

June 8, 2023

Bryan Healy, Manager  
Village of Croton-on-Hudson  
Municipal Building  
One Van Wyck Street  
Croton-on-Hudson, New York 10520

Mr. Healy,

Televate is pleased to provide our proposal to the Village of Croton-on-Hudson ("Village") for the Wireless Infrastructure Master Plan Study. Televate's extensive experience designing, constructing, and operating mobile broadband networks provides us with the skills and knowledge to understand how to help public agencies effectively assess and improve cellular coverage. Informed by decades of industry experience, our team will perform an infrastructure inventory and assessment, evaluate wireless coverage, identify gaps to be addressed, and provide recommendations for revisions to existing Chapter 206 (Telecommunications Towers) Village Code.

As part of our proposal, we bring with us a unique solution we believe is a key differentiator in conducting thorough coverage assessments: Televate will utilize its internally developed Pinpoint™ application to measure and map the network coverage, data throughput, and performance throughout the Village. The Pinpoint smartphone application was developed by Televate to provide an easy to use, yet powerful smartphone application that enables non-technical personnel to collect coverage and performance data for cellular networks. The application was built based on three years of interacting with thousands of communications users and leaders representing over 100,000 first responders across the country as part of our State and Local Implementation Grant Program (SLIGP) work in more than ten states.

Our hundreds of hours of research, network testing, and helping government agencies evaluate cellular coverage and performance enable us to provide a distinctive and innovative solution to achieve the Village's objectives. We appreciate the opportunity to provide our proposal to the Village of Croton-on-Hudson. Televate is excited with the possible opportunity to deliver this groundbreaking tool and services to aid the region. In the event that Televate is so fortunate to be the successful applicant for this project, we would be pleased to work jointly with the Village and the Town of Cortlandt on an expansion of this project.

Please do not hesitate to contact me should you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "A. Richard (Rick) Burke".

A. Richard (Rick) Burke  
Managing Partner, Televate, LLC  
Phone: 703-639-4201  
Email: [rburke@televate.com](mailto:rburke@televate.com)  
Address: 1934 Old Gallows Road, Ste 350,  
Vienna, VA 22182  
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Vienna, VA 22182

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## 1 Televate, LLC Background and Qualifications

Founded in September of 2001, Televate, LLC is a nationally recognized information technology and engineering consultancy delivering innovative wireless and wired telecommunication solutions to state and local governments, critical infrastructure organizations and authorities, and enterprise clients. As champions of public-centric communications solutions, Televate comprises software developers, engineers, and program managers who are not just wireless, wired and IT technology experts—we are advocates for agencies and organizations focused on enhancing their telecommunications capabilities. We have dedicated much of our careers to the delivery of solutions and communications networks for communities often underserved by technological advancement and budgetary funding. Televate works as a liaison between the diverse communities we serve and the legislative bodies that govern them to ensure that the needs and concerns of extended community are voiced and addressed.

Televate engineers and support personnel have direct knowledge in designing and operating cellular wireless networks based on their previous professional career practices. We likewise have recent experience in designing broadband wireless communications for various governments, along with extensive experience with the public safety First Responder Network Authority (FirstNet) ([FirstNet Authority | First Responder Network Authority](#)) and the nationwide 4G/5G FirstNet system, managed by AT&T Wireless ([Nationwide Broadband For First Responders & Public Safety at FirstNet](#)).

Members of our proposed Village of Croton-on-Hudson (“Village”) project team have designed 1,000s of wireless tower and antenna support structure site design and we fully understand the requirements to manage wireless facility designs in compliance with local government site zoning and permitting requirements. We have accessed numerous wireless facility sites on behalf of local and state governments and have served as expert witnesses in numerous zoning hearings and community associations briefings on behalf of governments to both support government radio tower implementations for public safety networks, and to ensure that commercial cellular tower implements are in the best interest of the local community.

Our decades of experience in supporting government and commercial wireless system design and tower site placement initiatives to ensure that the proposed tower/antenna support facility are ideally located, adhere to local code and ordinances, do not negatively affect land/building/residential property values, and do not pose risks to human exposure to harmful radio frequency (RF) exposure, are ideally suited to support the Village on the cellular carrier facility inventory and Telecommunications Code analysis and recommendations program. Televate has assisted our customers in assessing wireless facilities and the associated quality of fixed and mobile wireless coverage and in assess and recommending Telecommunications Code updating and development for both cell site placement and for public safety in-building coverage requirement for large building owners. Televate has designed and managed the all of the outreach and participation logistics of residential and business surveys to obtain and integrate community input into decision making for government leadership on telecommunications initiatives similar to the Village.

Televate additionally developed and will leverage for this project our Pinpoint™ cellular coverage measurement and assessment applications ([www.televate.com/pinpoint](http://www.televate.com/pinpoint)) that operates on commercial cellular smartphones to capture and quantify 3G/4G/5G cellular network coverage. Pinpoint will also support the wireless carrier mapping effort as it includes the capability to tri-angulate signal coverage to identify transmitting cell site locations. Pinpoint is one of a variety of proposed Televate project differentiators to support the program.

## 1.1 Corporate Organizational Structure

Televate is a limited liability company that drives the highest quality project results, anchored on sound project approach and strategy, and a commitment to on time and on budget performance. All of our projects are either lead by a Televate Partner, or a Partner serves as a sponsor to assigned Project Manager. Depending on the size and duration of the project, technical staff can be fully dedicated to a single project or assigned to several projects concurrently.

In addition to our current staff of full-time employees, Televate employs a variety of experienced and qualified broadband consultants to complement and supplement our project teams as may be appropriate. This includes software developers, GIS consultants, IT professionals to help maintain our proprietary wireless testing service Pinpoint™, and other support staff.

## 1.2 Firm Expertise and Capabilities

Televate's expertise is in large-scale government public safety and broadband network design, construction, management, and operations. Televate has led numerous design and deployments projects involving wireless networks, fiber networks, microwave networks, and Wi-Fi technologies serving our customers over thousands of square miles. Televate's team of engineers, technologists and consultants has resolved many of our nation's critical communications challenges, providing a variety of technical and program management services for dozens of technology initiatives, wired and wireless broadband networks, and distributed antenna systems. Having served customers ranging from states and large metropolitan areas to rural counties and building owners, we have built a wealth of knowledge regarding broadband communications technologies and requirements.

This expertise includes commercial cellular technology design, propagation analysis, network troubleshooting, network operations, and service audits. In addition to this networking experience, Televate has launched some of the earliest uses of government broadband applications, and quickly understood the key challenges associated with delivering high-quality user experience. As a result of unrealistic carrier maps and leveraging this expertise in networks and mobile applications, Televate developed the cellular coverage application and service, Pinpoint, in 2018.

Televate has been the leading consultancy in delivering local and state broadband communications systems and solutions for public safety and other government end user agencies. Beginning in 2003, we conceived, designed, facilitated the procurement process, managed system construction, and directly operated a multi-site 3G commercial wireless network (CDMA technology) and a fiber optic network connecting multiple local governments in the National Capitol Region (NCR). Televate leveraged and expanded on this initial government broadband work to provide broadband strategic planning, system implementation and operations for 14 states and U.S. Territories (Minnesota, Ohio, North Dakota, Florida, Virginia, Oklahoma, Vermont, Wisconsin, New Jersey, Alabama, New Mexico, Idaho, District of Columbia, Virgin Islands), and for multiple local jurisdictions.

## 1.3 Related Project Experience

Televate, and a number of our telecommunications professionals, have extensive experience in mapping and quantifying cellular carrier tower placement and network coverage, and in supporting governments with the review of tower placement code and zoning regulations. We have provided a few examples below, together with the government project contact information, and can provide additional references upon request.

### 1.3.1 Berlin Township, OH Wireless Coverage Expert Witness

Televate was recently retained by Berlin Township to serve as an expert witness in support of a dispute between the Township and cellular tower provider whom the Township maintained constructed a tower without following the appropriate zoning regulations. Televate performed an analysis and provided expert opinion on the following items:

- Reviewed the Townships telecommunications codes and associated zoning ordinances regarding wireless tower placement
- Confirmed whether a specific wireless service provider currently has cell coverage in the area where the new tower was proposed
- Provided an opinion on the nature and scope of the coverage
- Commenting on the findings of the opposing party relating to the extent of capacity issues within the area in question and how they related to coverage concerns
- Evaluating the impact on coverage of a proposed tower with antennas mounted at various heights, including 195 feet, as well as 130 and 145 feet in according with the zoning resolution, and
- Identifying potential alternative site locations both within and potentially outside the wireless service provider’s original search ring.

Reference Name	Christopher A. Rinehart
Title	Attorney
Phone Number	(614) 221-1244
Email Address	<a href="mailto:crinehart@rinehartlegal.com">crinehart@rinehartlegal.com</a>

### 1.3.2 Los Angeles Regional Interoperability Communications System (LA-RICS)



Televate was the lead technical and program management consultancy supporting the [Los Angeles Regional Interoperability Communications System](#) (“LA-RICS” or the “Authority”) with the design and implementation of a 240+ broadband wireless network that was eventually conveyed to AT&T Wireless for integration into the Los Angeles County FirstNet broadband network. In support of this ground breaking public safety broadband network design and implementation, Televate developed the initial wireless site design, prepared the supporting equipment vendor RFP, and

lead the effort to identify and lease site for new towers and gaining access to existing government owned and commercially leased towers. In support of this multi-year project, Televate project support included but was not limited to the following tasks:

- Designed the initial 4G LTE network design including wireless site placement and coverage analysis
- Analyzed local Telecommunications Code and Zoning requirements within local independent jurisdictions in which the new wireless sites were implemented
- Lead the site acquisition effort to acquire property to install new wireless towers in full compliance with local tower siting regulations
- Participated in numerous local government and community organizations to share insight into the tower requirements and to address local citizen group concerns
- Conducted RF electromagnetic measurements at all wireless sites to quantify potential RF exposure

Reference Name	Susy Orellana-Curtiss
Title	Program Administrator
Phone Number	323-881-8292
Email Address	<a href="mailto:Susy.Orellana-Curtiss@LA-RICS.org">Susy.Orellana-Curtiss@LA-RICS.org</a>

### 1.3.3 State of Vermont FirstNet Coverage and Pinpoint Drive Testing



The State of Vermont awarded Televate a contract to assist the state with evaluation of FirstNet/AT&T broadband coverage testing. Televate used Pinpoint™ to assist the Department of Public Safety in evaluating FirstNet wireless coverage.

Televate assisted the state in defining drive test routes based on direct input from public safety stakeholders who expressed concerns regarding FirstNet system coverage. These areas were located within FirstNet designated Interim Operating Capability (IOC) areas of the state and were also illustrated as primarily broadband covered areas on the FirstNet coverage maps.

Televate designed and executed a formal test plan to determine the actual coverage within the Vermont defined IOC test environments. Employing the Pinpoint application and measurement equipment typically employed by the commercial carrier engineers, a comprehensive FirstNet coverage test was performed. The resulting report detailed the outcome of the drive test together with recommendations for the State, applicable to those considering subscribing to FirstNet *and* those who have already subscribed. The report additionally exposed coverage gaps between the FirstNet maps and the actual available coverage, along with suggestions for FirstNet to improve the accuracy of the broadband coverage mapping. This report is available to the public at [FirstNet Coverage Test Report – January 2020](#).

Reference Name	Terry LaValley
Title	Director of Radio Technology Services
Phone Number	(802) 241-5215
Email Address	<a href="mailto:Terry.lavalley@vermont.gov">Terry.lavalley@vermont.gov</a>

## 1.4 Key Staff and Team

Our team takes great pride in our dedication and responsiveness to client requests. We achieve this not only by attracting high caliber project team members who are committed to the delivery of program quality and excellence, but also by assigning multiple dynamic staff members, under the leadership of our Project Manager, safeguarding project continuity under any circumstances. We share a common objective to produce high quality, timely deliverables and dedicate sufficient time to meet aggressive deliverable deadlines. The proposed team has the capacity to conduct this work, and Televate has identified additional resources to assist in the program should the need arise.

The Televate team is composed of experienced broadband technical and business professionals with in-depth expertise in all aspects of the project, including broadband technologies, economic modeling and development, digital inclusion, and municipal fiber optic project implementation and operations. A summary of each team member’s project role and responsibility with background and qualifications is provided in the table below; complete resumes are included in the following section. Please see *Appendix A* for complete resumes of assigned staff for this project.

Personnel	Brief Bio
<p><b>Joe Ross, Senior Partner</b>  <i>Project Role:</i> Project Manager, wireless inventory and coverage assessment</p>	<p>Performance-driven executive with over 33 years of experience in telecommunications and information technology with nationally recognized wireless system expertise. Served as program manager for several successful wireless and fiber network and application deployments providing comprehensive technical, financial, and administrative management. Supported telecom policy initiatives for various government and has made dozens of tower location and RF exposure community and zoning hearing presentations.</p>
<p><b>Dominick Arcuri, PE, PMP, ENP</b>  <i>Project Role:</i> Subject Matter Expert</p>	<p>An experienced communications consultant who has been engaged in the management and oversight of communications projects over a 42-year period. Dom holds a number of certifications and advises clients in areas related to critical communications and interoperability; commercial wireless; radio propagation and site locations; in-building coverage; broadband data planning and requirements; and other areas.</p>
<p><b>Rick Burke, Senior Partner</b>  <i>Project Role:</i> Project Executive</p>	<p>Over 43 years of experience in wired and wireless telecommunications and information technology. Comprehensive understanding and experience with commercial cellular wireless and public safety network design and operations. Design experience with 1,000s of radio towers. Has supported community tower related hearings and has assessed and drafted code to facilitate various Telecommunications requirements.</p>

## 2 Scope of Work

### 2.1 Existing Wireless Infrastructure Inventory and Mapping

To begin developing an understanding of the existing infrastructure, Televate performed a preliminary search of the wireless infrastructure in and around the Village and has mapped those initial findings—represented by red triangles—in the following figure.



**Figure 1: Village of Croton-on-Hudson with Initial Infrastructure Locations**

The three identified existing locations are listed in Table below.

Site	Site Type	Latitude	Longitude	Height	FCC ASR
<b>Train Station (M&amp;B)</b>	Tower	41.188333	-73.881583	144'	1260126
<b>Village Hall</b>	Tower on Building	41.20833	-73.8877	?	N/A
<b>SBA – Scenic Dr.</b>	Tower	41.228639	-73.901889	150'	1270476

**Table 1: Initial Infrastructure Inventory**



As part of this task, Televate will confirm these initial findings and expand the search to identify additional infrastructure within the area that may contribute to coverage within the Village. Televate will research all licensed and Federal Communications Commission (FCC) data through the FCC's Universal Licensing System (ULS) to identify cellular licensed facilities within the Village. We will additionally search the FCC's Antenna Structure Registration (ASR) database to identify and plot registered towers within the Village.

Televate will communicate with the wireless carriers to obtain cellular facility location information assuming they are willing to share with us. We will also inquire from the carriers on where additional cell sites may be required to enhance coverage and capacity. Televate will rely on the Village to provide cellular carrier contact information along with either an introduction to these contacts or an acknowledgement that Televate is under engagement with the Village to conduct this study.

While we understand that the Village has provided locations within Croton-on-Hudson where cellular operators can construct or access colocations towers, if the Village can provide the location of potential additional sites where antenna support structures could be implemented, those locations could be mapped and verified for RF coverage benefits to the carriers. Ultimately, mapping existing tower and other antenna supporting structures, together with potential new locations, particularly within areas of the Village that are not reliably covered today, will provide a comprehensive mapping of the current and possible future options available that could be supported by the Village and its residents.

With the support of the Village to provide known future construction plans, Televate will integrate future population trends and projected implementation of new housing, high density office and housing facilities, schools, healthcare, and other buildings and campus environments that are projected for future construction into the inventory and potential tower site maps. Assessing this future population trend data will assist the analysis in identifying potential future tower and antenna structure facilities for both mobile and fixed wireless.<sup>1</sup> The Village may also have options to offer wireless carriers access to Village-owned light, traffic and other structures, and if a database is available, these facilities can also be mapped.

Once the existing wireless infrastructure inventory is compiled, Televate will coordinate with the Village to deliver a findings and recommendations presentation during a public meeting. For the consideration of the Village, if it is possible to combine the public meetings for the inventory and mapping public meeting, Televate's proposed project cost could be reduced to support two public meeting, not the three meetings as required in the RFP.

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<sup>1</sup> Fixed wireless solutions are offering wireless broadband primarily over 5G technologies.

## 2.2 Wireless Coverage Mapping

To quantify and qualify reliable wireless carrier coverage within the Village, we propose to conduct onsite field measurements for each of the primary mobile cellular carriers delivering services within the Village. Conducting field measurements is the most comprehensive and accurate method to capture, map, and analyze the breadth and quality of cellular service. Televate has conducted extensive measurements and assessment of wireless carrier coverage and quality and will leverage our tools and experiences to perform this study for the Village in support of the wireless coverage mapping.

Televate proposes to use our Pinpoint service to provide detailed coverage and performance metrics pertaining to the wireless infrastructure supporting the Village. The data collected using Pinpoint will go above and beyond the requested inventory and will accurately map wireless coverage, data throughout, and other key performance variables for the primary commercial cellular carriers including AT&T, Verizon, and T-Mobile within the Village. Pinpoint will assist with the identification of coverage gaps, the location of wireless tower facilities, as well as provide detailed information regarding the quality of coverage and the available bandwidth. Please see a description of the Pinpoint application in

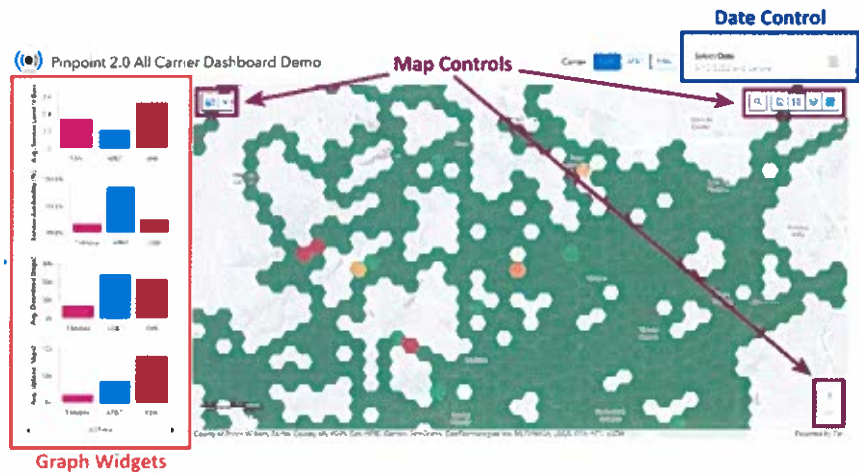


Figure 2: Sample Pinpoint Coverage Map

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## 3 Appendix A: Resumes of Proposed Professional Personnel

### JOSEPH J. ROSS

Joe Ross is a performance-driven executive with over 32 years of experience in communications and information technology with nationally recognized wireless system expertise. Joe began his career as a Design Engineer responsible for designing dozens of cellular systems encompassing 1,000s of cellular carrier radio site locations. He also worked for a major cellular network operator in both a system design and network operations capacity. He led the first public safety 700 MHz broadband deployment in the U.S. and was an instrumental leader in the first campaigns to secure 700 MHz broadband spectrum for public safety. He served as program manager for a number of successful public safety network and application deployments providing comprehensive technical, financial, and administrative management for highly complex programs. Joe has supported numerous public community and zoning hearings on radio tower location, RF exposure, and other telecommunications topics of interest to government and community groups. Joe has assessed existing code and ordinances and drafted language to support Telecommunications policy and code.

#### SKILLS

Televate will conduct an onsite street coverage test over a 1–2-day period to test most locations, including those highlighted by the Village. We can additionally provide the Village with the application to load onto Village government or resident smartphones to conduct in-building testing.

Pinpoint is a simple-to-download application from the Google Play Store that is easy to operate. It works in the background and does not affect operations. Pinpoint data is automatically uploaded to Televate secure portal and web server to support analysis by Televate personnel. Carrier coverage maps and statistics will be prepared and presented to the Village for consideration.

Once assembled, Televate will utilize this data, and together with the Village stakeholders, will develop potential options to improve the wireless infrastructure for the Village. We will use radio propagation simulation software to develop a model of the existing infrastructure and also provide recommendations on where optimal tower or rooftop locations could be sited to serve the currently underserved locations. The modeling will be based on the current Third Generation Partnership Project (3GPP) technologies used for wireless communication such as 4G LTE and 5G. The analysis results will provide potential site locations based on our decades of experience building towers for nationwide, statewide, and countywide wireless networks.

In conclusion with this phase of the project, Televate will coordinate a public presentation of the findings and recommendations. As stated above, Televate is confident the wireless inventory and coverage mapping public presentations could be combined into a single meeting if of interest to the Village.

### 3.1 Revising Existing Village Law

In conjunction with the wireless carrier inventory and coverage tasks, Televate will review the Village Code and integrate findings and recommendations into a focused presentation. The primary focus of this task is to study the existing Code as it relates to Chapter 206 and the findings to guide future radio tower or antenna structure facility siting to address existing coverage gaps within the Village. The Code may need to be modified to support the future goals of the Village to facilitate additional telecommunications towers if warranted.

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*Televate has experience developing technical policies for municipalities such as the detailed policies and procedures developed for the District of Columbia.*

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Televate has performed an initial review of Village Code – Chapter 206 relating to Telecommunications Towers. We find the code to be comprehensive in most respects, although there are opportunities to revise the code to cover more recent developments in the wireless industry such as small cells and 5G. As requested, we will provide a thorough review and, working together with the Village’s planning and zoning boards and attorney as necessary, specify specific modifications/enhancements for the Village to

consider. Televate has experience developing technical policies for municipalities such as the detailed policies and procedures developed for the District of Columbia regarding the installation and testing of wireless in-building enhancement systems – Please see the link: <https://ouc.dc.gov/page/oucs-public-safety-building-radio-systems-requirements>. We have also supported other municipalities with similar review and assessment of local codes and ordinances regarding telecommunications policy and will leverage this experience to the benefit of the Village program.

In conclusion with this phase of the project, Televate will coordinate a public presentation of the findings and recommendations.

### 3.2 Optional Public Participation Survey

Televate’s plan will primarily collect objective network availability and performance metrics using Pinpoint. This will allow us to develop a comprehensive map that identifies specific locations with poor or nonexistent coverage. However, engaging directly with members of the community adds a fundamental human element that will bolster our understanding of how these coverage gaps affect local residents. Our survey—administered online—will collect information about what carriers are actually being used, what coverage gaps are the most problematic (both outdoors and in buildings), and other concerns and frustrations that will help contextualize the Pinpoint data.

Across wireless, broadband and land mobile radio projects, Televate has managed the release of hundreds of surveys that identified end users’ communication needs and gaps. Televate will leverage our previous experience to deliver a draft survey to the Village, and with

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*Televate has managed the release of hundreds of surveys that identified end users’ communication needs and gaps.*

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input from the Village project team, will refine the survey to ensure it meets your needs. Every customer is different, and our goal is to release a survey that is customized to your particular objectives.

Televate will seek to collect online survey responses from your community as broadly as possible. Once the survey text is finalized, we recommend including a link to the online survey on the Village website that seamlessly steers the survey participant to a secure Televate server where the survey is stored; this will lend credibility to the effort, as residents will see the request is coming from a trusted government source. Additionally, the Village’s participation in advertising the survey via social media, newsletters, and/or direct communications and email notifications will ensure greater awareness, benefit, and participation. Although Televate can distribute links to the survey by email, we have found that invitations coming from government or other familiar (e.g., local organization) addresses are significantly more effective in yielding engagement.

If the Village would prefer that Televate distribute the survey, then Televate will rely on the Village to provide email addresses for survey recipients. Televate also expects that the Village will take the lead in advertising the survey and take responsibility for encouraging participation. Televate will support the Village by providing a strategy to guide this outreach.

### 3.3 Project Management

Televate subscribes to well-established project management principles throughout all phases of the project from contract signature to project close-out, including project planning, project execution, risk management, quality monitoring, and transition. Our team’s project management philosophy is anchored on the principles of the Project Management Institute (PMI) and has led to a documented history of successful technology solution implementations. All of our staff are trained on the underlying PMI and PMP project management principles.

Our team will begin the project with a video conference kickoff meeting between the Televate Team and the chosen Village stakeholders. The goal of the kickoff will be to present our project execution plan and schedule to achieve the desired Village objectives, seek support and resources from the stakeholders, and build a relationship that better enables our team to understand the requirements, goals, objectives, and expected outcomes of the program.

The project kickoff meeting objectives include:

- Define project team roles and responsibilities
- Establish program organizational chart
- Develop preliminary contacts list
- Review and refine the schedule
- Establish communications process and standards
- Define meeting types and frequency
- Develop status report requirements
- Review the issue/risk management process
- Review the project budget reporting and management process, and
- Discuss and define requirements for key stakeholder participants.

Following the kickoff meeting, the Televate Project Manager will facilitate recurring project status meetings guided by a well-structured agenda, high level objectives, and a detailed action item log. The proposed project schedule is to complete the effort within 60 calendar days and a total of 8-status/project review meetings have been included. Status and project management deliverables will include:

- Activities performed/completed during the previous period
- Status of on-going activities and action items, and
- Activities/plans for the upcoming period.

## 4 Price Schedule

VILLAGE OF CROTON-ON-HUDSON  
 1 Van Wyck Street  
 Croton-on-Hudson, N.Y. 10520

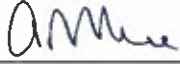
RFP #03-2023

### Wireless Infrastructure Master Plan Study

Item No.	Description	Unit of Measure	Unit Price	Total Price (In Numerals)
1	Wireless Infrastructure Master Plan Study as described in scope of work sections A & B.	Ea.	Twenty-five thousand, five-hundred, ninety-seven dollars and zero cents.	\$25,597.00
2	Optional Public Participation Survey as described in scope of work section C.	Ea.	Five thousand, six hundred fifty-six dollars and zero cents.	\$5,656.00
<b>Total</b>				<b>\$31,253.00</b>

Total in words: Thirty-one thousand, two hundred, fifty-three dollars and zero cents

Name of Proposer: Televate, LLC

Proposer Signature: 

Title of Signatory: Managing Partner

Please note that the proposed pricing could be further reduced if the three proposed public meetings could be reduced to two meetings, and/or if any of the public meetings were conducted as online video meetings (Teams, Zoom, WebEx, etc.).

Please note that the cost estimate to support this project is based on the following table of Televate professional labor categories and hourly rates.

Service Category/Title of Positions	Hourly Rate
Partner/Program Director/Principal	\$212.00
Subject Matter Expert	\$186.00
Senior Project Manager/Senior Consultant	\$175.00
Senior Engineer	\$159.00
Consultant/Design Engineer	\$136.00
Geographic Information System Specialist	\$125.00
Project Coordinator/System Analyst/Technical Writer	\$100.00
Administrative Coordinator	\$60.00



## 5 Non-Collusive Bidding Certification

### CERTIFICATE OF NON-COLLUSION

- A. By submission of this proposal, each proposer and each person signing on behalf of any proposer certifies and, in the case of a joint proposal, each party thereto certifies as to his own organization under penalty of perjury, that to the best of his knowledge and belief:
1. The prices in this proposal have been arrived at independently without collusion, consultation, communication or agreement for the purpose of restricting competition, or as to any matter relating to such prices with any other proposer or with any competitor;
  2. Unless otherwise required by law, the prices which have been quoted in this proposal have not been knowingly disclosed either directly or indirectly to any other proposer or to any competitor prior to opening, and;
  3. No attempt has been made or will be made by the proposer to induce any other person, partnership, or corporation to submit a proposal for the purpose of restricting competition.
- B. A proposal shall not be considered for award nor shall any award be made where A. 1, 2, and 3 above have not been complied with provided, however, that if in any case the proposer cannot make the foregoing certification, he shall so state and shall furnish with the proposal a signed statement which sets forth in detail the reasons therefor. Where A. 1, 2, and 3 above have not been complied with, or a signed statement furnished, the proposal shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the Village of Croton-on-Hudson, or his designee, determines that such disclosure was not made for the purpose of restricting competition.
- C. The fact that the proposer: (a) has published price lists, rates, or tariffs covering items being procured; (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items; or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of A. 2 above.

June 7, 2023

Date



Signature

A. Richard (Rick) Burke

Title

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## 6 Appendix A: Resumes of Proposed Professional Personnel

### JOSEPH J. ROSS



Joe Ross is a performance-driven executive with over 32 years of experience in communications and information technology with nationally recognized wireless system expertise. Joe began his carrier as a Design Engineer responsible for designing dozens of cellular systems encompassing 1,000s of cellular carrier radio site locations. He also worked for a major cellular network operator in both a susyem design and network operations capacity. He led the first public safety 700 MHz broadband deployment in the U.S. and was an instrumental leader in the first campaigns to secure 700 MHz broadband spectrum for public safety. He served as program manager for a number of successful public safety network and application deployments providing comprehensive technical, financial, and administrative management for highly complex programs. Joe has supported numerous public community and zoning hearings on radio tower location, RF exposure, and other telecommunications topics of of interest to government and community groups. Joe has assessed existing code and ordinances and drafted language to support Telecommunications policy and code.

#### SKILLS

- Fiber, cable, and wireless fixed broadband technologies, operations, and models
- VHF, UHF, 700 MHz, 800 MHz, 1900 MHz, Microwave, Satellite, and Alternative Spectral Bands & Wireless Networks
- Public safety application deployment
- Public Safety and Commercial Cellular Wireless System Design, Engineering, Deployment, Operations, Optimization, and Expansion
- Wireless Program Director and Network Team Leader
- Executive Program and Schedule Management and Team Development
- Customer Requirements Definition and Program Implementation
- Technical Leadership — FCC Related Matters
- WAN, LAN, and PBX deployment

#### EXPERIENCE

##### Community Broadband Projects

- Serving as the overall project manager for community broadband projects to leverage federal, state, and local funds to augment broadband service availability and adoption
- Oversee community broadband surveys, stakeholder engagements, and enagements with ISPs
- Oversee fiber and wireless network designs
- Built collaborative relationships with ISPs and community institutions to advance County objectives for broadband infrastructure and digital inclusion
- Oversee development of financial modelling of broadband infrastructure
- Oversee implementation of digital equity and digital inclusion data collection and planning

##### Technical Leadership

- Provided the early vision for nationwide 700 MHz broadband spectrum for public safety and the use of commercial technologies. Provided initial leadership and developed the Spectrum Coalition for Public Safety to advocate at the national level for 700 MHz broadband spectrum and national broadband interoperability
- Led design and deployment efforts for the first 700 MHz broadband networks for public safety in the United States including relationship development with infrastructure and device manufactures in a new spectrum band
- Chaired multiple NPSTC working group that created the 700 MHz Broadband Statement of Requirements, the Assessment of Future Spectrum and Technology, T-Band Impacts, and participated in other national efforts regarding public safety communications

## Los Angeles Regional Interoperable Communications System (LA-RICS):

- Oversight of design, deployment and operations of a county-wide LTE network that integrated LTE, microwave, and fiber
- Lead technical consulting to secure BTOP grant award of \$155m
- Developed detailed RFP specifications for broadband related system elements as well as joint LMR/LTE related specifications
- Conducted radio propagation analyses to assist LA-RICS in the selection of public safety communications sites
- Conducted backhaul design analysis including analysis of fiber (wired) and microwave (wireless) options.
- Conducted cost and financial analysis for public safety communications system
- Advised LA-RICS during contract negotiation with the selected vendor for the construction, operations and maintenance of the LTE broadband network
- Oversight of vendors constructing the LTE network including risk assessment and mitigation strategies, design review, independent verification and validation, acceptance test review, and scheduling
- Supported dozens of community meetings to deliver and address concerns regarding tower placement and RF exposure
- Developed detailed financial models for capital and operations costs for countywide wireless network operations, including fiber and microwave fixed broadband elements
- Advisor on policy and regulatory matters related to the application of LTE technology to public safety use

## Arlington County, Virginia

- Oversight of a program to assess cellular coverage county-wide including FirstNet coverage
- Executive oversight of a program to assess the integration of Arlington County and the City of Alexandria land mobile radio infrastructure into a single system

## General Technical and Financial Management

- Extensive experience in the development of broadband network requests for proposal, vendor management, and contract management
- Extensive design and design management experience for broadband communications networks including LTE RAN, backhaul, and Evolved Packet Core
- Conducted online surveys involving thousands of public safety personnel statewide to collect a census of users and their requirements for broadband service.
- Extensive experience in the financial modeling of broadband communications networks including Capital Expenditure (CapEx) and Operational Expenditure (OpEx).
- Managed grant development efforts for three BTOP applicants for public safety 700 MHz LTE systems including executive level consulting support for budgeting, system configuration, subscriber strategies, and design
- Built and led engineering teams of over 100 technical staff to engineer and implement comprehensive communications systems
- GPON, Microwave, 3GPP and other broadband technology architectures, cost structures, and operations.
- Managed budget in excess of \$50 million to create and implement wireless networks and solutions
- Provided land mobile radio engineering and consulting services including 800 MHz rebanding, P25 vendor selection, P25 interoperability analysis, system remediation analysis, P25 system budgeting and planning, and Communications Planning
- Ten years of experience designing, optimizing, maintaining, and managing commercial cellular systems comprising several thousand cell sites
- Deployed and managed enterprise communications and IT systems including Wi-Fi, WAN, LAN, cellular, VoIP, Microsoft Exchange, and Microsoft SharePoint

## EDUCATION

<b>1995</b>	<b>MBA, University of Florida, Gainesville, FL</b>
<b>1989</b>	<b>BS, Electrical Engineering, Virginia Polytechnic and State University, Blacksburg, VA</b>

## DOMINICK ARCURI, PE, PMP, ENP



Dominick Arcuri, P.E., PMP, ENP, SMC is an experienced communications consultant who has been engaged in the management and oversight of communications projects over a 42-year period. Mr. Arcuri advises clients in areas related to two-way radio technology and standards; regional communications systems and interoperability; radio propagation and site locations; in-building coverage; broadband data planning and requirements; and other areas. He is a registered professional engineer in multiple states, a certified Project Management Professional and an Emergency Number Professional. Dominick is a recent member of the NENA NG9-1-1 PSAP Systems working group and previously served on the APCO Project 43 technical committee and APCO broadband committee as well as the APCO P25 committees and has previously chaired the committee responsible for P25 Phase II TDMA systems.

## SKILLS

- P25 Network Design, Engineering and Implementation
- LTE/Broadband Data Requirements and Planning
- Public safety interoperable and regional communications solutions
- Technical Specification and RFP Development
- Distributed Antenna Systems (DAS) and Bi-directional Amplifiers (BDA)
- Proposal Evaluation, Assessment and Negotiations
- Communications Spectrum Planning and Rebanding
- RF Site Infrastructure Acquisition, Licensing, Assessment and Evaluation
- Automatic Vehicle Location (AVL) solutions

## EXPERIENCE

**Long Term Evolution (LTE)/FirstNet Projects**

- **Commonwealth of Kentucky** – Served as the public safety communications subject matter expert, provided expertise and assistance to the Commonwealth in support of their Public Safety Broadband planning activities.
- **State of Maryland** – Provided subject matter expertise related to the State’s data collection and Public Safety Broadband planning.
- **State of Indiana** – During the FirstNet data collection process, Mr. Arcuri performed an analysis and worked with the State to compile and analyze Public Safety Broadband requirements from nearly 100 agencies throughout the State.
- **City of Charlotte – Public Safety LTE requirements; RFP; negotiations** – The City of Charlotte and its regional partners in the Mecklenburg County engaged a consulting team, led by Mr. Arcuri, to assist in the development and definition of a comprehensive business plan for the Wireless Mobile Broadband Network and assist in its procurement and deployment.

**Evaluation and Validation Projects**

- **Berlin Township, OH** – Performed analysis of cellular coverage and capacity within the area of a proposed cellular tower application and provided expert witness and testimony in support of the Township.
- **Cell Site Application Review** – Numerous reviews provided for jurisdictions throughout Virginia and the east coast.
- **State of Michigan 800 MHz Rebanding** – Provided comprehensive rebanding services for the Michigan Public Safety Communications System (MPSCS) throughout all planning, negotiations and testing phases.
- **Kent County, MI** – Provided engineering and project management expertise to the Kent County Dispatch Authority in support of their 12-site, 22-channel, P25 radio system implementation and integration into MPSCS. This included negotiation and oversight of an enhanced coverage testing procedure.

- **PTToC project** – As part of a large commercial Push-to-Talk (PTT) deployment for a global oil and gas company, Mr. Arcuri developed a detailed PTT test plan and evaluation matrix.

#### Strategic Planning Projects

- **State of Ohio** – Reviewed the organizational structure and developed the future operating vision for the State’s Multi-Agency Radio Communications System (MARCS).
- **St. Louis, MO Regional Communications Plan** – Mr. Arcuri managed the project to develop the St. Louis Regional Land Mobile Radio Communications Plan for the St. Louis Urban Area.
- **Virginia Region 2000** – Mr. Arcuri managed the needs assessment, specification development, procurement and negotiations of multi-county P25 public safety radio system.
- **State of West Virginia** – Mr. Arcuri assisted with the development of a comprehensive plan for the long-term organization, maintenance and sustainability of the Statewide Radio Network and developed a high-level wireless broadband plan for the State.

#### Regulatory Planning and Compliance

- **Antrim County, MI** – As part of the development and implementation of an enhanced hybrid paging system for Antrim County, pursued and acquired a “Determination of No Hazard” finding from the FAA for a new communications tower.
- **Erie County FCC** – As part of this radio upgrade and interoperability project, managed locating new frequencies and completing UHF licensing at multiple sites for the County.
- **800 MHz Rebanding Projects** – During several dozens of FCC-mandated 800 MHz rebanding projects, including some state-wide projects, performed all FCC required negotiations, filings and licensing tasks.
- Mr. Arcuri possesses an FCC Registration Number (FRN) and a **General Radio Operator’s License (GROL)**.

#### Land Mobile Radio Projects

- **Antrim County, MI** – Performed an evaluation, coverage analysis, and needs assessment for a county-wide VHF paging and communications system and compared performance to the statewide network. Televate provided several next generation system recommendations along with a comparison and estimated budget for each and is currently supporting implementation of the preferred approach.
- **St. Louis, MO Regional Communications Plan** – Mr. Arcuri managed the project to develop the St. Louis Regional Land Mobile Radio Communications Plan for the St. Louis Urban Area and assisted with the management of integrated countywide LMR systems in St. Louis, St. Charles, and Jefferson Counties.
- **Lucas County, OH** - Lucas County, Ohio and the City of Toledo implemented a joint project to upgrade and expand the existing Toledo 800 MHz trunked radio system to provide complete county coverage and to serve all public safety entities within Lucas County. Mr. Arcuri served as the consultant project manager to direct the procurement and implementation of an integrated P25 City/County system.
- **Erie County, NY** – Managed the project to update the Tactical Interoperable Communications Plan (TICP) and develop standard operating guidelines (SOGs) for shared interoperability channels and the Mutualink interoperable communications system, as well as develop a field operations guide (FOG) for Erie County, NY, which is a member of the City of Buffalo, County of Erie, and County of Niagara (BEN) Urban Area Security Initiative (UASI) region, and the Western New York Interoperable Communication Consortium.

#### Project Management Experience

- **Kent County, MI** – Providing engineering and project management expertise to the Kent County Dispatch Authority in support of their 12-site P25 radio system implementation and integration into MPSCS.
- **Ingham County, MI** – Providing engineering and project management expertise to Ingham County Central Dispatch in support of their 9-site P25 radio system implementation and integration into MPSCS.
- **Clinton County, MI** – Providing engineering and project management expertise to Clinton County Central Dispatch in support of their 3-site P25 radio system implementation and integration into MPSCS.

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## EDUCATION AND CERTIFICATIONS

<b>2022</b>	<b>iBwave In-Building Public Safety Certification</b>
<b>2019</b>	<b>FCC General Radio Operator License (GROL)</b>
<b>2018</b>	<b>Scrum Master Certification (SMC)</b>
<b>2014</b>	<b>Six Sigma Green Belt</b>

**2011**      **Emergency Number Professional (ENP)**  
**2009**      **Certified Project Management Professional (PMP - ID: 1293786)**  
**2002**      **Registered Professional Engineer (P.E.), Missouri (License # 2010012793), VA, KY, CA, MI, FL**  
**2000**      **MBA, Duke University, Durham, NC**  
**1983**      **MSEE, Syracuse University, Syracuse, NY**  
**1980**      **B.S., Computer and System Engineering, Rensselaer Polytechnic Institute, Troy, NY**

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#### RECENT PUBLICATIONS

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- P25 Sharing = Cost Savings white paper: PTIG – Feb 2020
- P25 Trunking – Control Channel Options: MissionCritical Communications – Feb 2018

## A. RICHARD BURKE



Rick Burke is a co-founder and Managing Partner at Televate LLC, a Vienna, VA-based consultancy specializing in system engineering and program management for government and commercial communication systems and information technology solutions. With over 40 years of experience in wireless and broadband telecommunications and information technology, Rick has extensive system engineering and operational experience with, wired and wireless broadband technologies, commercial cellular, land mobile radio, and other voice and data networks. Accomplished in all facets of broadband network capital investment and operational cost modeling and assessment, and in facilitating network operational governance and cost sharing analysis.

### SKILLS

- Strategic planning and development of functional government telecommunications programs and initiatives
- Implementing large scale, multi-jurisdictional and multi-agency programs
- Extensive stakeholder and community outreach including interviews and survey techniques
- Program planning, management, scheduling, requirements gathering, budgetary management, procurement, technology development oversight, operational governance
- Crafted governance, policy, procedures, pricing to guide the government telecommunications operations
- Fiber and wireless broadband network design, deployment, and operations
- VHF, UHF, 700 MHz and 800 MHz
- Federal and state grant application strategy and preparation
- GIS mapping design, analysis, interpretation

### EXPERIENCE

#### **Broadband Communications Technology**

- Supporting multiple County broadband assessments including broadband survey design and analysis, stakeholder outreach, state and federal broadband grant analysis, digital equity and inclusion, and comprehensive strategic planning to address unserved and underserved communities
- Program Manager for the National Capital Region Interoperability Program (NCRIP or NCRNet) to deliver fiber optic and wireless broadband capabilities within the NCR
- Provided strategic consultation to a regional Chief Information Officer (CIO) team advancing, among other capabilities, a regional broadband fiber network – drafted and refined policies and procedures to guide the implementation, operations and funding, and the data securely shared over the network
- Develop comprehensive capital expenditure and operational expenditure modeling of broadband telecommunications systems to guide staffing, funding, and overall operations
- Prepared BTOP grant applications that resulted in over \$200 million in awards in the State of New Mexico and the Los Angeles Regional Interoperable Communications System (LA-RICS)
- Conducted needs assessment for public safety stakeholder broadband coverage, devices, and applications
- Authored multiple technical statements of work (SOW) to support the procurement of Band Class 14 (BC-14) RAN, CORE, network management system (NMS), user equipment (UE), fiber and microwave backhaul, and all associated design, construct, install, and optimization services
- Supported vendor evaluation and selection for the LTE BC-14 network solution and services
- Managed the LTE network design, and capital and operational budgeting to support network sustainability cost modeling
- Facilitated the development of a comprehensive training program to support end user training, together with network operational personnel along with RAN and CORE maintenance training

#### **State and Local Implementation Planning Grant (SLIGP) – FirstNet Consultation**

- Program Director for multiple State SLIGP projects – provide oversight direction, management, and quality control for these projects



- Conducted numerous outreach meetings at state, local, regional and tribal levels
- Prepared and delivered dozens of technical, programmatic, and operational training courses
- Drafted Public Notice and various other FirstNet requests for information
- Strategic planning with multiple state rural/community broadband directors to determine if FirstNet could support state broadband requirements
- Comprehensive cost modeling of FirstNet services, data applications, devices, and integration into service
- Developed governance models and operating policies and recommendations to guide broadband adoption and operations
- Prepared the State Plan Decision Process architecture and assessed draft State Plans for multiple states

#### **Communication Planning**

- Spearheaded a cross-agency effort to document agency communications operations, capabilities and solutions (Government Fiber Optic, Land Mobile Radio, Crisis Information Management Systems, Messaging Systems, Telephony, Data Applications and Information Technology Systems)
- Lead planner and author of the 2008 and 2012 Presidential Inauguration Communications Plans to facilitate real time alerts, messaging and voice and data communications for 10,000+ first responders over private and public wired and wireless networks

#### **Statewide and Regional Interoperability Planning**

- Conducted needs assessment to perform a gap analysis of the current state of interoperable voice and data communications
- Facilitated multiple joint agency meetings and workshops and documented a full scope of interoperable voice and data communications requirements to achieve the desired level of inter-agency interoperable communications
- Directed and managed regional interoperability to achieve a common system for sharing critical incident management communication and information among member jurisdictions
- Drive federal grant writing and grant program management and successfully lead grant awards worth hundreds of millions of dollars
- Deliver technology, training, grant development, voice and data interoperable system design and operations, 800 MHz rebanding and other consulting services to local, state and federal customers
- Provide radio network and technology consulting and design services to various Federal Government operators including the Secret Service, ATF, the Treasury Department, and other Federal agencies

#### **Grants, Training and Other**

- Drafted state and federal grants and managed the preparation of numerous other grants that lead to the successful award of hundreds of millions of dollars for local, regional and state grantees
- Delivered various technology, training, grant development, voice and data interoperable system design and operations, and other consulting services to a variety of local, state and federal customers
- Developed and delivered 100's of technical and tactical training programs to practitioners, telecommunicators/dispatchers, help desk staff, technicians, engineers and executives
- Hired, training and managed 100's of technical and administrative staff throughout my career
- Operations manager, system engineer and strategic planner for a major cellular network operator
- Managed an annual multi-million operations budget for a major telecommunications operator

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#### EDUCATION

<b>1980</b>	<b>Master's Program, Geography, University of Tennessee, Knoxville, TN</b>
<b>1978</b>	<b>Bachelors, Geography, Rowan University, Glassboro, NJ</b>

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#### PROFESSIONAL SOCIETIES

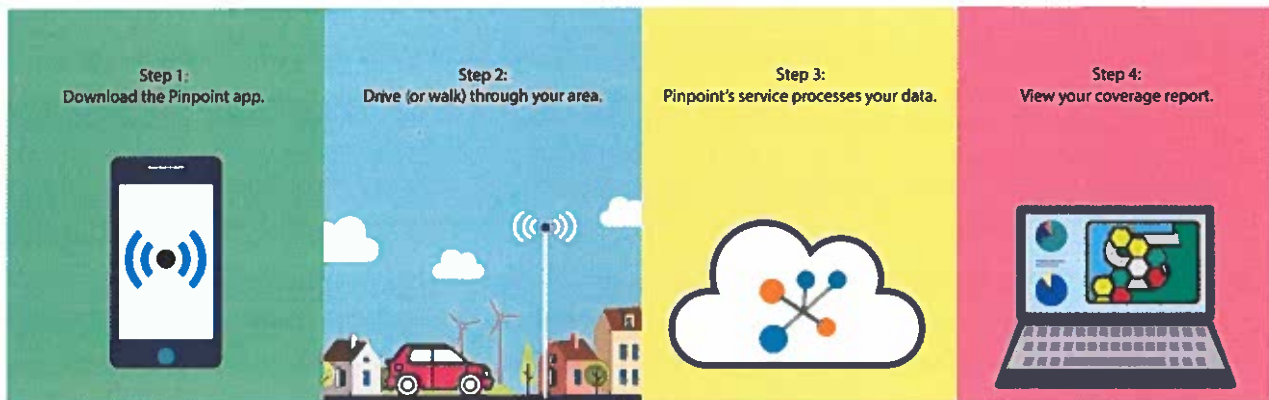
IEEE Member, APCO Member

## 7 Appendix B: Pinpoint

### 7.1 Overview

Wireless data has become an integral part of communications. Since its first introduction, there have been several evolutions of the wireless standards and the introduction of many new devices and applications to simplify user access to broadband data. Significant strides have been made in the expansion of wireless data coverage into many rural areas. Taken together, wireless data adoption has expanded dramatically, and in most cases, one would be hard-pressed to find a user that has not integrated wireless data into their daily operations. However, reliable wireless broadband coverage is a perennial issue. Wireless networks are dynamic and change as new towers and sites are added. The typical coverage maps available on the commercial carrier websites are often out of date and overly optimistic – leaving us to question – *What level of service can I depend on? Which areas lack sufficient coverage? Which carrier offers the best service in my county, city, or state?*

Pinpoint was designed to provide answers to these and other service-related questions. The Pinpoint application is designed to comprehensively test commercial cellular networks and verify coverage and performance, including the available data throughput speeds. It provides a clear and unambiguous representation of the service area of the assessed carrier networks. It is a statistical-based tool that collects and aggregates measured data directly from the end user smartphone, and displays the data in various levels of probability, service availability, and the capability of the network to support data applications through repeated tests of available throughput. The wireless carriers' coverage maps use a statistical average to predict service, whereas Pinpoint provides empirical evidence of the service level, not a prediction. The Pinpoint service includes an application, geo-processing services, and a dashboard to view maps and network statistics in an easy to use portal. Customers can create their own private, crowd-sourced maps in four easy steps:



Pinpoint collects this information frequently as the user travels over the full-service area – automatically. The results are processed nightly and are geographically depicted on easily comprehensible maps, using hexagonal grids. With Pinpoint, users can understand the details of the carrier's performance across their entire service area, not only at one point. It enables real conversations with service providers about where service is needed.

The Pinpoint application is designed for non-technical personnel use to evaluate and compare provider coverage, performance, cellular broadband data at a high level. The interface is not cluttered by irrelevant information and key functionality is easy to find and navigate. Key performance criteria are displayed clearly and prominently. There is a ten-hour activation toggle for entering the throughput test mode, which among

other purposes, is designed to manage data throughput consumption during the tests. A user can simply activate the test mode and go about their daily routine without bother. If the device travels out of the carrier's service area, the device continues to collect data, including the device location and the no service status. After the device re-establishes a connection to the wireless network, the device will automatically upload its collected data, including the all-important samples depicting lack of coverage, to our secure webservice for processing.

As a smartphone-based solution, Pinpoint includes an "Indoor" test mode. This feature supports the ability of the user to test vital indoor spaces that may be of a concern to public safety and the general public, such as schools, public venues, and other sensitive locations. The smartphone configuration requires less equipment and is more portable than a standard router configuration. An in-vehicle test scenario represents a more conservative test of the carrier's network. It is a more realistic test scenario given growing user expectations and preferences for handheld service.

The app collects over 50 different variables regarding location related information, cell network information, and test information. This includes key performance indicators such as frequency (channel number and band), technology (2G to 5G, and now with 5G+ detection), service level (number of bars), test results, and device speed, location, location accuracy, ping test results (jitter and loss), and upload and download speeds.

## 7.2 Pinpoint Dashboard

Pinpoint is a private crowd-sourced service that aggregates all customer devices into a single dashboard database. Data is processed per service provider so the customer can identify the qualities of each carrier individually.

The sample dashboard images below show actual data the Televate team collected with devices on three different carriers: AT&T, T-Mobile, and Verizon. This sample data was not collected at the same time and in the same location and should not be interpreted as a head-to-head comparison between the carriers. As a result, the graphs and figures below are for demonstrative purposes only.

The graphs on the left side of the dashboard show certain statistics to help compare carriers. These graphs include Average Service Level, Service Availability, Average Download Throughput and Average Upload Throughput for all carriers within the visible area of the map window. Users can also select specific areas with point, lines, lasso, box, and circle shapes to show core statistics for the three carriers. Bar graphs will show the aggregated data for all time, while line graphs will show the change over time. Examples of the bar and line graphs will be shown in the following dashboard images. The following sections outline our standard dashboard contents and are customizable. All map products are created in ESRI format and are downloadable by the customer at any point during the subscription using an authorized ArcGIS Online account.

The Pinpoint data is separated by carrier to aggregate coverage and performance for each individual service provider. The ESRI geodatabases, however, are aggregated by customer to allow customers to easily compare service provider coverage and performance. And because the data is natively in ESRI, any GIS professional can easily create new maps, analyses, and other output and content to suit each customer's individual needs. The Pinpoint 2.0 Dashboard comprises three basic elements: the graphing widgets, standard mapping features, and standard map layers. The figure below depicts these individual elements:

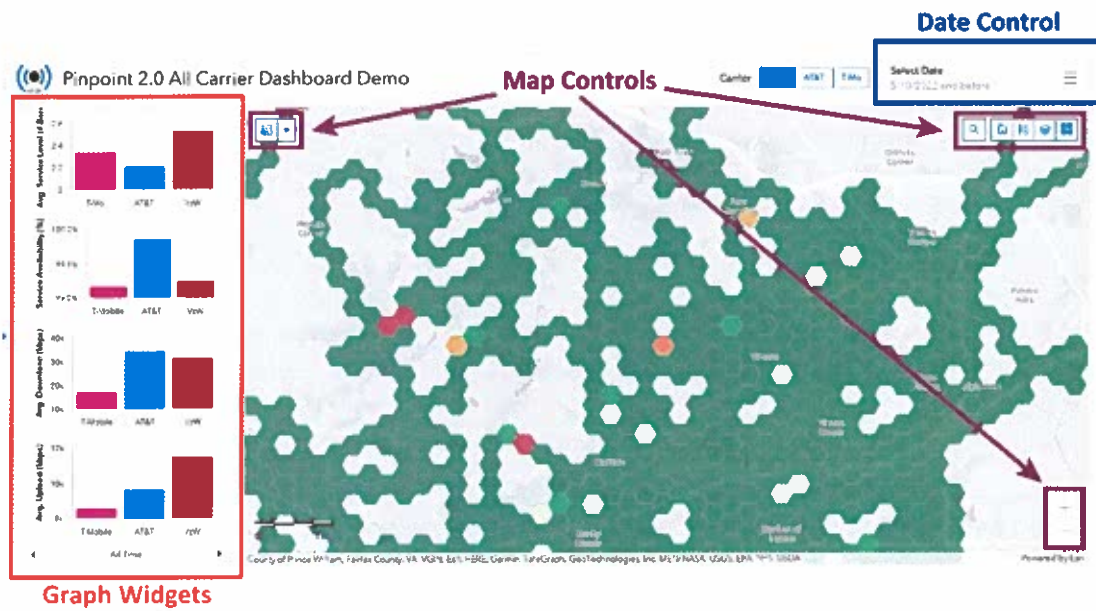


Figure 3: Pinpoint 2.0 Dashboard

## 7.3 Map Layers

The following sections detail the standard map layers that are provided by Televate. Most of the 50 different fields are mappable and can be made into map layers if desired by the customer. As depicted in *Figure 3: Pinpoint 2.0 Dashboard* above, the individual carrier map layers are nested so that each one can be visualized individually, or, if the customer desires, an all-carrier map can be provided so that elements of multiple carrier's service can be combined onto the same map. Each layer can be accessed via the map layers control, and the legend can be displayed or hidden. The standard Pinpoint grid structure is a hexagon with roughly 0.25-mile sides; however, this can be customized per the customer's desired structure.

### 7.3.1 Service Availability

Service Availability represents the aggregated data for a given bin where the device was registered on the network. The Pinpoint application records this information up to 30 times per minute, enabling the Pinpoint service to show areas where service was available only some of the time. The application depicts the percentage of samples in a given grid when the device was registered on the network.

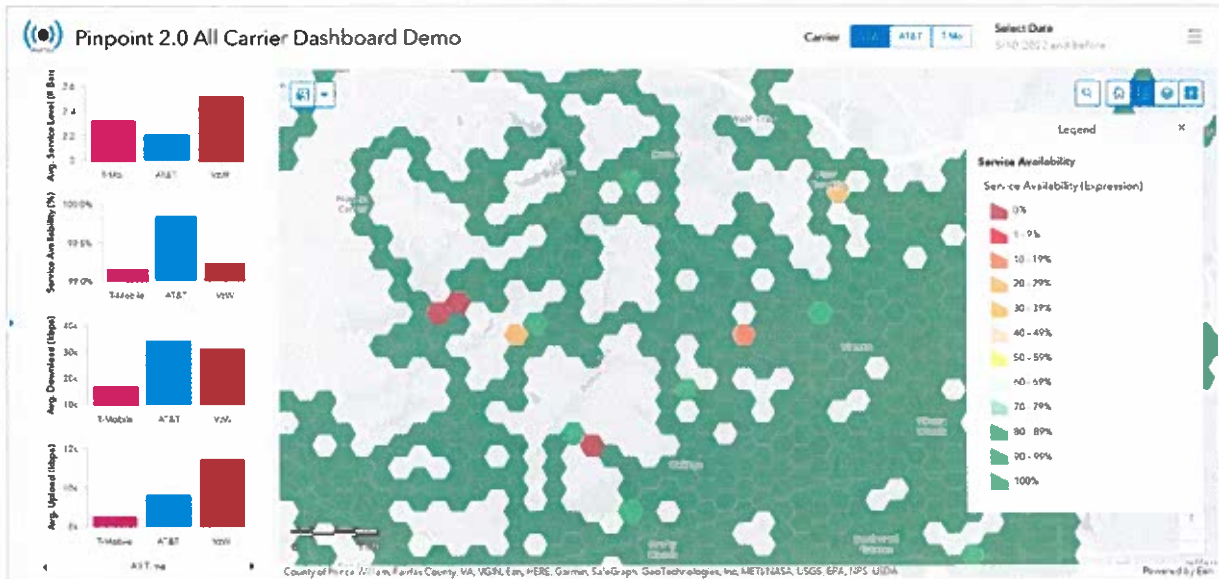
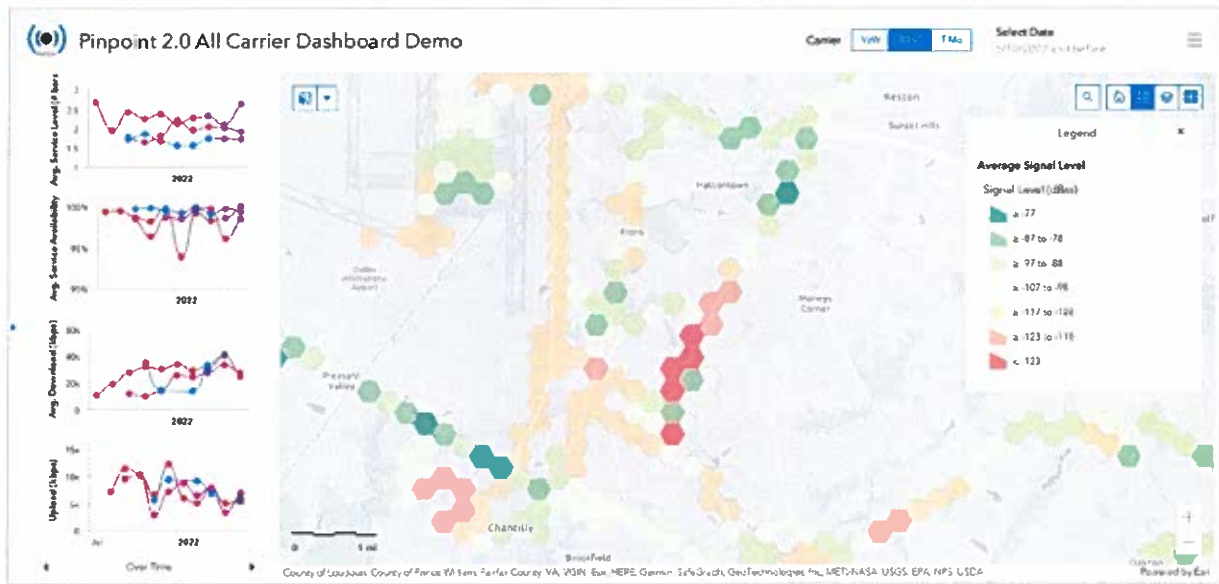


Figure 4: Sample Service Availability Map (Verizon)

### 7.3.2 Signal Level

Signal Level represents the aggregated data for a given bin and the data is presented in real world categories. The sample below equates the levels to the ability to achieve certain usage scenarios. In this particular case, all data was collected inside vehicles, and therefore, imputed coverage levels are possible. However, the actual Pinpoint application will depict signal levels in dBm.



**Figure 5: Sample Signal Level Map (AT&T)**

### 7.3.3 Average Service Level

The service level represents the number of signal level bars provided in the top tray of a smartphone device. The service level varies from zero to four. The implementation of the number of bars that are presented on the device is up to manufacturers, and therefore, there may be some subjectivity regarding service level, however, because users are more accustomed to the number of bars, Televate believes it is a highly useful measure of network service.

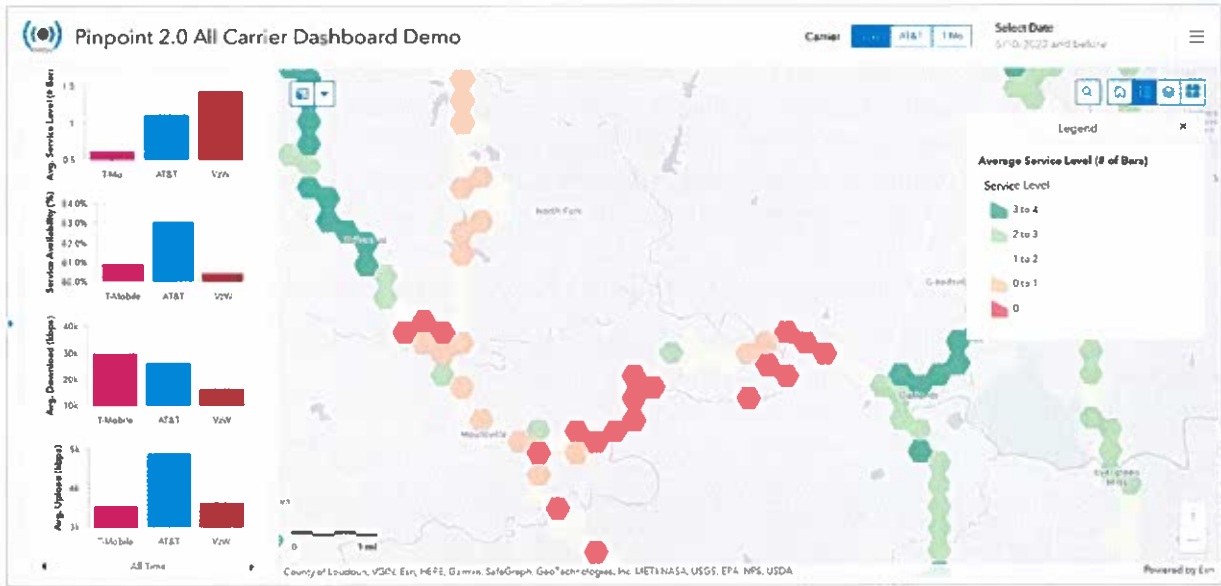


Figure 6: Sample Average Service Level Map (Verizon)

### 7.3.4 Ping Testing and Latency

A ping is a small packet of data that is sent to a server and then sent back to the originator. It represents basic connectivity and ability to connect. Pinpoint’s Ping Loss (shown in the example below) represents the percentage of pings that were successfully transmitted and received by the device. As a result, ping loss represents low-speed connection quality, and is an indicator of reliable service. The ping latency represents the total amount of time that transpired between the transmitted and received packets. It is an indicator of congestion and connectivity issues. When congestion levels in the network rise, the total amount of time between transmission and reception increases due to difficulties in securing resources to transmit the data.

Televate recently added jitter to the application and this information is captured in the aggregated database which means it is available to map if requested by the customer.

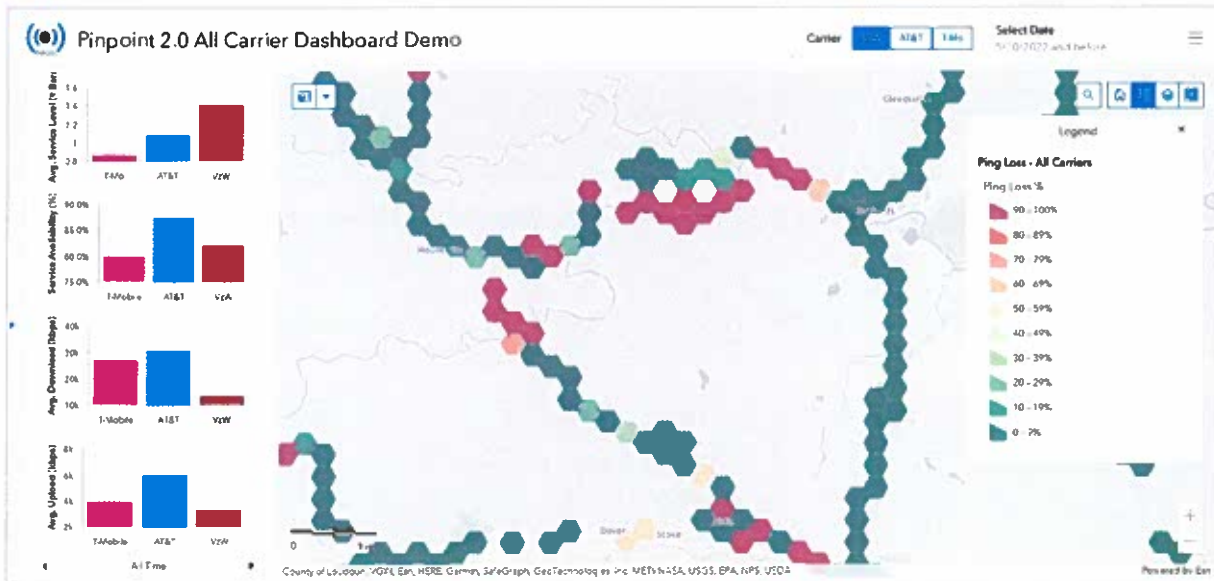
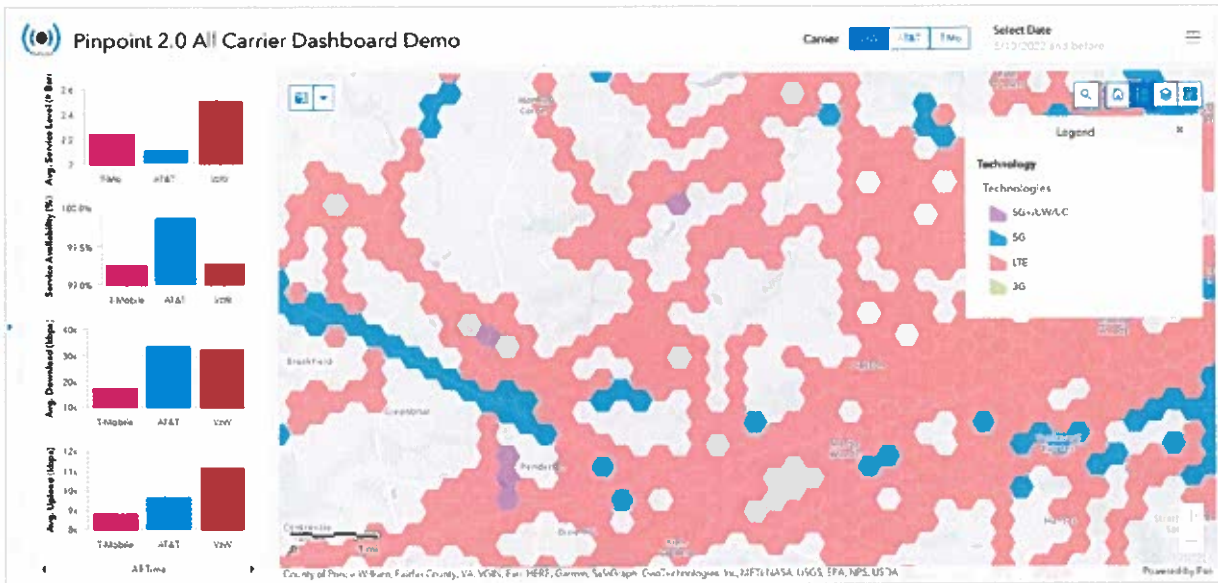


Figure 7: Sample Average Ping Loss Map (Verizon)



### 7.3.5 Technology

The technology represents the high-level technology type used by the device for every sample. It indicates whether the device uses 5G, 5G+, LTE, WCDMA, EVDO, CDMA, or GSM. This measurement is important because, at the same signal level, the performance of the mobile network may differ depending on the network type. For example, a carrier may not offer public safety quality of service over 3G technologies. In addition, 3G technologies tend to have far greater latency, affecting applications like push-to-talk. Some 3G technologies have far lower throughput capabilities.



**Figure 8: Sample Technology Type Map (Verizon)**

### 7.3.6 Download and Upload Throughput

Throughput represents the amount of data that the device was able to transmit or receive following a test designed to secure the maximum resources available to the device. The result is expressed in kilobits per second (kbps). Pinpoint includes a Throughput Test Mode, which enables it to measure the maximum available throughput for the given location. Pinpoint makes a request to download a sample file from Televate’s cloud service at the reporting interval (as rapid as once every 15 seconds), downloads as much data as it can over one second, and measures and records this information. After the download test is complete, Pinpoint conducts an upload test for one second in a similar manner. Throughput tests help to understand points in time when the network, for whatever reason does not allocate sufficient resources. This could be due to coverage, congestion, network configuration or engineering issues, or due to carrier configuration of the network to conserve resources.

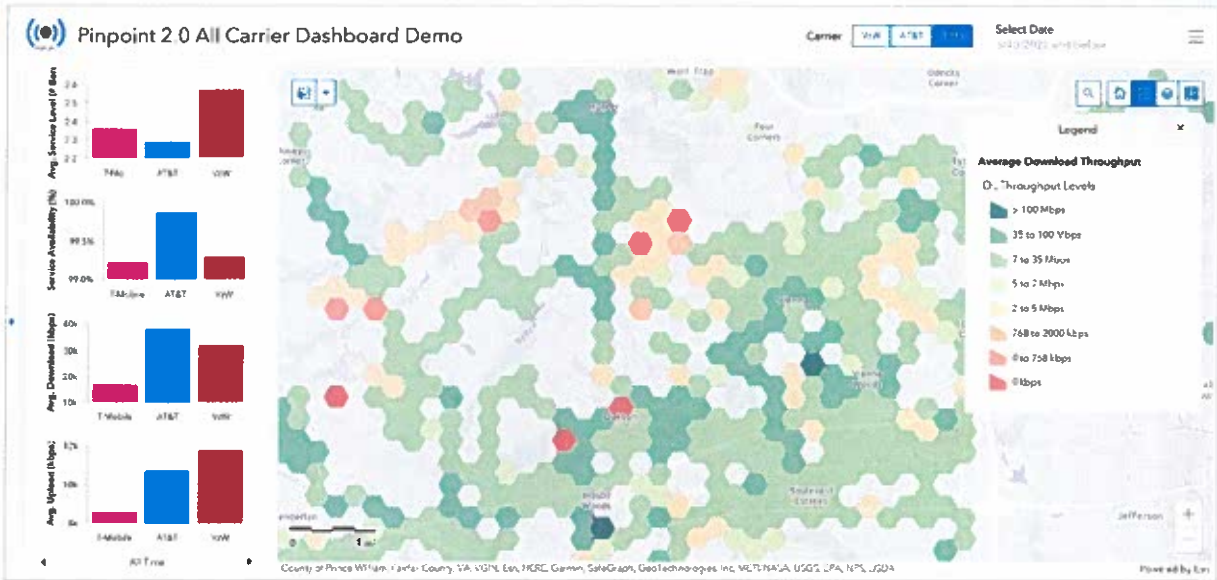


Figure 9: Sample Download Throughput Map (T-Mobile)

The following figure shows an example of upload throughput on the right-hand side of the screen, and service level, service availability, download, and upload speed changes over time.

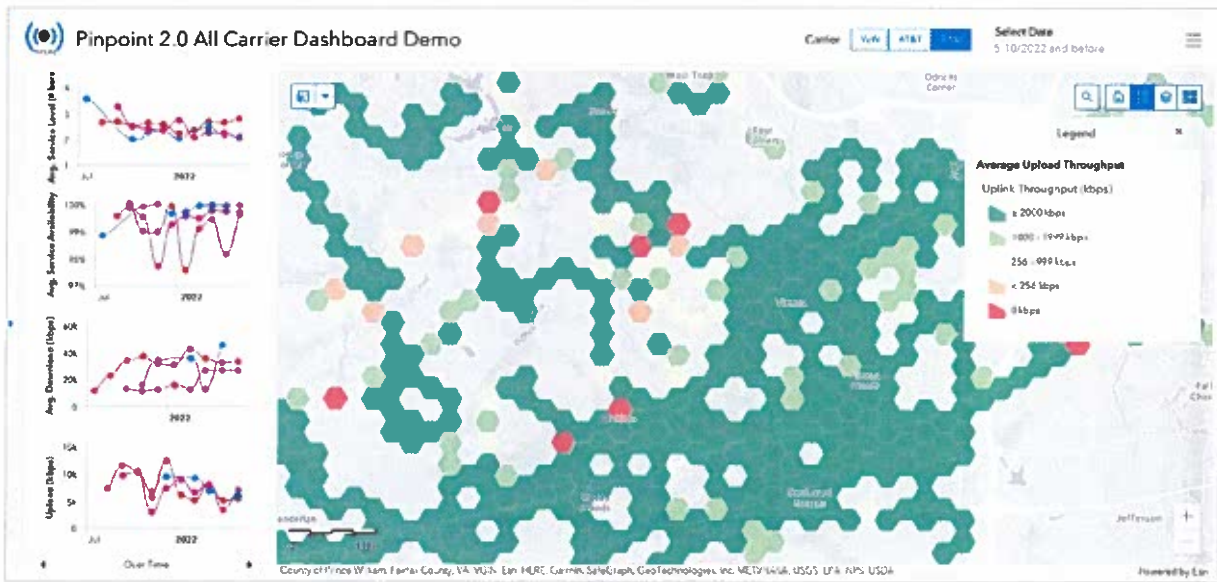
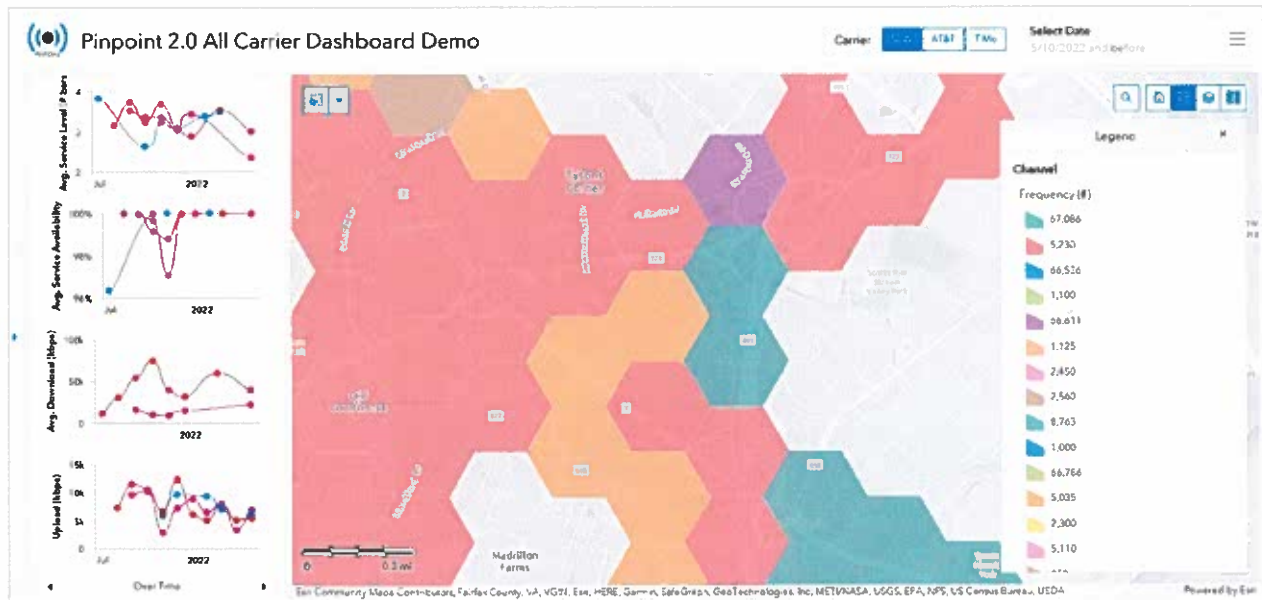


Figure 10: Sample Upload Throughput Map (T-Mobile)

### 7.3.7 Frequency/Band

Most Pinpoint data samples<sup>2</sup> contains the channel number used by the device at that point in time (up to once every five seconds). Pinpoint depicts the most frequently used (the modal) channel in each grid. The frequency can play a major role in the performance at that location. For example, use of the C-band with very large channel sizes leads to much higher throughput. Frequency will help understand where carriers have deployed new bands and can enable agencies to have a dialog with their carriers about the assignment of frequencies that would have a better coverage profile (e.g., to add a lower band to fill in service gaps or to add higher bands to address capacity issues).



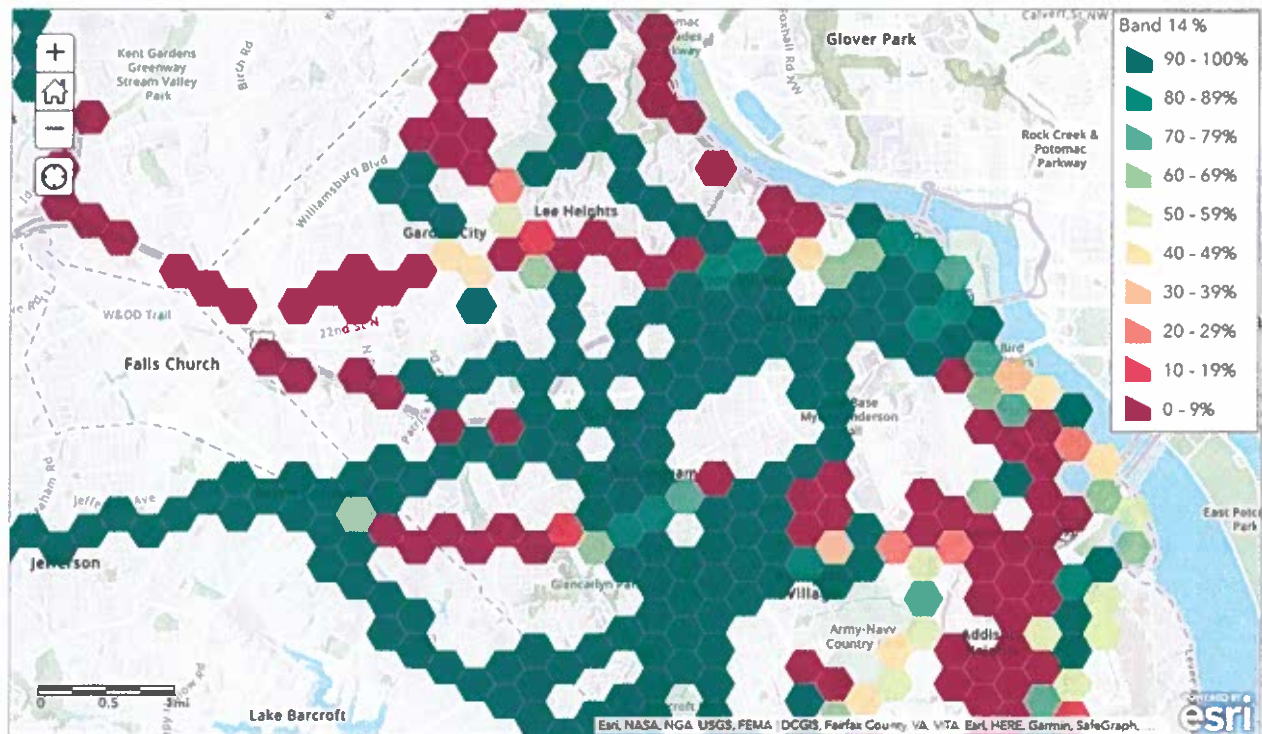
**Figure 11: Sample Frequency Map (Verizon)**

Android devices also report on the band (a collection of channels/frequencies). However, depending on the device, they provide the band less frequently than the channel numbers (frequency). Televate will create a band layer, if desired.

<sup>2</sup> Android devices provide the frequency between 50 and 70% of the time. This is generally sufficient to capture the frequency in each grid.

## 7.3.8 Band 14 (FirstNet Only) (Not included in the Village of Croton-on-Hudson program)

Similar to frequency, for FirstNet devices, Televate measures the percent of all samples where the device was primarily allocated Band 14. This helps the customer see the extent of Band 14 service (i.e., at the fringe of Band 14 service where only a percentage of devices are allocated Band 14). This information makes it easier to determine where Band 14 has been deployed, and how often FirstNet devices are being allocated Band 14. Because Band 14 may have less consumer traffic, this information may be helpful to FirstNet users to understand the actual allocation of Band 14.



**Figure 12: Sample Band 14 Map (FirstNet)**