NATIONAL FIRE PROTECTION ASSOCIATION

RACEWAYS AND WIRING:

1. WIRING OF EVERY KIND MUST BY INSTALLED IN CONDUIT, UNLESS NOTED OTHERWISE, OR AS APPROVED BY THE ARCHITECT/ENGINEER.
2. UNLESS OTHERWISE SPECIFIED, ALL WIRING SHALL BE COPPER (CU) TYPE THWN, SIZED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND LOCAL CODES.
3. RACEWAYS SHALL BE GALVANIZED STEEL, SIZED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND LOCAL CODES UNLESS OTHERWISE NOTED. ALL RACEWAYS SHALL BE APPROVED FOR THE INSTALLATION.
4. PULL OR JUNCTION BOXES SHALL BE PROVIDED AS REQUIRED TO FACILITATE INSTALLATION OF RACEWAYS AND WIRING. PROVIDE JUNCTION AND PULLBOXES FOR CONDUIT RUNS WITH MORE THAN (360) DEGREES OF BENDS.
5. PROVIDE A COMPLETE RACEWAY AND WIRING INSTALLATION, PERMANENTLY AND EFFECTIVELY GROUNDED IN ACCORDANCE WITH ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE AND LOCAL CODES.
6. ALL STEEL CONDUIT SHALL BE BONDED AT BOTH ENDS WITH GROUNDING BUSHING.

GENERAL NOTES:
SEE DETAILS, SCHEDULES AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS AND INFORMATION. CHECK ARCHITECTURAL, STRUCTURAL, AND OTHER MECHANICAL AND ELECTRICAL DRAWINGS FOR SCALE, SPACE LIMITATIONS, COORDINATION, AND ADDITIONAL INFORMATION, ETC. REPORT ANY DISCREPANCIES, CONFLICTS, ETC. TO ARCHITECT/ENGINEER BEFORE SUBMITTING BID. ALL EQUIPMENT FURNISHED BY OTHERS (FBO) SHALL BE PROVIDED WITH PROPER MOTOR STARTERS, DISCONNECTS, CONTROLS, ETC. BY THE ELECTRICAL CONTRACTOR UNLESS SPECIFICALLY NOTED OTHERWISE. THE ELECTRICAL CONTRACTOR SHALL INSTALL AND COMPLETELY WIRE ALL ASSOCIATED EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S WIRE DIAGRAMS AND AS REQUIRED FOR A COMPLETE OPERATING INSTALLATION. ELECTRICAL CONTRACTOR SHALL VERIFY AND COORDINATE ELECTRICAL CHARACTERISTICS AND REQUIREMENTS OF (FBO) EQUIPMENT PRIOR TO ROUGH-IN OF CONDUIT AND WIRING TO AVOID CONFLICTS.

COORDINATION WITH UTILITY COMPANY:
THE ELECTRICAL CONTRACTOR SHALL COORDINATE COMPLETE ELECTRICAL SERVICE WITH LOCAL UTILITY COMPANY FOR A COMPLETE OPERATIONS SYSTEM, INCLUDING TRANSFORMER CONNECTIONS, CONCRETE TRANSFORMER PADS, IF REQUIRED, METER SOCKETS, PRIMARY CABLE RACEWAY REQUIREMENTS, SECONDARY SERVICE, ETC. PRIOR TO SUBMITTING BID TO INCLUDE ALL LABOR AND MATERIALS. THE ELECTRICAL CONTRACTOR SHALL INCLUDE IN THE BID ANY OPTIONAL OR EXCESS FACILITY CHARGES ASSOCIATED WITH PROVIDING ELECTRICAL SERVICE FROM LOCAL UTILITY COMPANY. VERIFY BEFORE BIDDING TO INCLUDE ALL COSTS. THE ELECTRICAL CONTRACTOR SHALL VERIFY THE AVAILABLE FAULT CURRENT WITH THE LOCAL UTILITY COMPANY PRIOR TO SUBMITTING BID. ADJUST A.I.C. RATINGS OF ALL OVER CURRENT PROTECTION DEVICES IN DISTRIBUTION EQUIPMENT AS REQUIRED TO COORDINATE WITH AVAILABLE FAULT CURRENT FROM LOCAL UTILITY COMPANY.



CABLING NOTES:

A) WOOD, CONCRETE AND EXISTING METALLIC POLES

I) FROM GRADE LINE TO 11'-0" ABOVE GRADE, ALL CABLES/CONDUCTORS EXCEPT GROUNDING CONDUCTOR MUST RUN IN RIGID GALVANIZED STEEL CONDUIT (RGS)

II) GROUNDING CONDUCTORS IN EXPOSED LOCATIONS MUST BE INSTALLED IN PVC.

III) IN EARTH INSTALL PVC CONDUIT FOR BACKHAUL AND ELECTRICAL SERVICE. TRANSITION TO RGS AT GRADE LINE.

IV) ABOVE 11'-0" ALL CABLES (POWER, ETHERNET, COAXIAL) MUST RUN IN PVC UTILITY POLE RISER.

(1) AT MAJOR EQUIPMENT, EXTEND UTILITY DUCT IMMEDIATELY ADJACENT TO THE EQUIPMENT. INSTALL CABLES IN THE UTILITY POLE RISER CREATING CABLE DRIP LOOPS NOT LESS THAN THE CABLE BENDING RADIUS.

(2) INSIDE THE UTILITY POLE RISER, UTILIZE ½" COAX BLOCKS WITH LAG SCREWS TO SUPPORT COAX, RADIO AND MW POWER, RF COAX, AND ETHERNET CABLES TO WITHIN 12" OF THE EQUIPMENT BEING SERVED AND ON INTERVALS NOT TO EXCEED 6'.

V) FOR UNDERGROUND HFC/PUBLIC BACKHAUL, ROUTE ETHERNET CABLE IN CONDUIT UP THE POLE AND ENTER THE UTILITY POLE RISER. SEAL EXPOSED END OF CONDUIT WITH A CABLE TERMINATION FITTING.

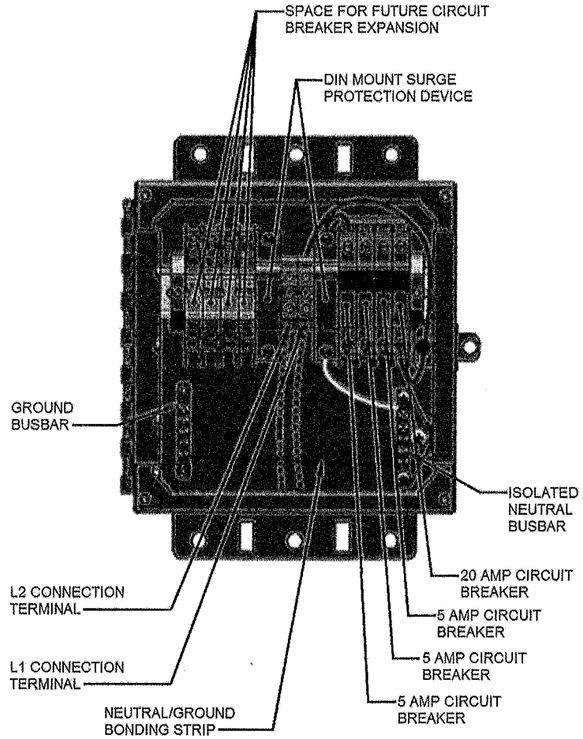
VI) BY APPROVAL IN SELECT CASES LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT (LFMC) MAY BE USED IN LENGTHS NOT TO EXCEED 36" TO EXTEND THE ELECTRICAL SERVICE CONDUIT TO THE AC DISTRIBUTION BOX. EXAMPLE: UTILITY-REQUIRED DISCONNECT ON POLE W/ AC DISTRIBUTION BOX ON OPPOSITE SIDE OF POLE.

B) NEW METALLIC POLES

I) PROCURE NEW POLES WITH SUITABLE HAND HOLES SUCH THAT HAND HOLES EXIST AT ALL EQUIPMENT LOCATIONS.

(1) WITH CLIENT APPROVAL IN SELECT CASES TO FACILITATE IMPROVED APPEARANCE, ½" COAXIAL CABLES MAY BE "SUPERFLEX" IN LIEU OF LDF-4.

II) WHERE POSSIBLE, INSTALL POLE BASE SUCH THAT THE ELECTRICAL FEED AND BACKHAUL (IF UNDERGROUND) CIRCUIT ENTER THE POLE THROUGH THE POLE BASE. IF A DISCONNECTING MEANS SEPARATE FROM THE AC DISTRIBUTION BOX IS REQUIRED BY JURISDICTION OR UTILITY, WITH APPROVAL IN SELECT CASES LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT (LFMC) MAY BE USED IN LENGTHS NOT TO EXCEED 36" TO EXTEND THE ELECTRICAL SERVICE CONDUIT TO THE AC DISTRIBUTION BOX.



CABLING DIAGRAM

SCALE: NOT TO SCALE

1

TECHNOLOGY MD
NETWORK COMPANY, LLC

INTERSTATE TRANSPORT AND BROADBAND

PROJECT NO:	ER600201
DRAWN BY:	M. DULLATE
CHECKED BY:	L. BUCK

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ELECTRICAL DETAILS

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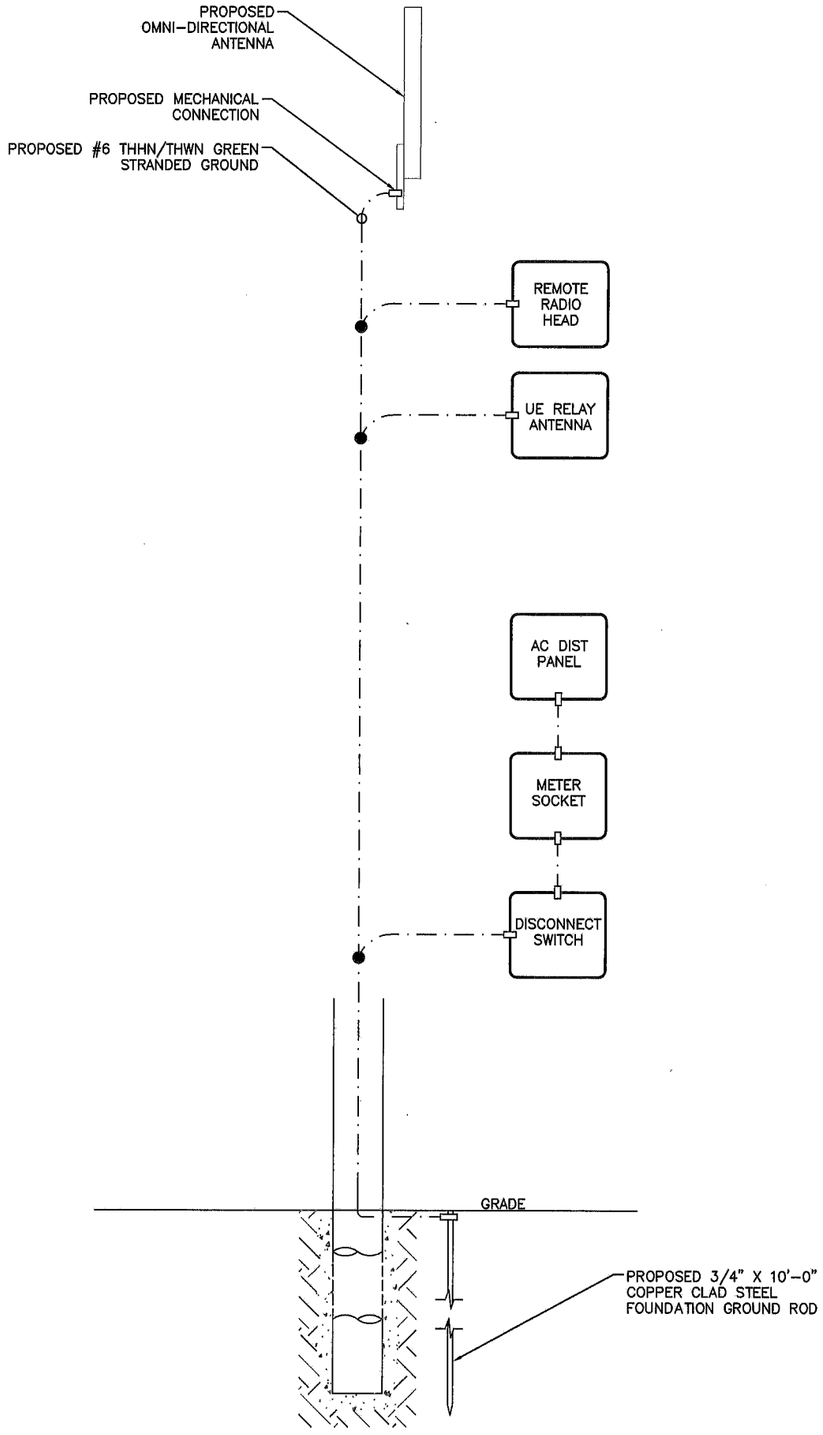

LEGEND
- ■ CADWELD CONNECTION
- ▭ MECHANICAL CONNECTION
- ● COMPRESSION CONNECTION

NOTE:
GROUNDING RISER FOR DIAGRAMMATIC PURPOSES ONLY. SEE ELEVATION DRAWING FOR EQUIPMENT AND ANTENNA LOCATIONS.

GROUNDING RISER DIAGRAM

SCALE: NOT TO SCALE

1

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SHEET TITLE

GROUNDING DETAILS

SHEET NUMBER

5.0

GENERAL

THE CONSTRUCTION DOCUMENT DRAWINGS ARE INTERRELATED. WHEN PERFORMING THE WORK, EACH CONTRACTOR MUST REFER TO ALL DRAWINGS. COORDINATION IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR.

GENERAL REQUIREMENTS

PART 1 – GENERAL

1. OBTAIN AND SUBMIT RELEASES ENABLING THE OWNER UNRESTRICTED USE OF THE WORK AND ACCESS TO SERVICES AND UTILITIES; INCLUDE OCCUPANCY PERMITS, OPERATING CERTIFICATES AND SIMILAR RELEASES.
2. SUBMIT RECORD DRAWINGS, DAMAGE OR SETTLEMENT SURVEY, PROPERTY SURVEY, AND SIMILAR FINAL RECORD INFORMATION.
3. COMPLETE FINAL CLEAN UP REQUIREMENT, INCLUDING TOUCH–UP PAINTING. TOUCH UP AND OTHERWISE REPAIR AND RESTORE MARRED EXPOSED FINISHES.

PART 2 – FINAL CLEANING

1. COMPLETE THE FOLLOWING CLEANING OPERATIONS BEFORE REQUESTING INSPECTION FOR CERTIFICATION ON COMPLETION.
   - A. CLEAN THE PROJECT SITE, YARD AND GROUNDS IN AREAS DISTURBED BY CONSTRUCTION ACTIVITIES, INCLUDING LANDSCAPE DEVELOPMENT AREA, OF RUBBISH, WASTE MATERIALS, LITTER AND FOREIGN SUBSTANCES. SWEEP PAVED AREAS BROOM CLEAN. REMOVE PETRO–CHEMICAL SPILLS, STAINS AND OTHER FOREIGN DEPOSITS. RAKE GROUNDS THAT ARE NEITHER PLANTED NOR PAVED, TO A SMOOTH EVEN–TEXTURED SURFACE.
   - B. REMOVE TOOLS, CONSTRUCTION EQUIPMENT, MACHINERY AND SURPLUS MATERIAL FROM THE SITE.
   - C. REMOVE SNOW AND ICE TO PROVIDE SAFE ACCESS TO THE SITE AND EQUIPMENT ENCLOSURE.
   - D. CLEAN EXPOSED EXTERIOR HARD SURFACED FINISHES TO A DIRT–FREE CONDITION, FREE OF STAINS, FILMS AND SIMILAR FOREIGN SUBSTANCES. AVOID DISTURBING NATURAL WEATHERING OF EXTERIOR SURFACES.
   - E. REMOVE DEBRIS FROM LIMITED ACCESS SPACES, INCLUDING HANDHOLES, MANHOLES, AND SIMILAR SPACES.
   - F. REMOVE LABELS THAT ARE NOT PERMANENT LABELS.
   - G. TOUCH UP AND OTHERWISE REPAIR AND RESTORE MARRED EXPOSED FINISHES AND SURFACES. REPLACE FINISHES AND SURFACES THAT CANNOT BE SATISFACTORILY REPAIRED OR RESTORED, OR THAT SHOW EVIDENCE OF REPAIR OR RESTORATION. DO NOT PAINT OVER "UL" AND SIMILAR LABELS, INCLUDING ELECTRICAL NAME PLATES.
   - H. LEAVE THE PROJECT CLEAN AND READY FOR OCCUPANCY.
   - I. DUST OFF ALL EQUIPMENT AND ITEMS WITHIN EQUIPMENT ENCLOSURE.
2. REMOVAL OF PROTECTION: REMOVE TEMPORARY PROTECTION AND FACILITIES INSTALLED DURING CONSTRUCTION TO PROTECT PREVIOUSLY COMPLETED INSTALLATIONS DURING THE REMAINDER OF THE CONSTRUCTION PERIOD.

SITE WORK

PART 1 – GENERAL

1. WORK INCLUDED: SEE SITE PLAN.
2. DESCRIPTIONS: IF APPLICABLE, LEASE AREA, AND UNDERGROUND UTILITY EASEMENTS ARE TO BE CONSTRUCTED TO PROVIDE A WELL DRAINED, EASILY MAINTAINED, EVEN SURFACE FOR USE AND ACCESS.
3. QUALITY ASSURANCE
   - A. APPLY SOIL STERILIZER IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS (AS NEEDED).
   - B. APPLY AND MAINTAIN GRASS SEED AS RECOMMENDED BY THE SEED PRODUCER (IF REQUIRED).
   - C. PLACE AND MAINTAIN VEGETATION LANDSCAPING, IF INCLUDED WITHIN THE CONTRACT, AS RECOMMENDED BY NURSERY INDUSTRY STANDARDS.
4. SEQUENCING
   - A. CONFIRM SURVEY STAKES AND SET ELEVATION STAKES PRIOR TO ANY CONSTRUCTION.
   - B. CONSTRUCT TEMPORARY CONSTRUCTION AREA. DESIGNATED AREA TO BE APPROVED BY CONSTRUCTION MANAGER AND LOCAL AUTHORITIES.
   - C. APPLY SOIL STERILIZER PRIOR TO PLACING BASE MATERIALS.
   - D. GRADE, SEED, FERTILIZE, AND MULCH ALL AREAS DISTURBED BY CONSTRUCTION (INCLUDING UNDERGROUND UTILITY EASEMENTS) IMMEDIATELY AFTER BRINGING LEASE AREA TO BASE COURSE ELEVATION, WATER TO ENSURE GROWTH.
   - E. AFTER APPLICATIONS OF FINAL SURFACES, APPLY SOIL STERILIZER TO STONE SURFACES.
5. SUBMITTALS
   - A. BEFORE CONSTRUCTION: IF LANDSCAPING IS APPLICABLE TO THE CONTRACT, SUBMIT TWO COPIES OF THE LANDSCAPE PLAN ON NURSERY LETTERHEAD. IF A LANDSCAPE ALLOWANCE WAS INCLUDED IN THE CONTRACT, PROVIDE AN ITEMIZED LISTING OF PROPOSED COSTS ON NURSERY LETTERHEAD
   - B. AFTER CONSTRUCTION
     1. MANUFACTURER'S DESCRIPTION OF PRODUCT AND WARRANTY STATEMENT ON SOIL STERILIZER.
     2. MANUFACTURER'S DESCRIPTION OF PRODUCT ON GRASS SEED AND FERTILIZER.
     3. LANDSCAPING WARRANTY STATEMENT
6. WARRANTY
   - A. IN ADDITION TO THE WARRANTY ON ALL CONSTRUCTION COVERED IN THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL REPAIR ALL DAMAGE AND RESTORE AREA AS CLOSE TO ORIGINAL CONDITION AS POSSIBLE AT SITE AND SURROUNDINGS.
   - B. SOIL STERILIZATION APPLICATION TO GUARANTEE VEGETATION FREE AREAS FOR ONE YEAR FROM DATE OF FINAL INSPECTION.
   - C. DISTURBED AREA WILL REFLECT GROWTH OF NEW GRASS COVER PRIOR TO FINAL INSPECTION.
   - D. LANDSCAPING, IF INCLUDED WITHIN THE SCOPE OF THE CONTRACT, WILL BE GUARANTEED FOR ONE YEAR FROM DATE OF FINAL INSPECTION.

PART 2 – PRODUCTS

1. MATERIALS
   - A. SOIL STERILIZER SHALL BE EPA–REGISTERED, PRE–EMERGENCE LIQUID:

TOTAL KILL PRODUCT 910 EPA 10292–7 (313) 563–8000	PHASAR CORPORATION P.O. BOX 5123 DEARBORN, MI 48128
AMBUSH HERBICIDE EPA REGISTERED (800) 526–4924	FRAMAR INDUSTRIAL PRODUCTS 1435 MORRIS AVE. UNION, NJ 07083

   - B. ROAD AND SITE MATERIALS SHALL CONFORM TO STATE AND LOCAL DOT SPECIFICATIONS FILL MATERIAL (UNLESS OTHERWISE NOTED) – ACCEPTABLE SELECT FILL SHALL BE IN ACCORDANCE WITH STATE DEPARTMENT OF HIGHWAY AND TRANSPORTATION STANDARD SPECIFICATIONS.
   - C. SOIL STABILIZER FABRIC SHALL BE MIRAFI 500X.

PART 3 – EXECUTION

1. INSPECTIONS: LOCAL BUILDING INSPECTORS SHALL BE NOTIFIED NO LESS THAN 48 HOURS IN ADVANCE OF CONCRETE POURS, UNLESS OTHERWISE SPECIFIED BY JURISDICTION
2. PREPARATION
   - A. CLEAR BRUSH AND DEBRIS FROM LEASE AREA AND UNDERGROUND UTILITY EASEMENTS AS REQUIRED FOR CONSTRUCTION.
   - B. UNLESS OTHERWISE INSTRUCTED BY LESSEE, TRANSPORT ALL REMOVED TREES, BRUSH AND DEBRIS FROM THE PROPERTY TO AN AUTHORIZED LANDFILL.
   - C. PRIOR TO PLACEMENT OF FILL OR BASE MATERIALS, ROLL THE SOIL.
   - D. WHERE UNSTABLE SOIL CONDITIONS ARE ENCOUNTERED, LINE THE AREAS WITH STABILIZER MAT PRIOR TO PLACEMENT OF FILL OR BASE MATERIAL.
3. INSTALLATION
   - A. CLEAR EXCESS SPOILS, IF ANY, FROM JOB SITE AND DO NOT SPREAD BEYOND THE LIMITS OF PROJECT AREA UNLESS AUTHORIZED BY PROJECT MANAGER AND AGREED TO BY LANDOWNER.
   - B. PLACE FILL OR STONE IN SIX INCH (6") MAXIMUM LIFTS, AND COMPACT BEFORE PLACING NEXT LIFT.
   - C. APPLY SEED, FERTILIZER, AND STRAW COVER TO ALL OTHER DISTURBED AREAS, DITCHES, AND DRAINAGE SWALES, NOT OTHERWISE RIPRAPPED.
   - D. APPLY SEED AND FERTILIZER TO SURFACE CONDITIONS WHICH WILL ENCOURAGE ROOTING. RAKE AREAS TO BE SEEDED TO EVEN THE SURFACE AND LOOSEN THE SOIL.
   - E. SOW SEED IN TWO DIRECTIONS IN TWICE THE QUANTITY RECOMMENDED BY THE SEED PRODUCER.
   - F. ENSURE GROWTH OF SEEDED AND LANDSCAPED AREA, BY WATERING, UP TO THE POINT OF RELEASE FROM THE CONTRACT. CONTINUE TO REWORK THE BARE AREAS UNTIL COMPLETE COVERAGE IS OBTAINED.
4. FIELD QUALITY CONTROL: COMPACT SOILS TO MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D–1557. AREAS OF SETTLEMENT WILL BE EXCAVATED AND REFILLED AT CONTRACTOR'S EXPENSE. INDICATE PERCENTAGE OF COMPACTION ACHIEVED ON AS–BUILT DRAWINGS.
5. PROTECTION
   - A. PROTECT SEEDED AREAS FROM EROSION BY SPREADING STRAW TO A UNIFORM LOOSE DEPTH OF 1–2 INCHES, STAKE AND TIE DOWN AS REQUIRED. USE OF EROSION CONTROL MESH OR MULCH NET WILL BE AN ACCEPTABLE ALTERNATE.
   - B. PROTECT ALL EXPOSED AREAS AGAINST WASHOUTS AND SOIL EROSION. PLACE STRAW BALES AT THE INLET APPROACH TO ALL NEW OR EXISTING CULVERTS. WHERE THE SITE OR ROAD AREAS HAVE BEEN ELEVATED IMMEDIATELY ADJACENT TO THE RAIL LINE, STAKE EROSION CONTROL FABRIC FULL LENGTH IN THE SWALE TO PREVENT CONTAMINATION OF THE RAIL BALLAST. ALL EROSION CONTROL METHODS SHALL CONFORM TO APPLICABLE BUILDING CODE REQUIREMENTS.

TECHNOLOGY MD
NETWORK COMPANY, LLC

INTERSTATE TRANSPORT AND BROADBAND

PROJECT NO:	ER800201
DRAWN BY:	M. DULLATE
CHECKED BY:	L. BUCK

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PRELIMINARY

IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

WA90XSDB5B
9MDB001751
MAIN ST &
4TH ST
LAUREL, MD 20707
UTILITY POLE

SHEET TITLE

GENERAL NOTES

SHEET NUMBER

GN-1

ELECTRICAL

1. CONTRACTOR SHALL REVIEW THE CONTRACT DOCUMENTS PRIOR TO ORDERING THE ELECTRICAL EQUIPMENT AND STARTING THE ACTUAL CONSTRUCTION. CONTRACTOR SHALL ISSUE A WRITTEN NOTICE OF ALL FINDINGS TO THE ARCHITECT/ENGINEER LISTING ANY DISCREPANCIES OR CONFLICTING INFORMATION.
2. ELECTRICAL PLANS, DETAILS AND DIAGRAMS ARE DIAGRAMMATIC ONLY. VERIFY EXACT LOCATIONS AND MOUNTING HEIGHTS OR ELECTRICAL EQUIPMENT WITH OWNER PRIOR TO INSTALLATION.
3. EACH CONDUCTOR OF EVERY SYSTEM SHALL BE PERMANENTLY TAGGED IN EACH PANELBOARD, PULLBOX, JUNCTION BOX, SWITCH BOX, ETC. THE TYPE OF TAGGING METHODS SHALL BE IN COMPLIANCE WITH OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (O.S.H.A.)
4. ALL MATERIALS AND EQUIPMENT SHALL BE NEW AND IN GOOD WORKING CONDITION WHEN INSTALLED AND SHALL BE OF THE BEST GRADE AND OF THE SAME MANUFACTURER THROUGHOUT FOR EACH CLASS OR GROUP OF EQUIPMENT. MATERIALS SHALL BE LISTED "U.L." WHERE APPLICABLE. MATERIALS SHALL MEET WITH APPROVAL OF ALL GOVERNING BODIES HAVING JURISDICTION. MATERIALS SHALL BE MANUFACTURED IN ACCORDANCE WITH APPLICABLE STANDARDS ESTABLISHED BY ANSI, NEMA, NBFU AND "U.L." LISTED.
5. ALL CONDUIT SHALL HAVE A PULL CORD.
6. PROVIDE PROJECT MANAGER WITH ONE SET OF COMPLETE ELECTRICAL "AS INSTALLED" DRAWINGS AT THE COMPLETION OF THE JOB, SHOWING ACTUAL DIMENSIONS, ROUTINGS, AND CIRCUITS.
7. ALL CIRCUIT BREAKERS, FUSES AND ELECTRICAL EQUIPMENT SHALL HAVE AN INTERRUPTING SHORT CIRCUIT CURRENT TO WHICH THEY MAY BE SUBJECTED, AND A MINIMUM OF 10,000 A.I.C.
8. THE ENTIRE ELECTRICAL INSTALLATION SHALL BE GROUNDED AS REQUIRED BY IBC, NEC AND ALL APPLICABLE CODES.
9. PATCH, REPAIR AND PAINT ANY AREA THAT HAS BEEN DAMAGED IN THE COURSE OF THE ELECTRICAL WORK.
10. PLASTIC PLATES FOR ALL SWITCHES, RECEPTACLES, TELEPHONE AND BLANKED OUTLETS SHALL HAVE ENGRAVED LETTERING WHERE INDICATED ON THE DRAWINGS. WEATHERPROOF RECEPTACLES SHALL HAVE SIERRA #WPD-8 LIFT COVERPLATES.

SERVICE AND DISTRIBUTION

1. WIRE AND CABLE CONDUCTORS SHALL BE COPPER, 600V, TYPE THHN OR THWN, WITH A MIN. SIZE OF #12 AWG, COLOR CODED.
2. METER SOCKET AMPERES, VOLTAGE, NUMBER OF PHASES SHALL BE NOTED ON THE DRAWINGS. MANUFACTURED BY MILBANK OR APPROVED EQUAL, AND SHALL BE UTILITY COMPANY APPROVED.
3. CONDUIT:
   - A. RIGID CONDUIT SHALL BE U.L. LABEL GALVANIZED ZINC COATED WITH GALVANIZED ZINC INTERIOR AND SHALL BE USED WHEN INSTALLED IN OR UNDER CONCRETE SLABS, IN CONTACT WITH THE EARTH, UNDER PUBLIC ROADWAYS, IN MASONRY WALLS OR EXPOSED ON BUILDING EXTERIOR. RIGID CONDUIT IN CONTACT WITH EARTH SHALL BE 1/2 LAPPED WRAPPED WITH HUNTS WRAP PROCESS NO. 3.
   - B. FLEXIBLE METALLIC CONDUIT SHALL HAVE U.L. LISTED LABEL AND MAY BE USED WHERE PERMITTED BY CODE. FITTINGS SHALL BE "JAKE" OR "SQUEEZE" TYPE. ALL FLEXIBLE CONDUITS SHALL HAVE FULL LENGTH GROUND WIRE.
   - C. IT IS REQUIRED AND WILL BE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO NOTIFY 811 OR OTHER SUCH UTILITY LOCATING AGENCY 3 DAYS BEFORE DIGGING.
4. CONTRACTOR TO COORDINATE WITH UTILITY COMPANY FOR CONNECTION OF TEMPORARY AND PERMANENT POWER TO THE SITE. THE TEMPORARY POWER AND ALL HOOKUP COSTS ARE TO BE PAID BY THE CONTRACTOR.
5. ALL ELECTRICAL EQUIPMENT SHALL BE LABELED WITH PERMANENT ENGRAVED PLASTIC LABELS WITH WHITE ON BLUE BACKGROUND LETTERING (MINIMUM LETTER HEIGHT SHALL BE ONE FOURTH INCH (1/4"). NAMEPLATES SHALL BE FASTENED WITH STAINLESS STEEL SCREWS, NOT ADHESIVE.
6. UPON COMPLETION OF WORK, CONTINUITY, SHORT CIRCUIT, AND FALL POTENTIAL GROUNDING TESTS BY AN INDEPENDENT TESTING SERVICE ENGAGED BY THE CONTRACTOR SHALL BE SUBMITTED FOR APPROVAL. SUBMIT TEST REPORTS TO PROJECT MANAGER. CLEAN PREMISES OF ALL DEBRIS RESULTING FROM WORK AND LEAVE WORK IN A COMPLETE AND UNDAMAGED CONDITION.
7. GROUNDING ELECTRODE SYSTEM
   - A. PREPARATION
     1. SURFACE PREPARATION: ALL CONNECTIONS SHALL BE MADE TO BARE METAL. ALL PAINTED SURFACES SHALL BE FIELD INSPECTED AND MODIFIED TO ENSURE PROPER CONTACT. NO WASHERS ARE ALLOWED BETWEEN THE ITEMS BEING GROUNDED. ALL CONNECTIONS ARE TO HAVE A NON-OXIDIZING AGENT APPLIED PRIOR TO INSTALLATION.
     2. IF CONDUCTORS MUST RUN THROUGH CONDUIT, BOTH ENDS OF CONDUIT SHALL BE GROUNDED. SEAL BOTH ENDS OF CONDUIT WITH SILICONE CAULK.
   - B. EXTERNAL CONNECTIONS
     1. ALL BURIED GROUNDING CONNECTIONS SHALL BE MADE BY THE EXOTHERMIC WELD PROCESS. CONNECTIONS SHALL INCLUDE ALL CABLE TO CABLE, SPLICES, TEE'S, CROSSES, ETC. ALL CABLE TO GROUND RODS, GROUND ROD SPLICES AND LIGHTNING PROTECTION SYSTEMS ARE TO BE AS INDICATED. ALL MATERIALS USED (MOLDS, WELDING METAL, TOOLS, ETC.) SHALL BE BY "ULTRAWELD" AND INSTALLED PER MANUFACTURER'S RECOMMENDED PROCEDURES.
     2. ALL ABOVE GRADE GROUNDING AND BONDING CONDUCTORS SHALL BE CONNECTED BY TWO HOLE CRIMP TYPE (COMPRESSION) CONNECTIONS (EXCEPT FOR THE ACEG AND GROUND ROD). MECHANICAL CONNECTIONS, FITTINGS OR CONNECTIONS THAT DEPEND SOLELY ON SOLDER SHALL NOT BE USED. ALL CABLE TO CABLE CONNECTIONS SHALL BE HIGH PRESSURE DOUBLE CRIMP TYPE CONNECTIONS. CONNECTIONS TO STRUCTURAL STEEL SHALL BE EXOTHERMIC WELDS.
   - C. GROUND RODS: ALL GROUND RODS SHALL BE 5/8-INCH DIAMETER X 10'-0" LONG "COPPERWELD" OR APPROVED EQUAL, OF THE NUMBER AND LOCATIONS INDICATED. GROUND RODS SHALL BE DRIVEN FULL LENGTH VERTICAL IN UNDISTURBED EARTH.
   - D. GROUND CONDUCTORS: ALL GROUND CONDUCTORS SHALL BE STANDARD TINNED SOLID BARE COPPER ANNEALED, AND OF SIZE INDICATED ON DRAWINGS UNLESS OTHERWISE NOTED.
   - E. LUGS
     1. LUGS SHALL BE 2-HOLE, LONG BARREL, STRAND COPPER UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS. LUGS SHALL BE THOMAS AND BETTS SERIES #54____BE OR EQUIVALENT

A.	535 MCM DLO	54880BE
B.	262 MCM DLO	54872BE
C.	#1/0 DLO	54862BE
D.	#4/0 THWN AND BARE	54866BE
E.	#2/0 THWN	54862BE
F.	#2 THHN	54207BE
G.	#6 DLO	54205BE

     2. WHEN THE DIRECTION OF THE CONDUCTOR MUST CHANGE, IT SHALL BE DONE GRADUALLY. THE CURVATURE OF THE TURN SHALL BE DONE IN ACCORDANCE WITH THE FOLLOWING CHART:

GROUNDING CONDUCTOR SIZE	MINIMUM BENDING RADIUS TO INSIDE EDGE
NO. 6 AWG TO NO. 4 AWG	6 INCHES
NO. 2 AWG TO NO 1/0 AWG	8 INCHES
NO. 2/0 AWG TO 4/0 AWG	12 INCHES
250 MCM TO 750 MCM	24 INCHES

8. GROUNDING RESISTANCE TEST REPORT: UPON COMPLETION OF THE TESTING FOR EACH SITE, A TEST REPORT SHOWING RESISTANCE IN OHMS MUST BE SUBMITTED. TWO (2) SETS OF TEST DOCUMENTS FROM THE INDEPENDENT TESTING SERVICE ARE TO BE BOUND AND SUBMITTED WITHIN ONE (1) WEEK OF WORK COMPLETION.

POLES, POSTS, AND STANDARDS (SINGLE MAST AND SELF SUPPORTING TOWERS)

1. GENERAL
   - A. LIGHTNING ROD AND EXTENSION PIPE INCLUDING ALL APPURTENANCES, TO BE FURNISHED BY OWNER, IF REQUIRED.
   - B. GROUNDING: GROUND METAL POLES WITH A MINIMUM OF #2 AWG TINNED SOLID BARE COPPER CONDUCTOR CADWELDED TO TOWER BASE PLATE.

TELECOMMUNICATIONS WIRING COMPONENTS (COAXIAL ANTENNA CABLE)

1. GENERAL
   - A. ALL MATERIALS, PRODUCTS OR PROCEDURES INCORPORATED INTO WORK SHALL BE NEW AND OF STANDARD COMMERCIAL QUALITY.
   - B. ALL MATERIALS AND PRODUCTS SPECIFIED IN THE CONTRACT DOCUMENTS SHALL BE SUPPLIED BY THE CONTRACTOR UNLESS NOTED OTHERWISE.
2. MATERIALS:
   - A. COAXIAL CABLE:
     1. INSTALL COAXIAL CABLE AND TERMINATIONS BETWEEN ANTENNAS AND EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS WITH COAXIAL CABLES SUPPORTED AT NO MORE THAN 3'-0" O.C. WEATHERPROOF ALL CONNECTORS BETWEEN THE ANTENNA AND EQUIPMENT PER MANUFACTURER'S REQUIREMENTS. TERMINATE ALL COAXIAL CABLE THREE FEET (3') IN EXCESS OF EQUIPMENT LOCATION UNLESS OTHERWISE STATED.
     2. LENGTHS LESS THAN OR EQUAL TO 100 FEET SHALL BE 7/8".
3. ANTENNA AND COAXIAL CABLE GROUNDING
   - A. ALL COAXIAL CABLE GROUNDING KITS ARE TO BE INSTALLED ON STRAIGHT RUNS OF COAXIAL CABLE (NOT WITHIN BENDS)
4. COAXIAL CABLE IDENTIFICATION
   - A. TO PROVIDE EASY IDENTIFICATION AND UNIFORM MARKING OF ANTENNA CABLING, PLASTIC TAGS SHALL BE USED AT THE FOLLOWING LOCATIONS:
     1. FIRST LOCATION IS AT THE END OF THE COAX NEAREST THE ANTENNA (WHERE THE COAXIAL CABLE AND JUMPER ARE CONNECTED).
     2. SECOND LOCATION IS AT END OF THE COAX NEAREST THE EQUIPMENT.
   - B. USE ANDREW CABLE TIES (PT.# 27290) TO SECURE IDENTIFICATION TAGS.
     1. TESTING: LESSEE SHALL PROVIDE AN INDEPENDENT TESTING AGENCY TO PERFORM THE COAXIAL SWEEP TEST & REPORT. THE CONTRACTOR IS TO PROVIDE ONE CLIMBER/QUALIFIED PERSONNEL TO ASSIST IN ANY REPAIRS AND WEATHERPROOFING ONCE THE TEST IS COMPLETE. THE CONTRACTOR IS TO PROVIDE LESSEE WITH A MINIMUM OF 48 HOURS NOTICE PRIOR TO THE TIME OF THE SWEEP TEST.

TECHNOLOGY MD
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WA90XSDB5B
9MDB001751
MAIN ST &
4TH ST
LAUREL, MD 20707
UTILITY POLE

SHEET TITLE

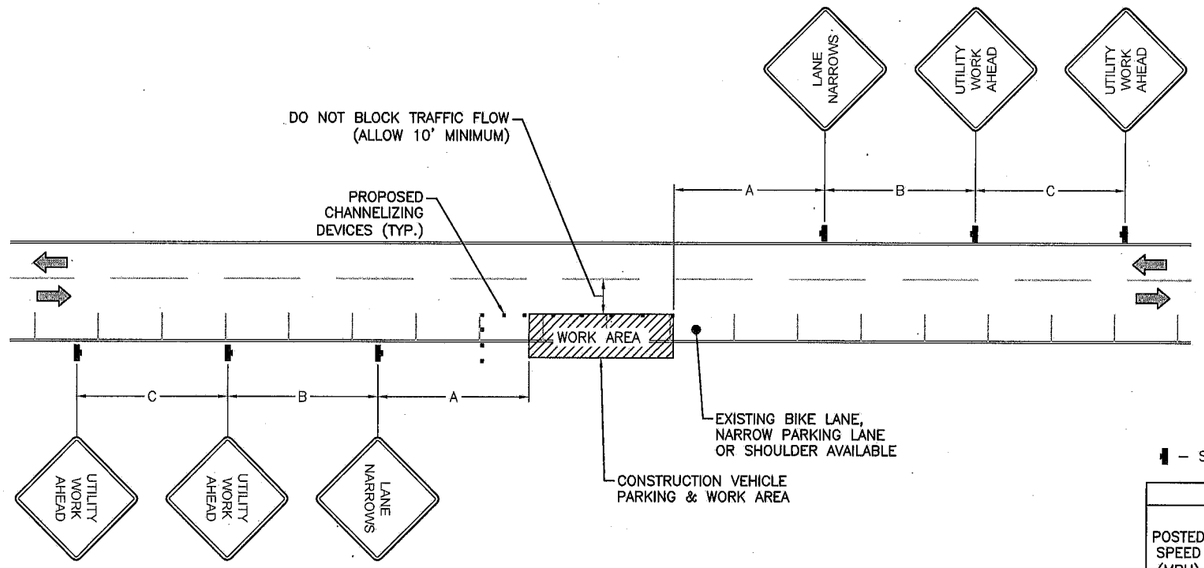
GENERAL NOTES

SHEET NUMBER

GN-2

PLAN NOTES:

1. PLANS DEPICTED ARE GENERAL GUIDELINES FOR TEMPORARY TRAFFIC CONTROL PLANS (TCP) TO INCLUDE PEDESTRIAN AND WORKER SAFETY. CONTRACTOR IS REQUIRED TO HAVE PREPARED A SITE-SPECIFIC TCP FOR REVIEW AND APPROVAL BY THE HIGHWAY AUTHORITY HAVING JURISDICTION. IF REQUIRED, THE FIRM PREPARING THE TCP SHALL BE AUTHORIZED OR CERTIFIED BY THE AUTHORITY HAVING JURISDICTION.
2. EXTEND CHANNELIZATION DEVICES INTO SHOULDER WHERE APPLICABLE.
3. DISTANCES AS INDICATED IN TABLE 1 SHOULD BE INCREASED FOR CONDITIONS THAT WOULD AFFECT STOPPING DISTANCE SUCH AS DOWNGRADES OR LIMITED SIGHT DISTANCES. DISTANCES CAN BE DECREASED FOR LOW-SPEED (RESIDENTIAL) AREAS WITH APPROVAL BY THE AUTHORITY HAVING JURISDICTION. NIGHT-TIME WORK IS PROHIBITED UNLESS IT IS REQUIRED AS A CONDITION OF APPROVAL BY THE HIGHWAY AND LOCAL AUTHORITY HAVING JURISDICTION.
4. SHOULDER TAPERS SHOULD BE 1/3 OF THE ON-STREET TAPER LENGTH.
5. MAINTAIN A MINIMUM LANE WIDTH OF 10'.



▮ – SIGN

TABLE 1

POSTED SPEED (MPH)	DISTANCE BETWEEN SIGNS			TAPER	BUFFER
	A	B	C	L (SEE NOTE)	
15	100'	100'	100'	45'	100'
20	100'	100'	100'	80'	115'
25	100'	100'	100'	125'	155'
30	200'	200'	200'	180'	200'
35	200'	200'	200'	245'	250'
40	350'	350'	350'	320'	305'
45	350'	350'	350'	540'	360'
50	500'	500'	500'	600'	425'
55	500'	500'	500'	660'	495'
60	500'	500'	500'	720'	570'
65	500'	500'	500'	780'	645'

NOTES:

A) DISTANCES IN FEET UNLESS OTHERWISE NOTED.
B) CONTRACTOR TO VERIFY EXISTING SPEED LIMIT.
C) DISTANCES SHOWN ARE NOT VALID FOR LIMITED ACCESS HIGHWAYS. CONSULT STATE DOT MANUAL FOR DISTANCES.
D) ADJUST DISTANCES TO COMPLY WITH REQUIREMENT OF THE STATE OR LOCAL HIGHWAY AUTHORITY HAVING JURISDICTION. SEE NOTE 1, SHEET 6.1.
E) TAPER LENGTHS SHOWN BASED ON 12' LANE WIDTH. SEE NOTE 18, SHEET 6.1.

TRAFFIC CONTROL PLAN - CURBSIDE PARKING

1

TECHNOLOGY MD NETWORK COMPANY, LLC

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UTILITY POLE

SHEET TITLE

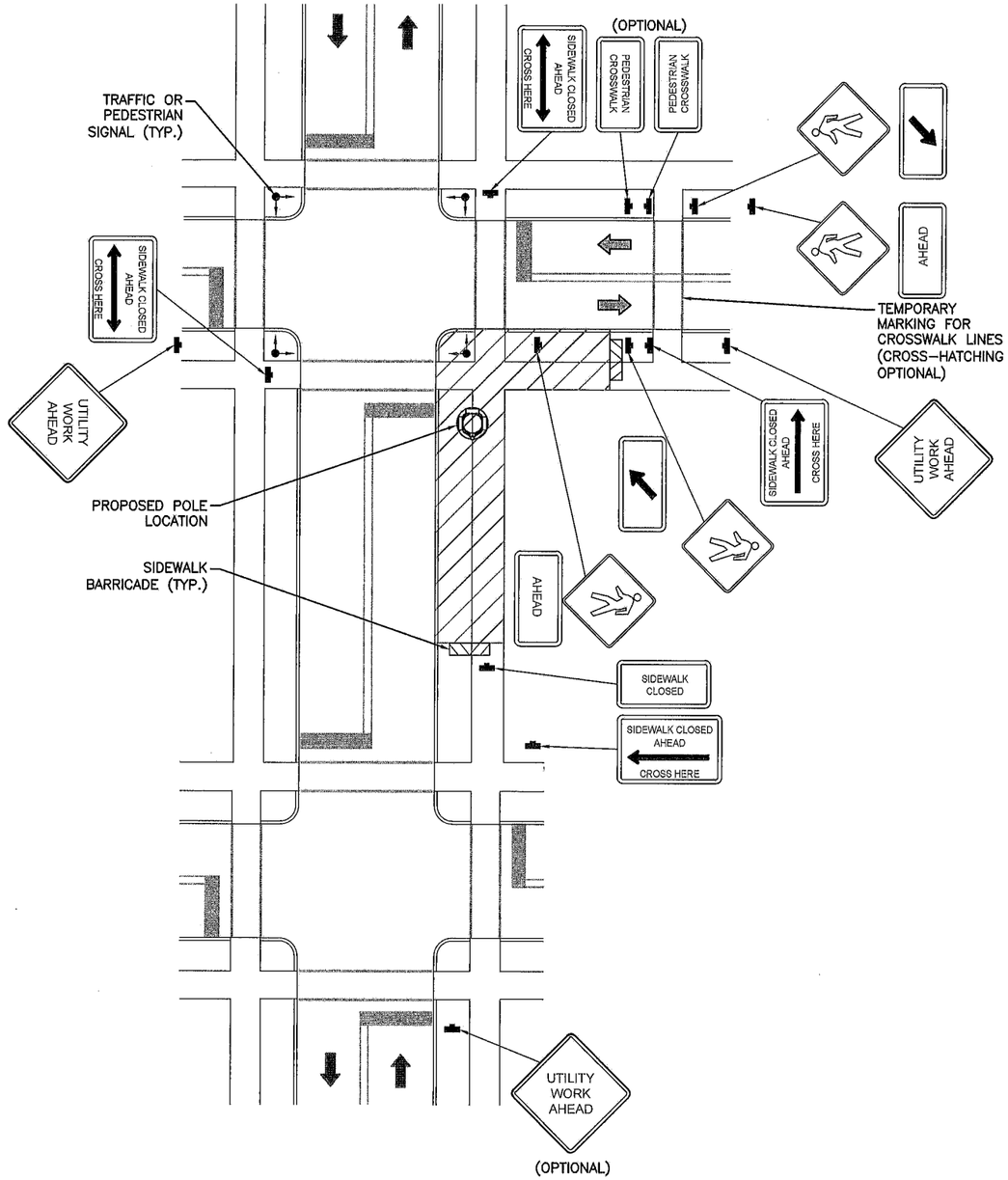
TRAFFIC CONTROL PLAN

SHEET NUMBER

6.0

TRAFFIC CONTROL GENERAL NOTES

1. ALL TEMPORARY TRAFFIC CONTROL SIGNAGE, LAYOUTS AND PROCEDURES SHALL COMPLY WITH LOCAL JURISDICTIONAL REQUIREMENTS AND MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), LATEST EDITION, WHICHEVER IS MORE STRINGENT.
2. PRIOR TO ANY ROAD CONSTRUCTION, TRAFFIC CONTROL SIGNS AND DEVICES SHALL BE IN PLACE.
3. TRAFFIC CONTROL DEVICES FOR LANE CLOSURES INCLUDING SIGNS, CONES, BARRICADES, ETC. SHALL BE PLACED AS SHOWN ON PLANS. SIGNS SHALL NOT BE PLACED WITHOUT ACTUAL LANE CLOSURES AND SHALL BE IMMEDIATELY REMOVED UPON REMOVAL OF THE CLOSURES.
4. SELECTION, PLACEMENT, MAINTENANCE, AND PROTECTION OF TRAFFIC, PEDESTRIANS, AND WORKERS SHALL BE IN ACCORDANCE WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) – PART VI "TEMPORARY TRAFFIC CONTROL", AND LOCAL JURISDICTIONAL REQUIREMENTS UNLESS OTHERWISE NOTED IN THE PLANS AND SPECIFICATIONS, AND SHALL BE APPROVED BY THE APPROPRIATE HIGHWAY AUTHORITY HAVING JURISDICTION.
5. ADVANCE WARNING SIGNS, DISTANCES, AND TAPER LENGTHS MAY BE EXTENDED TO ADJUST FOR REDUCED VISIBILITY DUE TO HORIZONTAL AND VERTICAL CURVATURE OF THE ROADWAY AND FOR ACTUAL TRAFFIC SPEEDS IF IN EXCESS OF POSTED SPEED LIMITS.
6. TAPERS SHALL BE LOCATED TO MAXIMIZE THE VISIBILITY OF THEIR TOTAL LENGTH.
7. CONFLICTING OR NON–OPERATING SIGNAL INDICATIONS ON THE EXISTING TRAFFIC SIGNAL SYSTEMS SHALL BE BAGGED OR COVERED.
8. ALL EXISTING ROAD SIGNS, PAVEMENT MARKINGS AND/OR PLOWABLE PAVEMENT REFLECTORS WHICH CONFLICT WITH THE PROPOSED TRAFFIC CONTROL PLAN SHALL BE COVERED, REMOVED, OR RELOCATED. ALL TRAFFIC CONTROL DEVICES SHALL BE RESTORED TO MATCH PRE–CONSTRUCTION CONDITION AFTER COMPLETION OF WORK.
9. CONTRACTOR SHALL CONTACT LOCAL AUTHORITY HAVING HIGHWAY JURISDICTION AND PROVIDE ADDITIONAL "FLAGMEN" OR POLICE SUPERVISION, IF REQUIRED.
10. ALL EXCAVATED AREAS WITHIN OR ADJACENT TO THE ROADWAY SHALL BE BACKFILLED AND PLACED ON A MINIMUM 6H:1V SLOPE PRIOR TO END OF EACH WORK DAY. OTHER EXCAVATED AREAS WITHIN THE CLEAR ZONE ARE TO BE EITHER BACKFILLED OR PRECAST CONCRETE CURB BARRIER CONSTRUCTION BARRIER SET TEMPORARILY IN PLACE TO SHIELD VEHICULAR AND PEDESTRIAN TRAFFIC.
11. WHERE DICTATED BY LOCAL CONDITIONS, THE CONTRACTOR SHALL MAKE PROVISIONS FOR MAINTAINING PEDESTRIAN AND WORKER CROSSING LOCATIONS IN ACCORDANCE WITH ALL APPLICABLE CODES AND OSHA REQUIREMENTS.
12. CONSTRUCTION ZONE SPEED LIMIT IF REDUCED FROM POSTED LIMITS SHALL BE IN ACCORDANCE WITH MUTCD AND WILL BE DETERMINED BY THE AUTHORITY HAVING JURISDICTION.
13. THERE SHALL BE NO WORKERS, EQUIPMENT, OR OTHER VEHICLES IN THE BUFFER SPACE OR THE ROLL AHEAD SPACE.
14. DRIVEWAYS AND/OR SIDE STREETS ENTERING THE ROADWAY AFTER THE FIRST ADVANCE WARNING SIGN SHALL BE PROVIDED WITH AT LEAST ONE W20–1 SIGN (ROAD WORK AHEAD) AS A MINIMUM.
15. CONES MAY BE SUBSTITUTED FOR DRUMS AND INSTALLED UPON THE APPROVAL OF THE AUTHORITY HAVING JURISDICTION PROVIDED THEY COMPLY WITH MUTCD.
16. THE SPACING BETWEEN CONES, TUBULAR MARKERS, VERTICAL PANELS, DRUMS, AND BARRICADES SHOULD NOT EXCEED A DISTANCE IN FEET EQUAL TO 1.0 TIMES THE SPEED LIMIT IN MPH WHEN USED FOR TAPER CHANNELIZATION, AND A DISTANCE IN FEET EQUAL TO 2.0 TIMES THE SPEED LIMIT IN MPH WHEN USED FOR TANGENT CHANNELIZATION.
17. WHEN CHANNELIZATION DEVICES HAVE THE POTENTIAL OF LEADING VEHICULAR TRAFFIC OUT OF THE INTENDED VEHICULAR TRAFFIC SPACE, THE CHANNELIZATION DEVICES SHOULD BE EXTENDED A DISTANCE IN FEET OF 2.0 TIMES THE SPEED LIMIT IN MPH BEYOND THE DOWNSTREAM END OF THE TRANSITION AREA.
18. TAPER LENGTHS ARE CALCULATED AS FOLLOWS:
L= $WS^2/60$ (40 MPH AND HIGHER) OR L2= WS (OVER 40 MPH),
WHERE W= OFFSET WIDTH (FT), S= TRAFFIC SPEED (MPH).



TYPICAL PEDESTRIAN / WORKER SAFETY PLAN | 1

SCALE: NOT TO SCALE

TECHNOLOGY MD NETWORK COMPANY, LLC

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A	06.23.16	FOR REVIEW

PRELIMINARY

IT IS A VIOLATION OF THE LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT

WA90XSDB5B
9MDB001751
MAIN ST &
4TH ST
LAUREL, MD 20707
UTILITY POLE

SHEET TITLE

TYPICAL PEDESTRIAN / WORKER SAFETY PLAN

SHEET NUMBER

6.1