Zoning Board of Appeals Meeting
Meeting Minutes of Monday, May 11, 2026
Approved

Present: Chairman John Steinmetz, Members Kim Fay, Elaine Begy, Harry Reiter, Joe Ruta, Alternate Members Laura Pettine and Paul Cliff, Village Liaison Christine Brower, Dave and Ann Wright, Shaun Logue of MRB, Ellie Dickerman of MRB, Independent Radio-frequency Engineering Consultant Bill Johnson, Deputy Clerk Amy Harter, Recording Secretary Fawn Cretelle-Galan

This meeting was held in the Board Room. Zoom was unavailable due to internet connection issues.

1. Chairman Steinmetz called the meeting to order at 6:34 p.m. with the Pledge of Allegiance and a moment of silence.
2. Chairman Steinmetz declared that a quorum was present and the meeting may proceed.

Minutes

The board reviewed the meeting minutes of April 13, 2026 and clarified that the Parkland townhomes will have 2 parking spaces within the garage and more than 2 in the driveway, for a possibility of 6 parking spaces per unit.

Member Fay made a motion to approve the minutes of April 13th, seconded by Member Ruta, carried 5-0. Alternate Members Pettine and Cliff did not vote.

Verizon Tower

Bill Johnson, Independent Radio-Frequency Engineering Consultant, gave an overview of his RF analysis report at the request of Chairman Steinmetz. (Please see attached report.)

Bill Johnson suggested the next step would be to have Verizon respond to the findings noted here in the report.

Board Comment:

ZBA Question/Comment: Chairman Steinmetz questioned if there are modeling limitations because the tower is not built.

Response: Bill Johnson stated that the model is fine, the footprint is good, capacity is the issue. It depends on equipment and what users are doing. When there is high bandwidth the site will peak and hit capacity, everybody slows down as to not disconnect users. Capacity issue is an

actual metric measurement and can't be simulated. The growth is exponential, and until the new site is on air there's no idea how much traffic is grabbed by Parma site.

ZBA Question/Comment: Member Fay questioned whether the current tower is at capacity.

Response: Bill Johnson noted that Verizon hasn't said. Burritt and Parma are limited. Parma might be saturated, but 80 feet won't do anything because it's too far away. If Hilton High School site is not grabbing traffic from Parma, the proposed site won't, either.

ZBA Question/Comment: Member Ruta asked whether the tower would use the same equipment already present at the site.

Response: Bill Johnson answered yes, height helps increase footprint; all other things being equal.

CEO Question/Comment: Ron Bragg mentioned that the current tower sits at 50 feet due to being situated on top of a 20-foot building.

Response: Bill Johnson notes the propagation plots states 31 feet.

MRB Question/Comment: Shaun Logue asked how microcells mentioned in the report would work.

Response: Bill Johnson replied macro is 80 or 120 feet, covers a wide area, and is preferred due to battery banks that can power the site for up to 8 hours in the event of a power outage, some also have generators. Small cell (or micro cell) sits on top of telephone poles in a 3 cubic foot box mounted on the side of the pole with a "cantenna" (trash can shaped antenna) on top. There is no backup power because of the restricted size, which is not good for an emergency. Small cell is great for grabbing capacity but not good for wide area.

ZBA Question/Comment: Chairman Steinmetz asked Mr. Johnson to speak about Pittsford's 20 microcells mentioned in the appendix.

Response: Bill Johnson states that this was a hybrid approach using two technologies and Verizon has never done this before, trying to get coverage with no above ground utilities or poles. It didn't work as they'd hoped. Verizon will not propose a hybrid system again. Small cells might be a solution if they can pull that traffic to small cell- they need to speak to what their need is. No one can tell the service provider what technology to use, but we can suggest it. The main 3 steps are: applicant must show need, show it works, and it has to be least intrusive means technologically feasible to serve that area.

ZBA Question/Comment: Chairman Steinmetz notes the existing water tower is the least intrusive.

Response: Bill Johnson says finances come into play, adding cost to public utility that will pass those costs onto customers and there are limitations because Verizon is a public utility.

Resident Question/Comment: Dave Wright questions the tower at the high school, if it is functional, and whether the effects of that are included on prop maps.

Response: Bill Johnson states that it is shown, but it is so close to the Parma tower further to north, and there is no note of how that is drawing traffic.

Resident Question/Comment: Dave Wright asks if cell tower sites have sophisticated software to determine users need and throttle use and if microcells need grounds.

Response: Bill Johnson states they do, and that makes sense as you don't want a delay on a phone call or GPS navigation, as opposed to downloading content. Fiberoptic connection is needed for microcells.

ZBA Question/Comment: Member Reiter notes Verizon claims to have explored all other potential sites and they declined. Mr. Reiter would like the railroad tracks considered as a potential site.

Response: Bill Johnson reiterates that Federal law requires all decisions to be backed up and documented, that municipalities must work with utilities to find solutions. The board is able to suggest possible sites Verizon's team might not know about.

ZBA Question/Comment: Chairman Steinmetz asks about following New York State standards and if there is a different standard for use variance of telecommunications.

Response: Bill notes that Verizon is a public utility, and there has to be need- economic or otherwise- to provide service. Courts don't look at use and area variances differently, if it violates code, variance must be granted.

ZBA Question/Comment: Chairman Steinmetz questions if the timing is premature due to the Parma tower not yet existing.

ZBA Question/Comment: Member Begy inquiries about precedents set by allowing one tower at this location.

Response: Bill Johnson agrees this would set a precedent, these are regulations and not laws from the FCC.

Resident Question/Comment: Dave Wright claims Hilton did not have a code for antennas and the existing antenna is therefore an illegal installation.

Response: Bill Johnson states that residents can't put a 30-foot on a house, but Verizon is a public utility.

Trustee Question/Comment: Christine Brower questions if the board can defer decision until the tower is functional to determine need and to promote a more accessible location.

Response: Bill Johnson suggests contacting the board attorney.

ZBA Question/Comment: Member Pettine questions the safety of the tower, the population that will be exposed, and why Verizon claims 80 feet is the answer as opposed to 70, 60 or 50 feet.

Trustee Question/Comment: Christine Brower notes that because of the nearby hill, there is more exposure risk to residents that are on the same level as the tower.

Response: Bill Johnson notes that they look at everyday population, then occupational exposure for safety. Even if Verizon asks for 80 feet, they don't necessarily need 80. Exposure works like a lighthouse, with power going across the horizon, and not much downward exposure. A report on this potential exposure is recommended.

There is some discussion about the ramifications of approving one tower, if others will follow and if the process will be the same. According to Bill Johnson, the FCC facilitates that and a court may say they don't have to follow the same process.

Bill Johnson informed the board that another service provider can be added to the tower without additional approvals from the village. This would require a 20 foot extension onto the top of the proposed 80 foot tower. Chairman Steinmetz and Member Pettine questions the 20 additional feet on top of the tower and clarify that ONE addition of 20 feet is the limit.

ZBA Question/Comment: Member Begy asks about timeline for construction of tower.

Response:

Bill Johnson states that it depends on the particular construction schedule, a few weeks sometimes.

There is some discussion regarding the fall zone of the tower. Bill Johnson talks about public safety and ice falling from the tower in inclement weather. There is a break point halfway up the tower to prevent tower falling, it is designed to bend at the break point.

Bill Johnson recommends asking for extension since he asked Verizon for additional material, and it will take time for them to gather. He notes that this application has many holes in it. Mr. Johnson asks for permission from the board to work with the Verizon attorney and RF engineer and the board agrees.

Discussion ensued about other possible tower locations and requesting verifiable documentation from Verizon that they have explored other locations.

Parkland

Chairman Steinmetz notes he spoke with Shultz Associates regarding changes to the models and notes the applicant has been noncommunicative.

Christine Brower gave the village board liaison report.

Discussion

The board agreed to change the Zoning meetings to Monday at 6:30 p.m. until further notice to accommodate scheduling conflicts.

Next Meeting: Monday, June 8, 2026
Agenda Deadline: Monday, May 18, 2026

Adjournment

Member Fay made a motion of adjourn at 8:35pm. Motion seconded by Member Reiter. Motion carried 5-0.

Respectfully submitted,

Fawn Cretelle-Galan
Recording Secretary

WILLIAM P. JOHNSON
RF ENGINEERING CONSULTANTS
P.O. BOX 20263 ROCHESTER, NEW YORK 14602

May 5, 2026

Ms. Shari Pearce, Village Manager
VILLAGE of HILTON
59 Henry Street
Hilton NY 14468

RE: Wireless Telecommunications Services Facility RF Site Review
Proposed Modification and Upgrade – 144 South Avenue
Bell Atlantic Mobile Systems LLC d/b/a Verizon

Dear Ms. Pearce,

This initial review report discusses the radio-frequency (RF) aspects of the proposed Verizon (Applicant) project in the Village of Hilton. Subsequent reports, if needed, will address any remaining questions or issues that arise during public hearings at the request of the village. The purpose of this report is to highlight issues that may require Applicant to respond with supplemental materials and/or narrative explanations of certain ambiguities in the materials. Appendix A to this report includes our qualifications to render opinions on this matter.

The following materials available to date form the basis for this report:

1. Permit, site plan and variance application materials dated January 8, 2026 consisting of exhibits A through N

Exhibit A: Completed Village-supplied application form;

Exhibit B: Project description;

Exhibit C: Applicable legal standards;

Exhibit D: Proof of compliance with the Village's requirements for Towers;

Exhibit E: Proof of compliance with the Village's area variance requirements;

Exhibit F: Radio Frequency C'RF") analysis;

Exhibit G: 11" x 17" copy of the project plans;

Exhibit H: Environmental assessment form ("EAF") with Visual EAF Addendum;

Exhibit I: Copies of Verizon's FCC licenses;

Exhibit J: Proof of the Landowner's consent to the Application;

Exhibit K: Tower design letter;

Exhibit L: Tower and equipment removal letter;

Exhibit M: Proof of compliance with applicable federal regulations; and

Exhibit N: Photos/simulations of the proposed tower and visibility map.

Site Details

Applicant currently proposes removal of an existing rooftop-mounted antenna array ACL approximately 31' ("ACL" = Antenna Center Line) and construction of a new ground-mounted 80' tower (plus 4' lightning rod) and ancillary equipment to achieve improved RF coverage and capacity in the existing cell. Location of a wireless facility generally requires a location central to a service gap area where either existing radio-signal strength is weak for reliable service or the user service demand placed on existing neighbor base stations exceeds capacity to provide reliable service.

Initial Report Summary of Findings

1. Hilton DT Future site (and perhaps others not yet commissioned) is shown with "existing" RF coverage propagation plots. Page 3 of Exhibit F states that this 120' tower site "is currently being sought" but is not yet constructed.
2. Subsequent to submission of the permit application materials for the current site, Verizon's representatives explained by phone that the Hilton DT Future site is located about 120' west and outside the Village of Hilton jurisdictional boundary and is already approved for construction by the Town of Parma. When it is constructed and commissioned it is expected to provide the RF coverage shown on the current application's propagation plots. Therefore we will consider this to be an "existing" site for purposes of showing need and justification for the proposed project.
3. The current application materials includes propagation plots for low-band and mid-band RF signal coverage and existing site LTE capacity metrics. We will use these materials to assess Verizon's need for the modified site at Pleasure Lanes Bowling. Appendix C to this report discusses the general considerations for wireless network design.
4. The application materials indicate in several places that there is a need for more RF coverage and improved user capacity to relieve congestion at existing neighbor sites.
5. The need for a new facility takes the form of an evidence-based (i.e. "substantial evidence") showing of a significant service gap in RF coverage and/or user capacity.
6. Justification of a proposed site shows how it will address the evidence-based significant service gap.
7. Reasonableness of the proposed site involves showing that the proposed solution is "the least intrusive means for closing a significant gap. "[1] Alternative solutions that may not be the least intrusive means and were therefore removed from further consideration by Applicant

[1] *Sprint v. Willoth* 176 F.3d 630, 643 (2nd Circuit, 1999)

might include other viable alternative locations, alternative technology, or modified implementation.

8. No alternative locations, technologies, or implementation have been identified by Applicant against which to compare the proposed site.
9. Not withstanding the note on page 2 of Exhibit F ("Engineering Necessity Case") (a) the cited FCC regulation does not rise to the level of the *Willoth* authority and (b) the FCC regulation is silent on the matter of the means used to address the need and does not change the *Willoth* "least intrusive means" requirement.
10. Application materials Exhibit N include before/after photo simulations for selected locations to help assess the visual impact of the proposed 80' tower. There is no visual analysis for any alternative locations, heights or implementations. Appendix H to this report presents some considerations for visual impact analysis.
11. In order to evaluate whether the proposed project is indeed the least intrusive means, there is necessarily a comparison with other technically viable and reasonable approaches, even if those approaches are not the ones most preferred by a wireless service provider. The *prima faci* (i.e. on its face) fact that a project is proposed by an applicant implies it is the one most preferred. However, that does not demonstrate whether it is actually the least intrusive means to address the objective service gap(s).
12. In order to properly evaluate compliance with the *Willoth* least intrusive means requirement to address the need, alternatives must be compared to their ability to substantially, even if not perfectly, address the objective service gap(s). We do not find any such comparison presented in the permit application materials.
13. Capacity metrics for two neighbor sites, "Parma" (1.75 miles distant) and "Burritt Rd (1.1 miles)" are said to be serving the area from "a terrain or foliage + distance challenged position" and that mid-band service cannot be provided from those locations to the area described as "primary objectives" (page 3, Exhibit F). The "primary objectives" areas are quite general and make it difficult to assess whether alternative sites, if any, might serve those objectives.
14. Capacity performance of existing sites is improved by placing a new base station facility such that its RF "footprint" intrudes onto the existing site "footprint" where the service provider intends to capture the excess wireless traffic to relieve the existing site. To our knowledge, Applicant does not have a means to quantify the capacity relief as a function of height and location other than by use of "footprint" overlap and assumptions about area population density.
15. Other than a qualitative comparison of existing and proposed RF coverage, there is no quantitative assessment of how much capacity relief will occur for the existing neighbor sites.
16. Since the "Hilton DT Future" site is not yet constructed, the LTE capacity metrics for existing neighbor sites presented in the permit application materials, particularly those for the existing "Parma" site, does not include the expected contribution from that site.
17. The "Hilton DT Future" site covers a significant coverage area and will likely capture traffic from the existing "Parma" site. While an existing site may have adequate RF footprint coverage, unless a site also has available capacity there is the potential for lack of adequate service – that is, a service gap. We <u>recommend</u> more detailed analysis by Applicant to

demonstrate to what extent the "Hilton DT Future" site alone will accomplish the capacity improvement desired for "Parma" perhaps without need for the construction of the proposed 80' tower at Pleasure Lanes. Pending that analysis, we must delay an assessment of need for capacity improvement at "Parma" to justify the new tower at Pleasure Lanes Bowling.

18. It appears from the documentation in Exhibit F that the proposed new tower will not provide any significant capacity relief to "Parma" at low-band frequencies that is not already provided by "Hilton HS" and the new "Hilton DT Future" facilities. We recommend that, unless Applicant shows there is any significant contribution from the proposed 80' tower for capacity relief at "Parma," that this aspect of the justification be removed from the permit application to avoid confusion when evaluating alternative sites.
19. The existing Pleasure Lanes Bowling rooftop site already provides some overlap with the "Burritt Rd" footprint, but the proposed 80' tower will increase the low-band overlap to the existing "Burritt Rd" footprint. We cannot assess the degree to which that new overlap will improve the capacity issues at "Burritt Rd" and, therefore, recommend, additional objective data from Applicant to properly assess the significance of the capacity relief for use of the 80' tower they anticipate.
20. In all capacity relief scenarios, when modifications of height or change of location are evaluated for alternative sites, the same objective data such as increased service area and capacity relief at neighbor sites should be used to compare the degree to which an alternative site will address the service gap(s).
21. The permit application materials contain some qualitative RF and capacity evidence, but the materials lack objective quantifiable data measured against the objective need criteria that shows the proposed location and height are the minimum intrusion on the community, specifically:
    a. There is no disclosure of alternative sites considered and analysis of alternative sites or technology;
    b. There is no discussion of potential mitigation measures such as a stealth site or reduction in height.
    c. There is no explanation as to why the specific location on the proposed property was chosen for reasons such as visual impact mitigation.
22. Propagation studies use the Antenna Center Line ("ACL") as the measurement for antenna height, which is slightly different than the tower height. The ACL shown for the Pleasure Lanes Bowling rooftop site shows ACL=31' while the proposed coverage propagation plots (Exhibit F) show the same ACL for the 80' tower. We believe this is a simple typographical error. The site plan elevation drawing (Exhibit G) shows the ACL=75'.
23. Deployment of cellular base stations can be affected by developing plans for neighboring sites. We recommend that Applicant discuss whether any neighbor site deployments are at or near a point where they may allow height reduction of the proposed tower.
24. During public hearings and municipal site plan review, other alternate sites that may provide improved visual impact are often identified by the siting authority or the public in addition to those Applicant identified. We recommend Applicant perform an RF analysis for any additional nearby sites identified by municipal staff and others that have potential for improved visual impact.

25. FCC regulations[2] require Applicant perform a preliminary analysis to ascertain whether or not it is likely the proposed site will expose members of the "General Population"[3] to excessive electromagnetic energy. Applicant's RF engineer has stated that the site will comply with FCC requirements but the analysis, sometimes called the "Jurisdictional Report" which states the assumptions for the conclusion, was not provided. We recommend Applicant provide the underlying report.
26. If the proposed site is ultimately approved, it will meet the FCC requirements in 47 C.F.R. §1.6100 as an "Existing" structure. Modifications of "Existing" structures in the form of an "Eligible Facilities Request" that fall outside of that section's definition of "Substantial Change" are likely not subject to local review and approval. We recommend that your review of this proposed site consider the possibility that such a request will come before the village in the future as a co-location request by another wireless service provider or modification to improve Applicant's service levels.

The information in this report concerns the RF engineering issues related to the proposed project to assist the board in weighing the alternatives and planning for the future of the community. Engineering design choices implicate aesthetic and legal issues as well. However, this report must not be relied upon for any legal advice or direction. Legal advice about action on these issues must be obtained from the board's counsel.

Thank you for the opportunity to assist the Village of Hilton. Please feel free to let us know if there are additional questions or other concerns at this time.

Sincerely,

William P Johnson
Consultant

Appendix A: Summary of Qualifications
Appendix B: FCC Shot Clock Summary
Appendix C: Wireless Network Service Design
Appendix D: Computer-based RF Modeling and the FCC
Appendix E: Co-location Issues
Appendix F: Human Exposure to NIER
Appendix G: Alternative and Supplemental Technologies
Appendix H: Photo Simulation Evaluation Issues

[2] 47 CFR §1.1307 and 47 CFR §1.1310
[3] "General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure." 47 CFR §1.1310 footnote (3).

Appendix A: Background and Qualifications

I, William P. Johnson, certify that I:

1. joined the faculty of Rochester Institute of Technology (RIT) in September, 1989, and currently hold the rank of Professor Emeritus;

2. served as Graduate Program Director for the Telecommunications Engineering Technology program at RIT until June 30, 2020;

3. am and have been employed since 1972 in the radio-frequency (RF) and microwave industry holding positions prior to 1989 such as design engineer, staff engineer, VP Engineering, and consultant;

4. am actively involved in RF/microwave consulting;

5. hold graduate degrees in both electrical engineering and law;

6. am qualified to analyze radio-frequency design and performance documentation relevant to the justification of minimum radio antenna height and tower locations;

7. am qualified to comment upon alternate site analysis, aesthetic characteristics, and visual impact effects relevant to telecommunication towers by virtue of extensive involvement since 1997 in telecommunications site plan and New York SEQRA reviews, administrative agency testimony, and expert testimony for litigation;

8. have consulted for over 80 municipalities and private organizations since 1997 in the area of broadcast and telecommunication facility tower review;

9. have a reputation in both the industry and among clients for being qualified and having the necessary relevant technical expertise needed to provide telecommunication facility review;

10. am the author of the technology content for the New York Department of State Land Use Technical Series publication *Planning and Design Manual for the Review of Applications for Wireless Telecommunications Facilities* (2001) (available at http://www.dos.state.ny.us/lgss/localgovt.html);

11. provided expert services and subsequent engineering testimony on behalf of defendant Town of Ontario, NY, during successful litigation defense in *Sprint v Willoth*, 996 F.Supp. 253 (WDNY 1998) and during petitioner Sprint's appeal in *Sprint v Willoth*, 176 F.3d 630 (2nd Cir. 1999).

Signed: 

William P. Johnson
Consultant

Appendix A: Background and Qualifications

I, Steven M. Ciccarelli, certify that I:

1. am currently an Associate Professor at Rochester Institute of Technology (RIT) and joined the faculty in September, 2001;

2. served as Program Chair for the Electrical Engineering Technology program at RIT from September, 2005 until November, 2009;

3. served as Co-Chair of the IEEE Rochester Section, Microwave Theory and Techniques Society from 2004 until 2008;

4. successfully completed graduate courses and laboratories in analog IC design, MEMS devices and systems, microelectronics, micro-optics and photonics, RADAR and RFIC design from 2002 until 2007;

5. received The IEEE Third Millennium Medal *In recognition and appreciation of valued services and outstanding contributions* in 2000;

6. have been employed since 1993 in the radio-frequency (RF) and wireless industry holding positions such as RF/Analog Engineer, Senior RF/Analog Engineer and Director of Technology Development;

7. am actively involved in RF/wireless consulting;

8. hold graduate degrees in both electrical engineering and education;

9. am qualified to analyze radio-frequency design and performance documentation relevant to the justification of minimum radio antenna height and tower locations;

Signed: 

Steven M. Ciccarelli

Consultant

Appendix B: FCC Shot Clock Summary

After passage of the Telecommunications Act of 1996 and the rapid deployment of personal wireless services that followed, the Federal Communications Commission (FCC) responded to industry concerns about the time it took for siting authorities to review and make a final decision on zoning and variance approvals. The delay arguably caused a back-up of plans to deploy towers to expand or densify licensee wireless networks. The FCC issued and periodically updates the regulations to define what, in the agency's opinion, are reasonable timeframes for such decisions. The Shot Clock is the collective of those opinions[4].

> Co-locate a Small Wireless Facility[5], once so identified using permit application documentation, using an existing structure: 60 days;
>
> Co-locate a facility other than a Small Wireless Facility using an existing structure: 90 days;
>
> deploy a Small Wireless Facility using a new structure: 90 days; or
>
> deploy a facility other than a Small Wireless Facility using a new structure: 150 days.

Siting authority review is sometimes delayed due to the technical complexities related to wireless site deployment but the C.F.R. makes no provision for that possibility without affirmative action by the siting authority. If time has lapsed it may be possible to negotiate the Shot Clock deadlines with Applicant in writing for good cause to allow time for a thorough review of alternate sites, analysis of height requirements, addition of supplemental materials to support action, and additional justification of need where appropriate and allowed.

Unless there is a written agreement with the wireless service provider for a different timeframe, upon receipt of a permit application for a wireless telecommunications facility the municipality has a limited amount of time[6] to toll the Shot Clock and notify the applicant of a "materially incomplete" application. Notification of a materially incomplete application for purposes of tolling the Shot Clock must be effectuated within ten (10) days for a small-cell facility[7] or thirty (30) days[8] for other wireless telecommunication facilities. A valid notification of deficiency "clearly and specifically identifies the missing documents or information" to make the application complete and, in the case of a small-cell "the specific rule or regulation creating the obligation to submit such documents or information."[9]

[4] 47 C.F.R. §1.6003
[5] A "Small Wireless Facility" is defined as one meeting all requirements in 47 C.F.R. §1.6002 (l)
[6] 47 C.F.R. §1.6003(d)
[7] 47 C.F.R. §1.6003(d)(1)
[8] 47 C.F.R. §1.6003(d)(2)
[9] 47 C.F.R. §1.6003(d)(1) and 47 C.F.R. §1.6003(d)(2)(i)

Appendix C: Wireless Network Service Design

A wireless service provider's wireless subscribers are often located inside buildings or vehicles that are screened by foliage from direct view of a base station. Foliage, buildings and vehicles are obstacles to radio wave penetration. In order to "render safe and adequate service"[10], the wireless RF signal must travel over the terrain in the coverage area, penetrate obstacles that block a direct path to the subscriber, and then arrive with sufficient signal level to achieve the desired level of service. Wireless telecommunication systems must operate simultaneously in both directions between the base station facility and the subscriber's mobile equipment. Therefore, the return signal from the subscriber's mobile or stationary equipment must also overcome the signal losses due to terrain and other obstacles. Service levels are affected by several metrics. The fundamental metric is RF signal strength. RF signal strength is measured in several ways. The most recent technology, Long Term Evolution" systems use Reference Signal Received Power to predict service levels while other technologies will use similar measurements related to signal power level at the subscriber location. This one-way predictive calculation is sometimes misunderstood since the "uplink" (from subscriber to base station) and "downlink" (base station to subscriber) differ in the type and deployment of equipment for each. Suffice it to say that the one-way threshold level required for reliable communication takes into account the "uplink" parameters as well to assure sufficient signal strength is available for both directions. Once RF signal strength levels are established the user capacity and interference levels must be evaluated.

Generally, when a high level of service reliability or high user capacity are needed, network base stations must be placed closer together to provide both high RF signal levels and increased network user capacity over a smaller area. In less populated areas where user capacity is not as much an issue, the base stations can be spaced at greater distances where the separation is generally limited by path loss caused by terrain features, buildings, and other obstacles. For RF coverage considerations from a particular base station, the wireless service provider's choice of minimum RF signal level limits the extent of cell coverage. If the RF signal level requirement is high, then the acceptable coverage area is generally small. When a service provider adopts lower but acceptable reliability and uses a lower RF signal threshold for their network design, a single base station will cover more area at the reduced level.

Design engineers for wireless service providers use an RF link budget to quantify the RF signal level required for "safe and adequate" wireless network operation. The RF link budget ultimately establishes the maximum permitted path loss between the base station and mobile terminal. The RF link budget includes all relevant system design assumptions, including measures of dropped connections related to signal strength and ultimately quantifies maximum permissible path loss. Path loss, or signal attenuation during propagation, is the reduction in RF signal level as it travels from the base station to the subscriber's mobile device and, likewise, from the mobile device back to the base station. If the path loss is too high, then the received signal will be below the established minimum RF signal level threshold. When the received signal is below threshold, unreliable operation (i.e. dropped connections or reduced data transmission speed) may result. Service providers monitor network performance for reliability and may adjust link budget

[10] *Cellular Tel. Co. v. Rosenberg*, 82 N.Y.2d 364, 371-371 (1993).

assumptions to respond to the actual performance experience. Thresholds for future sites may show different service level requirements as new technology, additional operating bands, and propagation model adjustments are implemented.

Appendix D: Computer-based RF Modeling and the FCC

Since 2020, we have been aware that certain parties who solicit local residents and municipal zoning and planning boards as clients to oppose deployment of wireless facilities have made incorrect and arguably deceptive statements regarding document FCC 20-94 titled "SECOND REPORT AND ORDER AND THIRD FURTHER NOTICE OF PROPOSED RULEMAKING" (see also GN Docket No. 19-367 "MOBILITY FUND PHASE II COVERAGE MAPS INVESTIGATION STAFF REPORT"). The parties in question purport that the FCC has declared computer-based propagation plots inaccurate and that only RF drive tests are acceptable to the FCC. This assertion is patently incorrect. An excerpt from the Federal Register from August 18, 2020, that formalized the proposed rules in FCC-20-94 states the following:

> In this document, a Second Report and Order adopted by the Commission establishes important measures for developing improved broadband data, including requiring fixed wireline and satellite providers to submit shapefiles, or lists of addresses or locations, representing where they have customers or could install service within 10 business days of a request; requiring terrestrial fixed wireless providers to report their coverage areas based on propagation maps and models using prescribed parameters, or based on lists of addresses or locations, to define their specific coverage areas; and requiring mobile providers to submit coverage maps and propagation model details based on minimum specified parameters and to disclose other assumptions underlying the models.[11] (emphasis added)

FCC-20-94 as adopted by the FCC *does not assert the claims of inaccurate RF computer-based analysis*. It states that computer-based modeling is part of the information the FCC requires.[12] FCC-20-94 describes the outcome of an FCC project that sought to measure "speed" (bandwidth) claimed by service providers. The information previously submitted to the FCC *may have been* overstated or the measurement techniques used by the FCC field personnel who sought to confirm the measurements *may have been flawed* due to site sector saturation and/or measurement techniques that did not account for heavy site sector utilization. Perhaps without realizing it, those who cite FCC-20-94 to discount computer-based modeling have made a stronger case for a service provider's use of RF propagation plots as endorsed by the FCC. The ultimate goal of a service provider's design is to provide adequate bandwidth to subscribers. Network bandwidth (i.e. data speed) performance is not just based on RF propagation levels as would be documented by an RF drive test assuming the sector serving the area is not "saturated." An adequate RF propagation level is a "necessary" but not a "sufficient" condition for capturing user traffic and providing adequate bandwidth. The "sufficient" conditions include sector capacity, user demand over time, and interference from other users attempting to use the cell. The data demand and throughput is collected by the base station's control center (i.e. the MTSO switch). Ideally this set of information is available from a project sponsor to show need when capacity issues are to be addressed.

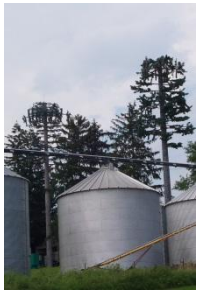
[11] See https://www.govinfo.gov/content/pkg/FR-2020-08-18/pdf/2020-17633.pdf (Federal Register / Vol. 85, No. 160 / Tuesday, August 18, 2020 / Final Rule)
[12] See FCC-20-94

Given the uncertainties, there are two views on the matter of co-location each having advantages and disadvantages.

First, some municipalities take the position that it is better to concentrate the co-locations at one site rather than conduct hearings for multiple shorter towers. Under this approach, the current tenant and each future service provider with an area coverage gap will ideally locate on the proposed tower. If co-location is agreeable to a service provider, it will force an approximately similar coverage grid to that of the existing carriers. In some cases the similar grid pattern can increase the likelihood that future neighbor tower sites will be required in a location that may be more controversial or in places where it may be undesirable to stack multiple service providers on the same tower. The concentration of a large number of service providers on the same tower can result in a visual impact that far exceeds that of the original tower as proposed even if the height remains unchanged.

Second, some municipalities prefer multiple shorter towers since the lower height may make them more easily buffered by foliage and/or facilitate stealth structures. Stealth structures include structures designed to look like clock towers, church steeples, building facades, or trees. Stealth tree structures are generally effective when antenna centerline and tower height are within 15' of the existing tree canopy, so this generally precludes future co-location without additional height. When the tower height dramatically exceeds the existing tree canopy the advantages of a stealth tree are arguably diminished. Stealth structures are generally more expensive to implement and exhibit some structural limitations for future co-locations. An additional advantage to the multiple-shorter-site approach using more traditional tower structures is that it does provide co-location for capacity expansion when multiple shorter towers are already in place. As more wireless subscribers join the network, the need increases for smaller cells where each cell can handle approximately the same number of calls and will then relieve the burden of the additional subscribers on existing cells. This affect will be more likely in suburban or urban settings, but may occur in rural installations where population is concentrated in a specific sector and demand starts to reach capacity.

There are many variables that affect successful co-location. There is no guarantee that any future service provider will be interested in co-location at a specific site since their RF coverage requirements may be remarkably different than the service provider that proposed the tower in the first place. Given the advantages and disadvantages, some municipalities handle it with a compromise solution.



A compromise between multiple short towers and consolidation of service providers on a single tower is to build a proposed tower to the minimum required height as currently required but design the tower foundation and the lower superstructure to accommodate a future height increase if so justified by a future co-location application. Increases in height can generally be in 20' increments on a tower designed for expansion. Future expansion in height, unlike the mere addition of antennas to an existing tower, is arguably a *substantial change* and, if so, would likely fall outside of the Middle Class Tax Relief and Jobs Creation Act of 2012 (PL 112-96, February 22, 2012, 126 Stat 156) which includes Sec. 6409: Wireless facilities deployment. That

law limits municipal review of an *eligible facility request* under specific circumstances. This matter and the implications for future site review of a tower designed for expansion should be discussed in more detail with the board's attorney if or when needed.

Appendix F: Human Exposure to Non-ionizing Electromagetic Radiation (NIER)

Federal law preempts local zoning authorities from considering environmental effects of and human exposure to cellular/PCS RF emissions as long as the proposed base station complies with Federal Communications Commission (FCC) emission standards.[13] Nonetheless, the matter is sometimes of concern to residents, municipal staff and board members. In response to those concerns, the following information is offered for your consideration.

The FCC is required by the National Environmental Policy Act of 1969 to evaluate the effect of emissions from FCC-regulated transmitters on the quality of the human environment.[14] Toward this end, a substantial effort has been made by the FCC and other agencies to provide information to both the public and the wireless/broadcast industries. Guidelines and information relevant to Non-Ionizing Electromagnetic Radiation (NIER) health and safety assessment are published by the Federal Communications Commission Office of Engineering and Technology (FCC-OET).[15] FCC-OET and the Federal Drug Administration (FDA) jointly maintain an internet web site that provides basic information to consumers regarding cell phone health effects.[16] FCC-OET also publishes detailed technical information for the industry that recommends calculations and field measurement methodology to demonstrate compliance with the NIER exposure guidelines.[17] These methods and calculations were codified at 47 CFR §1.1307 and 47 CFR §1.1310.

At the international level, the International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), and the U.S. National Toxicology Program (NTP), which is formed from parts of several different government agencies, including the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA) provide on-going research and summary information regarding a wide range of RF emissions including emissions from cell phones and base stations.[18] To date neither IARC nor NTP have declared that the radio signals emitted from cellular 4G and 5G base stations that comply with FCC human exposure regulations cause human cancer or other human health abnormalities.[19]

In light of the information available, Congress and the FCC decided in the 1990s to exclude cellular/PCS and other base stations from mandatory NIER analysis when those sites meet certain emission and height requirements. In a study that spanned 13 counties and included 13,000 cell phone users, the World Health Organization (WHO) International Agency for Research on Cancer (IARC) Interphone Study Group published the results of a 13-country study in the International Journal of Epidemiology on May 17,

[13] 47 USC §332(c)(7)(B)(iv).
[14] See National Environmental Policy Act of 1969, 42 U.S.C. Section 4321, et seq.
[15] http://www.fcc.gov/oet/rfsafety/
[16] http://www.fda.gov/cellphones/
[17] http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf and updates.
[18] http://www.who.int/peh-emf/en/
[19] See a very user-friendly summary of research and issues at the American Cancer Society web site https://www.cancer.org/cancer/cancer-causes/radiation-exposure/cellular-phone-towers.html

2010.[20] According to the World Health Organization in June, 2011, "[a] large number of studies have been performed over the last two decades to assess whether mobile phones pose a potential health risk. To date, no adverse health effects have been established as being caused by mobile phone use."[21]

Commenting on the Interphone study, Dr. Christopher Wild, IARC's director, said that "[a]n increased risk of brain cancer is not established from the data from Interphone. However, observations at the highest level of cumulative call time and the changing patterns of mobile phone use since the period studied by Interphone, particularly in young people, mean that further investigation of mobile phone use and brain cancer risk is merited."[22]

Beyond the potential damage to tissue caused by exposure to high-intensity NIER fields, some individuals report symptoms they attribute to low level NIER exposure. One hypothesis is that symptoms are correlated with physiological changes. Measurable physiological changes include metrics such as heart rate, blood pressure, and skin conductance. A three-year study performed at the University of Essex, UK, published in July, 2007, failed to find a correlation between low-level NIER exposure and such physiological changes.[23] In the study, the number of symptoms reported during the double-blind portion of the experiments was not related to the actual presence of low-level NIER.[24] This result is in agreement with earlier more limited studies.

On the arguably more conservative side, a report released on August 25, 2009[25] by International EMF Collaborative entitled "Cellphones and Brain Tumors: 15 Reasons for Concern, Science, Spin and the Truth Behind Interphone" includes, according to the report, endorsement by Ronald B. Herberman, MD, University of Pittsburgh Cancer Institute. While serving as director, Dr. Herberman had previously urged his staff[26] and the general population to recognize and understand that, while research has not proved conclusively one way or the other and given the uncertainty about the ultimate long-term safety of wireless radio signals, there are precautions that one can take. The report urges a skeptical individual and public policy approach to NIER exposure and encourages the on-going study of radio emissions and health concerns. The report urges prudent defensive actions to protect one's self and to move public policy toward a conservative

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[20] Elisabeth Cardis et. al., *International Journal of Epidemiology* (2010;1–20) (Oxford University Press on behalf of the International Epidemiological Association) (May 17, 2010).
[21] "Electromagnetic fields and public health: mobile phones ", Fact Sheet No. 193 (updated June, 2011) http://www.who.int/mediacentre/factsheets/fs193/en/.
[22] CNET News at http://news.cnet.com/8301-27083_3-20005235-247.html (May 18, 2010).
[23] Stacy Eltiti et. al. "Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomised provocation study" (Environmental Health Perspectives, 7/25/2007) (University of Essex, UK) available at http://www.ehponline.org. The study is also available at http://www.essex.ac.uk/psychology/EHS/eltiti%20et%20al%20BEMS%20ON-LINE%20PUBLICATION.pdf
[24] *Ibid*.
[25] See http://www.radiationresearch.org/pdfs/15reasons.asp
[26] See http://www.post-gazette.com/downloads/20080722upci_cellphone_memo.pdf

approach to NIER exposure. More recently, Dr. Brenden Curley[27], a medical doctor who specializes in hematology and oncology, stated in an interview with a news reporter that

> There is currently no definitive scientific evidence that cell phone use causes cancer. Some people may worry that cell phones emit radio waves or radiofrequency energy that can damage nearby tissue, causing brain cancer. According to recent research, patients with brain cancer do not report more cell phone use than controls or people without brain cancer. However, current research does have limitations, mostly because cell phones are relatively new and we're using them more now. So it's difficult to give a definitive answer right now. However, evidence currently does not support cell phones causing cancer.[28]

A report of partial findings from the National Toxicology Program (NTP) released on May 26, 2016, and the draft reports for tests on lab mice and lab rats was released on February 2, 2018. These releases present initial and final data regarding development of tumors during a multi-year study of lab mice and rats[29]. The study exposed lab rats to high levels of whole-body electromagnetic radiation (CDMA and GSM modulation formats) for 9 hours a day over a two-year period. The level of exposure was chosen to avoid thermal issues beyond that which the animal could self-regulate body temperature.[30] While this level is far more than exposure based on mass than allowed by the FCC for humans, the higher level (i.e. a "provocation" study) was used to allow study of the impact on the animal's organs other than just the brain. After release of the initial report, a press briefing was held to allow reporters to ask questions about the study data and preliminary results[31]. The audio and transcript may be a useful way for the general public to hear answers to some of the complex issues raised by release of the initial report. Researcher Dr. John Bucher, when asked by a reporter for the "take away" from the initial report for the general public said:

> So this is a study that is looking at the plausibility, biological plausibility, of carcinogenic effect due to cell phone radiation. The direct translation of these findings to the way humans are using cell telephones is not currently completely worked out and that's part of the evaluation that's going forward. This may have relevance, it may have no relevance.[32]

As of February, 2018, the NTP study has been released for peer review to establish independent credibility. The technical reports and related information is available on the NTP web site.[33] When last checked, an updated summary of the NTP study of high-level and long-duration NIER exposure to rats and mice is available online.[34] It should be

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[27] See his bio at https://www.honorhealth.com/physicians/brendan-curley
[28] See http://www.12news.com/news/local/outreach/healthcheck/debunking-9-common-cancer-myths/452221027
[29] See http://biorxiv.org/content/early/2016/05/26/055699
[30] A 1-degree body temperature rise.
[31] Audio and transcript available at http://www.niehs.nih.gov/news/newsroom/releases/2016/may27/
[32] See transcript of press briefing available at http://www.niehs.nih.gov/news/newsroom/releases/2016/may27/ Page 24 of 36.
[33] https://www.niehs.nih.gov/news/newsroom/releases/2018/february2/index.cfm
[34] See https://www.niehs.nih.gov/health/materials/cell_phone_radiofrequency_radiation_studies_508.pdf

noted that the NTP study used much higher exposure levels and duration than a human using a cell phone held to their head would experience. The human exposure from a base station that complies with FCC threshold regulations is orders of magnitude lower than that of a cell phone held to the head or near the body. While the information in the technical reports is highly technical and uses terminology unfamiliar to most readers who do not perform research or services in the medical field, NTP summarizes the study findings for the rest of us and its application to human health by answering this question: Do the rat and mouse findings apply to humans? The published answer is as follows.

> The findings in animals cannot be directly applied to humans for two key reasons:
>
> - The exposure levels and durations were greater than what people may receive from cellphones.
> - The rats and mice received RFR across their whole bodies, which is different from the more localized exposures humans may receive, like from a cellphone in their pocket or next to their head.
>
> However, the studies question the long-held assumption that radio frequency radiation is of no concern as long as the energy level is low and does not significantly heat the tissues. [35]

Without meaning to minimize concerns on the part of any individual on this matter, the scientific information to date as a whole seems to favor a conclusion that neither the biological effects of tissue heating nor symptoms allegedly due to low-level NIER DNA damage are likely caused by a base station facility that complies with FCC guidelines. If anything, the use of a hand-held mobile device held to one's head or in proximity to the body is more of a concern since the mobile device transmits radio signals while communicating with a base station. When a base station is nearby, the propagation losses are less and the transmit power of the mobile device can be reduced (base stations control the mobile device output power to maintain low levels of interference with other users who are more distant or behind obstacles that block the RF signals. We note that while it is possible to prove scientifically that something is "unsafe" (i.e. identifiable and repeatable conditions that lead to the undesired result) it is logically impossible to prove that something is "safe" by performing any number of tests that are limited in scope and time. Wireless mobile device use, as is the case with other environmental exposure, is in the later category.

It remains undisputed that someday a peer-reviewed study and subsequent historical data validation *may* show that low-level NIER (as opposed to high-level and long-duration exposure of lab rats and mice) is likely problematic for a class of human population, such evidence does not currently appear to exist. The lack of such clear and objective evidence tends to defeat the assertion that low-level NIER from base station facilities may be dangerous. Naturally, a person who has health-related concerns or experiences any health-related symptoms should consult with a heath care professional – not an RF engineer.

[35] Ibid.

Other Technology Approaches to Mobile Wireless Services - Satellite Systems, Distributed Antenna Systems, Small/Micro Cells, and Pico Cells

The board may already be aware of other approaches to deliver wireless communications that could avoid tall towers in a given area. On one extreme certain cellular-type systems can be implemented using low-Earth orbit satellites. On the other extreme, very small pico-cell systems can allow subscribers to connect to their own home or office network using technology similar to a cordless phone. Each approach has its advantages and disadvantages. Satellite systems provide a very large "cell" that is about 50 miles in diameter. Such a system is useful when there are very few users in the "cell" that require service, such as ocean-going vessels and land locations where natural disasters or other locations where there are limited base stations. Some wireless service providers offer "direct-to-phone" satellite service as a supplement to the terrestrial wireless network. One of the tech publications provided an overview that may help the reader understand the current types of services in this rapidly emerging market.[36] Pico-cell technology, sometimes called "WiFi calling," uses a hard-wired subscriber's broadband connection to bypass the cellular network for that localized location. One such system that fits between satellite systems and pico-cells is called a Distributed Antenna System (DAS). Another approach, similar to a DAS, is a micro-cell that implements functions of a regular base station in a localized area. DAS and micro-cell systems, including transport sites, are presented here for completeness because this issue can arise in municipal planning and zoning hearings for new towers.

Distributed Antenna Systems (DAS)

DAS systems are designed and deployed by companies such as CommScope[37], Corning Inc.[38], JMA Wireless[39], NextG Networks[40], ExteNet Systems[41], and others who install and then lease use of the DAS to wireless service providers. Essentially a DAS involves an array of antennas mounted on existing telephone poles and short towers/structures that are otherwise unsuitable for a "macro" wire-area base station facility. The antennas and associated transceivers, sometimes called "nodes", are interconnected by fiber optic or coaxial cable links called a "backhaul." In the case of backhaul fiber optic links, the wireless RF signals are converted at each node to optical signals which can then be routed to a hub site and converted back into the signals useable by a specific service provider at a "head end" facility that will interface with the service provider's network.

Some wireless service providers use DAS technology to service tunnels, airport terminals, office buildings and other facilities where either signal penetration limitations, subscriber capacity demands, or lack of ability to construct a tower would stop wireless

[36] See https://www.cnet.com/tech/mobile/heres-everything-you-need-to-know-about-satellite-connectivity-in-phones/ (July, 2025)
[37] See https://www.commscope.com/
[38] See https://www.corning.com/
[39] See https://jmawireless.com/
[40] See https://www.nextgennetworksinc.com/
[41] See http://www.extenetsystems.com/

services. When above-ground utilities exist in an area, a DAS may have the distinct advantage of allowing wireless services from short sites that would tend to alleviate certain aspects of aesthetic concern over tall towers. Unfortunately, the multiplicity of antenna sites, the backhaul interconnection of the nodes using hard-wired connections and the lack of contingency power tend to limit their practical use to very dense areas or areas that are not serviceable by other means. Examples of DAS limitations include:

- need for numerous closely-spaced above-ground utility poles or light stanchions in the service area
- potential lack of of E-911 location technology to allow emergency responders to know a more precise location of an outdoor emergency call (an in-building DAS would not present such a problem since it is localized to the building in question),
- the regulatory constraints and deployment/operating costs to negotiate outdoor pole attachments and ground equipment locations,
- the potential fragility of the fiber optic or wired inter-node links that are usually more extensive and more exposed to falling trees or ice as in a conventional wireless base station topology, and
- lack of reliable/durable/cost-effective remote power at each node.

These limitations present significant potential reductions in performance and reliability that should be carefully weighed. Further, since the systems are sometimes deployed and operated by a third party, the cost to use the system may be excessive. While the limitations are real, in situations where it is not feasible to approve a tower that provides the necessary RF coverage and capacity a permit applicant seeks, a DAS to supplement their network or one that replaces the proposed tower is a possible approach. If necessary, the board's prerogative in this matter should be thoroughly discussed with the board's counsel because it is subject to all the legal limitations associated with the Telecommunications Act, court decisions, and Applicant's legal standing as a public utility in New York.

For an example of where DAS systems were previously operational and where new nodes were being installed, Lower Merion Twp in Pennsylvania had a twelve-node operational DAS.[42] The system was reported to be operational and, in the spring of 2009, there were zoning proposals before the municipality to increase the number of nodes in the system. Please refer to the township web site for the most up-to-date information. As of September, 2009, the City of Mount Vernon planning board had a joint application from ExteNet, a DAS system provider, and Metro PCS, a wireless service provider, for a special use permit for the installation of a DAS consisting of fiber optic cable and telecommunications equipment placed on utility pole structures located within the corridor of the public right of way throughout the city. Previously, the City of Yonkers granted pole attachment rights to ExteNet within that jurisdiction. A July 15, 2009 article that briefly discusses the use of the ExteNet DAS by MetroPCS is available

[42] See http://www.lowermerion.org/index.aspx?recordid=558&page=50 or search the base URL for "DAS" and "NextG" for multiple documents, including the January 22, 2009, press release.

online[43]. A more detailed news report dated March 31, 2009, is available from Reuters at their web site[44].

Micro-cells and Transport Sites

Micro-cells provide the functionality of a regular base station in a very localized area. Depending on the deployment, the micro-cell communicates through a fiber optic or radio link backhaul, similar to a base station. Power backup and the reliability of fiber optic cable runs between antennas above ground are similar to the issues described in the DAS system discussion. Micro-cells are particularly useful in applications where user demand is limited to a small area such as a shopping or business area where mobile users are concentrated. Micro-cells can also be used in more densely populated areas where a tower base station is impractical due to zoning constraints. About nine (9) micro cell installations were approved by the Town of Pittsford, NY, for Verizon Wireless in 2022. The micro-cells can be mounted on existing above-ground utility poles, light stanchions, or on buildings in the area. These sites use self-contained electronics and antennas that communicate with a transport site, a "head end" facility, or a mobile telephone switching center via fiber optic or wired connections. The transport site can be an existing tower site, a tall structure, or a new tower either central to or within range of the micro-cells. A transport site will typically be in the range of 70' to 120'. The use of micro-cell antennas, sometimes called "cantennas," provide localized service and avoid a tall tower central to the coverage area In the case of a radio backhaul, the transport site, a tall tower, can be located off-center from the coverage area to collect the traffic from the local micro-cell. The combination of the micro-cells and one or more transport sites potentially replace the use a tall tower in the center of the coverage or capacity gap area. A discussion of one municipality and their reaction to the use of micro cells can be found online.[45]

Both micro-cells and DAS installations have become more important in recent years as wireless service providers struggle to bring increased use capacity and bandwidth to their subscribers. This push has placed municipal boards and planning staff in the difficult position of determining how to handle zoning applications for these systems. Transport sites (75' – 120' or more) are sometimes proposed in right-of-way areas adjacent to roadways and pedestrian walkways where the potential for ice shedding can be a public safety issue. Beyond the obvious aesthetic and issues related to fall zones and proximity to vehicles and pedestrians, municipalities are still trying to develop a process to represent the financial impact incurred by use of municipal infrastructure (light poles, traffic light support poles, etc.) due to the installation of equipment on these structures that increase wind loading and can affect the galvanizing on steel poles that potentially will decrease the service life of the structure. On the positive side, the use of micro-cells can avoid the challenges of zoning a tall tower in areas where aesthetics of the tower can be deferred to the aesthetics of the numerous micro-cell DAS antennas throughout the area.

[43] See http://www.govtech.com/gt/articles/702090 (available as of September 7, 2009)
[44] See http://www.reuters.com/article/pressRelease/idUS254010+31-Mar-2009+BW20090331
[45] See http://buffalonews.com/2017/04/22/towns-confronted-ever-shrinking-cell-antennas/

Appendix H: Photo Simulation Evaluation Issues

Photo simulation of a new tower structure is produced using a brightly-colored balloon tethered at the height of the proposed tower on a day when weather will allow observation of the balloon from a distance. Since the goal is to hold the balloon at a height representing the proposed tower, the wind velocity on the day of observation must be low. After the balloon is positioned, a photographer moves around the area to capture photographs of the balloon from critical vantage points. Later, the photographs are modified by stripping out the balloon and replacing it with an photo image of a tower like the one that is proposed. The tower image is properly scaled and post-processed into the photograph. This composite photograph that shows the expected scene that will result if the tower is constructed.

When viewing a tower scene, one's attention is generally drawn to visual discontinuities or abnormalities that result from a disruption of the horizon. As we walk around our own neighborhood we mentally process the foreground and background objects based on our previous experiences of size and proportion. When one views a visual discontinuity scene in-person, the viewer is usually able to mentally process the near-field "clutter" using three-dimensional visual clues and remove them from the scene to get an accurate proportional assessment of the situation. Two-dimensional photographs lack the three-dimensional clues we use to get a proper proportional assessment, so a viewer supplements their assessment by inferring the proportionality information. Generally that process provides a good appraisal of the visual impact provided care is taken when producing the photo simulations to avoid unintentional false clues.

False clues are often foreground clutter that appears to minimize the visual discontinuity of a proposed tower or tower modification. Objects such as telephone poles, trees, utility wires, and roadway signage in the foreground are a few of the possible clutter items that require a two-dimensional viewer to take special care in assessing visual discontinuities produced by a proposed tower or tower modification. Reasonable care should be taken to avoid photo simulations that include unnecessary items in the foreground because they can sometimes mask the assessment of the tower or tower modifications. Most of us have seen humorous photographs of friends holding their hands out in such a way as to make it appear an object in the background is resting on their hands in the foreground. This effect is possible when proportionality clues are misinterpreted by the viewer. An example is shown below.

1. Two examples of false visual clues in two-dimensional photographs.

In the first example, one eventually discerns that the person is located in the foreground and the Gateway Arch in St. Louis is some distance in the background – but for most

viewers it takes a few seconds to make that connection. Unless one knows the proportion of the arch, it would be easy to draw the false conclusion that the arch is fairly minimal in size.

2. Gateway Arch in St. Louis with minimal foreground objects

In the second example, the visual perspective is an arguably "accurate" depiction of the scene of view. Some viewers would conclude that the tower, although a dramatic visual continuity on the horizon, is in proportion to the surrounding scene. If that photograph had been produced with a perspective that excluded the building and foreground trees, the true visual discontinuity would be more apparent. In a worst-case example of photo simulations gone bad, a photograph showed a large tree in the foreground with the caption "Proposed tower buffered by existing vegetation" when, in fact, had the photograph been taken from a position only ten feet either side of the tree, the balloon would have been clearly visible from that street view. However, with careful scene selection and minimal editing, photo simulations can provide a good assessment of visual impact.