

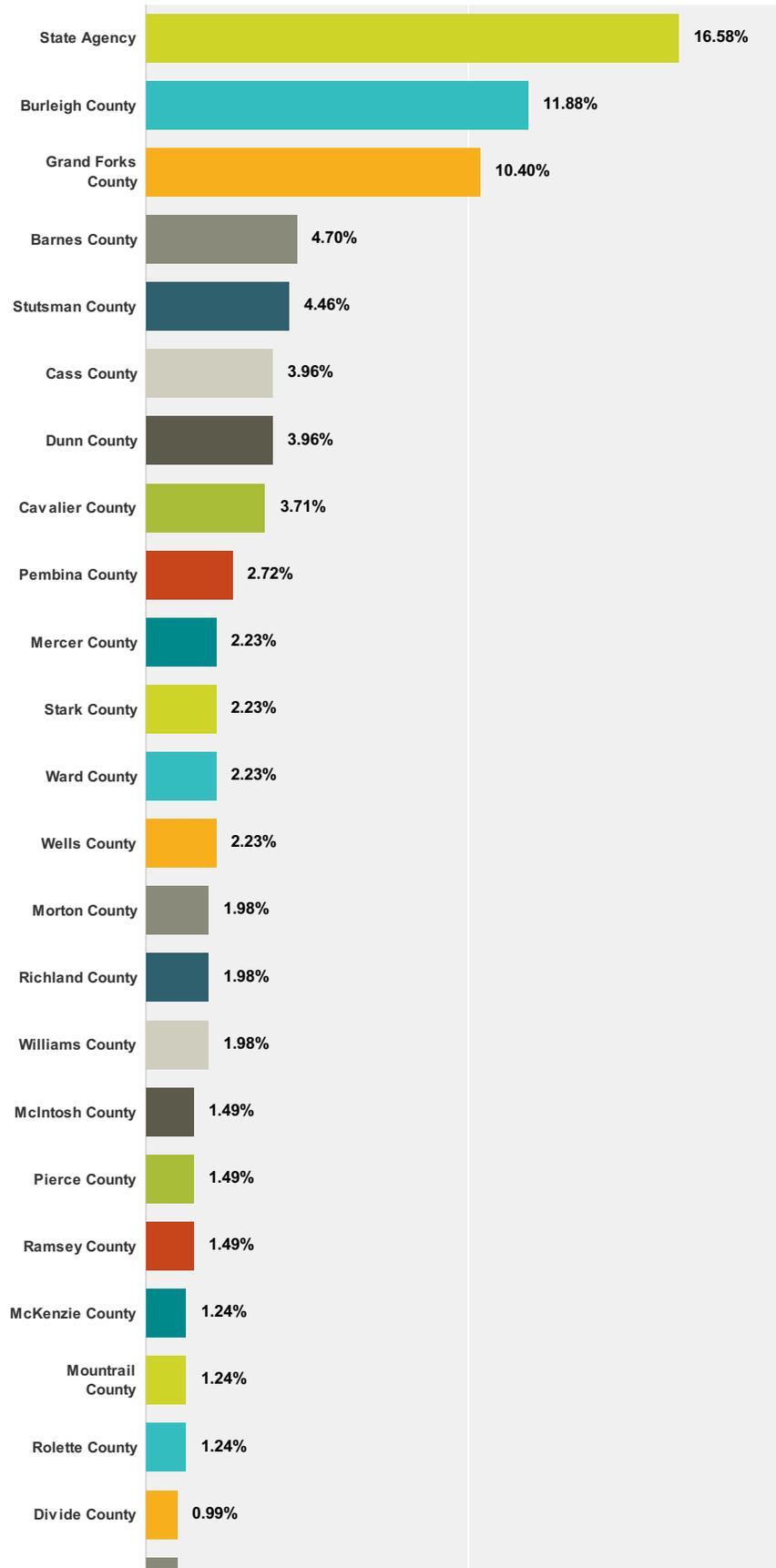
**Q1 (OPTIONAL) Please provide your contact information below in case we have questions about your responses.**

Answered: 256 Skipped: 148

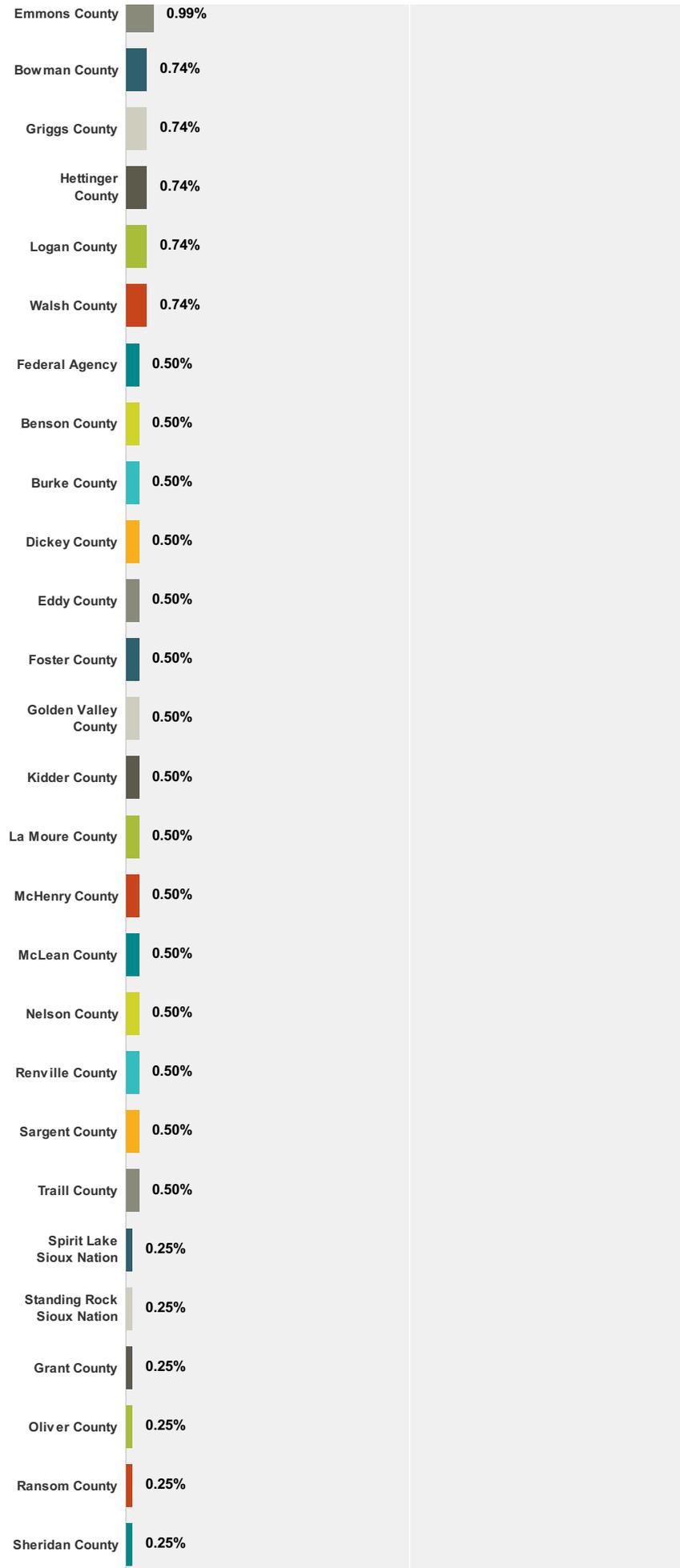
Answer Choices	Responses	
Name:	91.02%	233
Agency:	99.61%	255
Address:	0.00%	0
Address 2:	0.00%	0
City/Town:	0.00%	0
State:	0.00%	0
ZIP:	0.00%	0
Country:	0.00%	0
Email Address:	89.06%	228
Phone Number:	0.00%	0

**Q2 Please select the answer below which best describes your jurisdiction, or where your jurisdiction resides, or area of responsibility.**

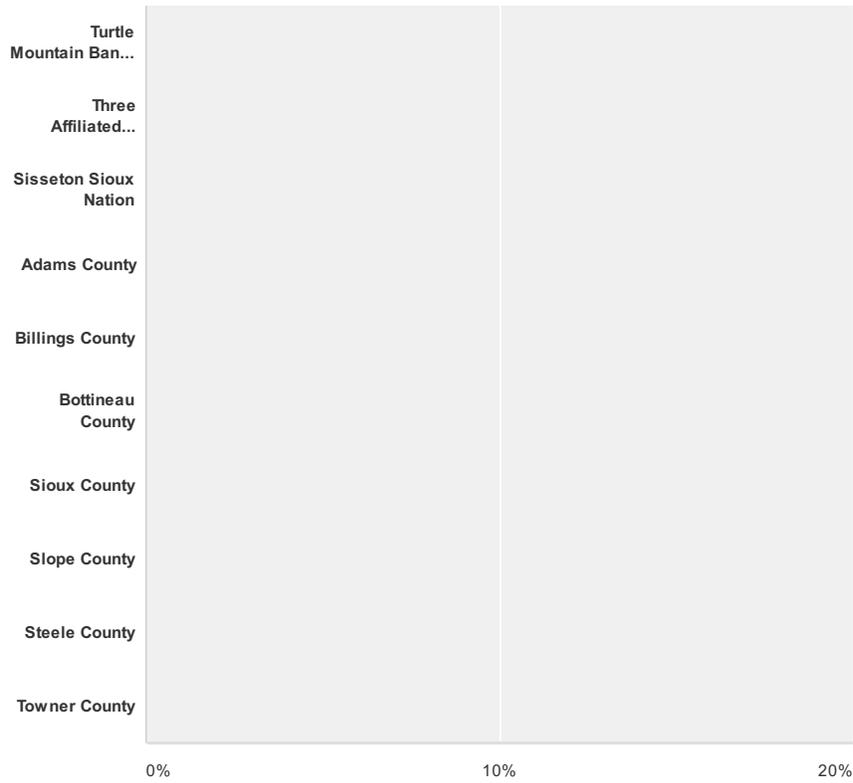
Answered: 404 Skipped: 0



# State Interoperable Executive Committee Radio Communications Survey



# State Interoperable Executive Committee Radio Communications Survey



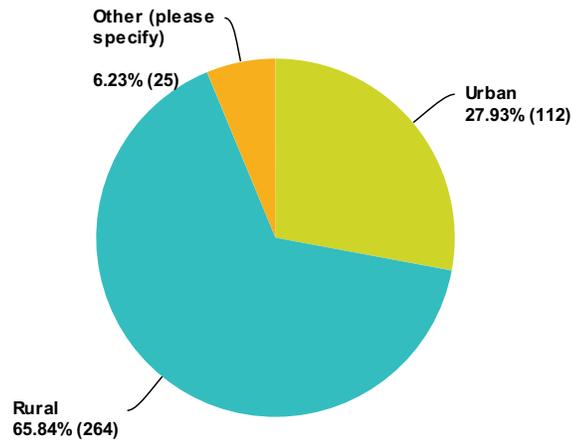
Answer Choices	Responses	Count
State Agency	16.58%	67
Burleigh County	11.88%	48
Grand Forks County	10.40%	42
Barnes County	4.70%	19
Stutsman County	4.46%	18
Cass County	3.96%	16
Dunn County	3.96%	16
Cavalier County	3.71%	15
Pembina County	2.72%	11
Mercer County	2.23%	9
Stark County	2.23%	9
Ward County	2.23%	9
Wells County	2.23%	9
Morton County	1.98%	8
Richland County	1.98%	8
Williams County	1.98%	8
McIntosh County	1.49%	6
Pierce County	1.49%	6
Ramsey County	1.49%	6
McKenzie County	1.24%	5
Mountrail County	1.24%	5
Rolette County	1.24%	5
Divide County	0.99%	4
Emmons County	0.99%	4

# State Interoperable Executive Committee Radio Communications Survey

Bowman County	0.74%	3
Griggs County	0.74%	3
Hettinger County	0.74%	3
Logan County	0.74%	3
Walsh County	0.74%	3
Federal Agency	0.50%	2
Benson County	0.50%	2
Burke County	0.50%	2
Dickey County	0.50%	2
Eddy County	0.50%	2
Foster County	0.50%	2
Golden Valley County	0.50%	2
Kidder County	0.50%	2
La Moure County	0.50%	2
McHenry County	0.50%	2
McLean County	0.50%	2
Nelson County	0.50%	2
Renville County	0.50%	2
Sargent County	0.50%	2
Traill County	0.50%	2
Spirit Lake Sioux Nation	0.25%	1
Standing Rock Sioux Nation	0.25%	1
Grant County	0.25%	1
Oliver County	0.25%	1
Ransom County	0.25%	1
Sheridan County	0.25%	1
Turtle Mountain Band of Chippewa Nation	0.00%	0
Three Affiliated Tribal Nation	0.00%	0
Sisseton Sioux Nation	0.00%	0
Adams County	0.00%	0
Billings County	0.00%	0
Bottineau County	0.00%	0
Sioux County	0.00%	0
Slope County	0.00%	0
Steele County	0.00%	0
Towner County	0.00%	0
<b>Total</b>		<b>404</b>

**Q3 What land use is predominant in your jurisdiction or area of responsibility?**

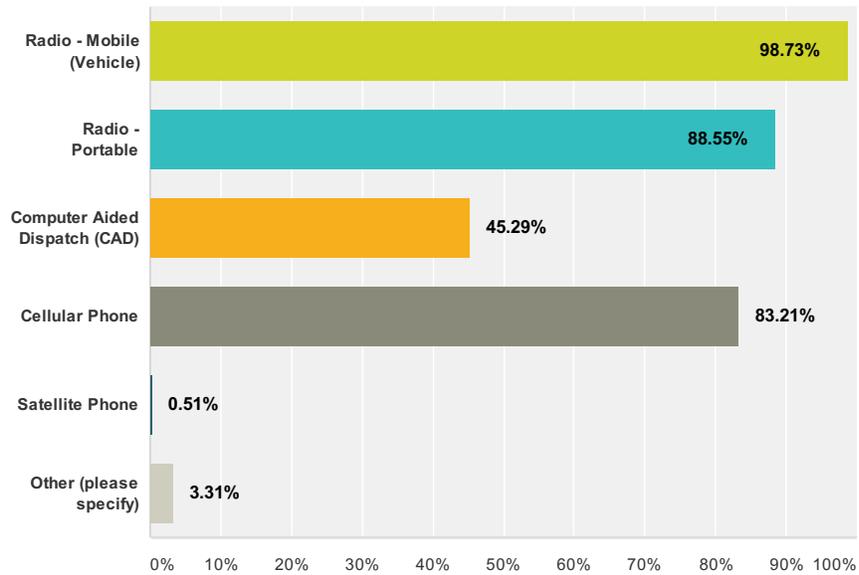
Answered: 401 Skipped: 3



Answer Choices	Responses	
Urban	27.93%	112
Rural	65.84%	264
Other (please specify)	6.23%	25
<b>Total</b>		<b>401</b>

**Q4 What devices do you use for communications with a Public Safety Answering Point (PSAP) i.e. dispatch?  
(Select all that apply)**

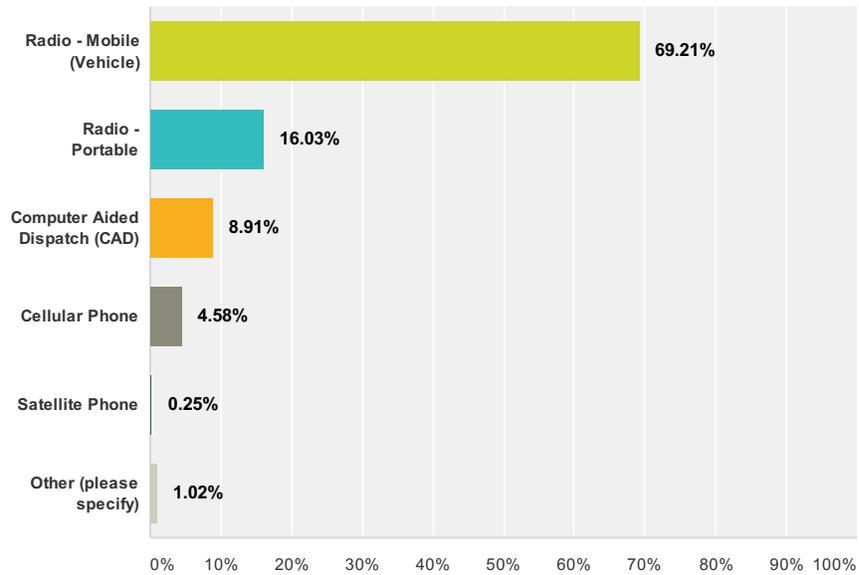
Answered: 393 Skipped: 11



Answer Choices	Responses	Count
Radio - Mobile (Vehicle)	98.73%	388
Radio - Portable	88.55%	348
Computer Aided Dispatch (CAD)	45.29%	178
Cellular Phone	83.21%	327
Satellite Phone	0.51%	2
Other (please specify)	3.31%	13
<b>Total Respondents: 393</b>		

**Q5 Of these, which is your PRIMARY device used for communication with a Public Safety Answering Point (PSAP) i.e. dispatch? (Choose only one device)**

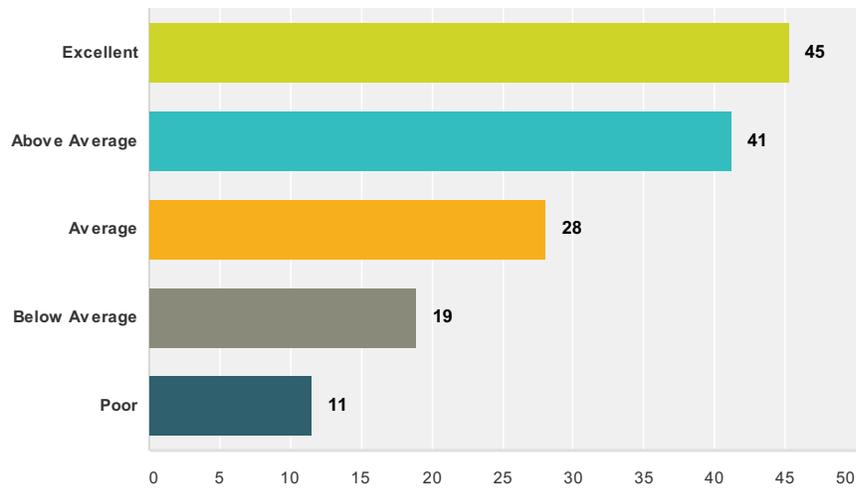
Answered: 393 Skipped: 11



Answer Choices	Responses	Count
Radio - Mobile (Vehicle)	69.21%	272
Radio - Portable	16.03%	63
Computer Aided Dispatch (CAD)	8.91%	35
Cellular Phone	4.58%	18
Satellite Phone	0.25%	1
Other (please specify)	1.02%	4
<b>Total</b>		<b>393</b>

**Q6 How would you rate, on a percentage basis (do not enter the "%" sign, just the number describing the percent), the quality of Radio - Mobile (Vehicle) communications transmitted TO dispatch?**

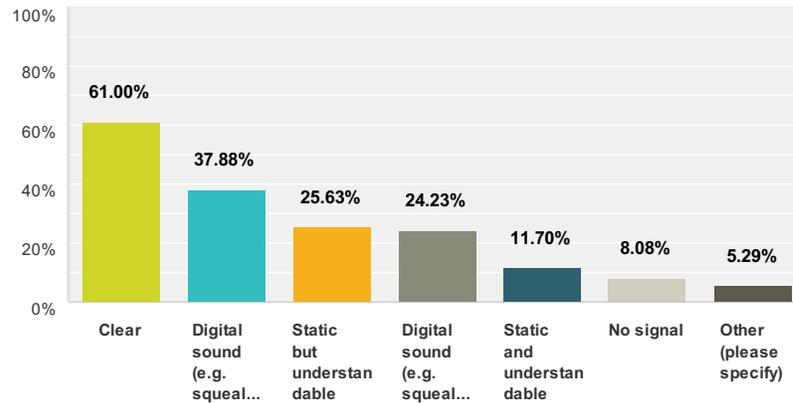
Answered: 351 Skipped: 53



Answer Choices	Average Number	Total Number	Responses
Excellent	45	10,963	242
Above Average	41	12,208	296
Average	28	6,869	245
Below Average	19	3,448	182
Poor	11	1,612	141
<b>Total Respondents: 351</b>			

**Q7 Please describe sound received by dispatch from your communications (Select all that apply).**

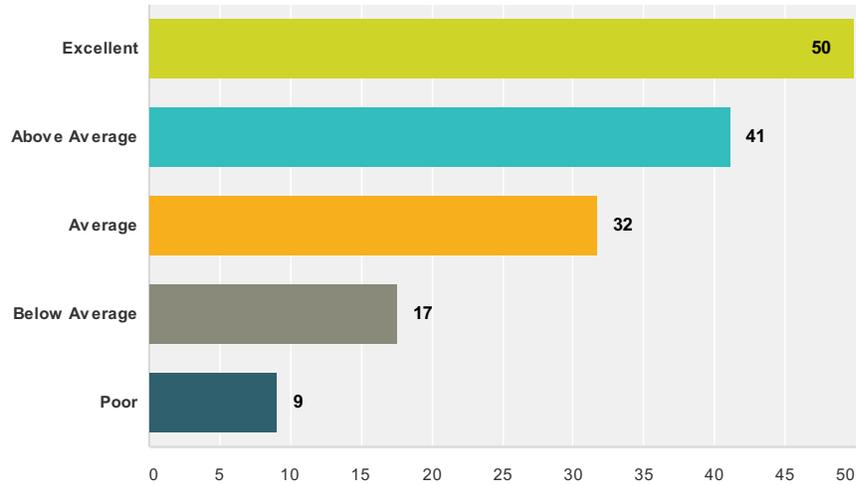
Answered: 359 Skipped: 45



Answer Choices	Responses	Count
Clear	61.00%	219
Digital sound (e.g. squeal) but understandable	37.88%	136
Static but understandable	25.63%	92
Digital sound (e.g. squeal) and unreadable	24.23%	87
Static and understandable	11.70%	42
No signal	8.08%	29
Other (please specify)	5.29%	19
<b>Total Respondents: 359</b>		

**Q8 How would you rate, on a percentage basis (do not enter the "%" sign, just the number describing the percent), the quality of the Radio - Mobile (Vehicle) communications transmitted FROM dispatch?**

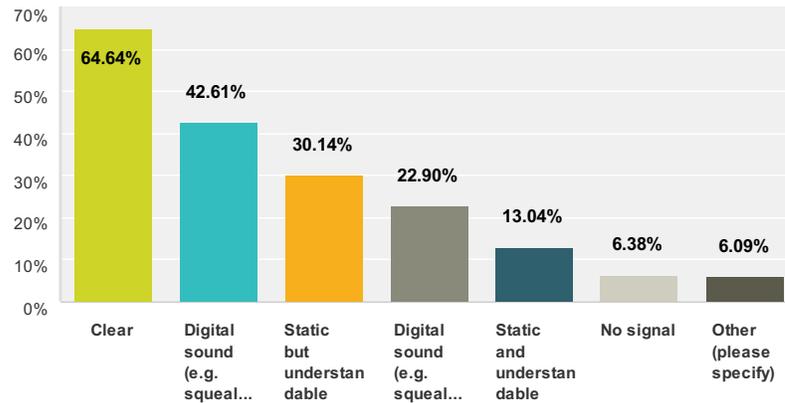
Answered: 342 Skipped: 62



Answer Choices	Average Number	Total Number	Responses
Excellent	50	11,227	225
Above Average	41	11,556	281
Average	32	7,130	225
Below Average	17	3,095	177
Poor	9	1,192	131
<b>Total Respondents: 342</b>			

**Q9 Please describe sound received from dispatch communications by you (Select all that apply).**

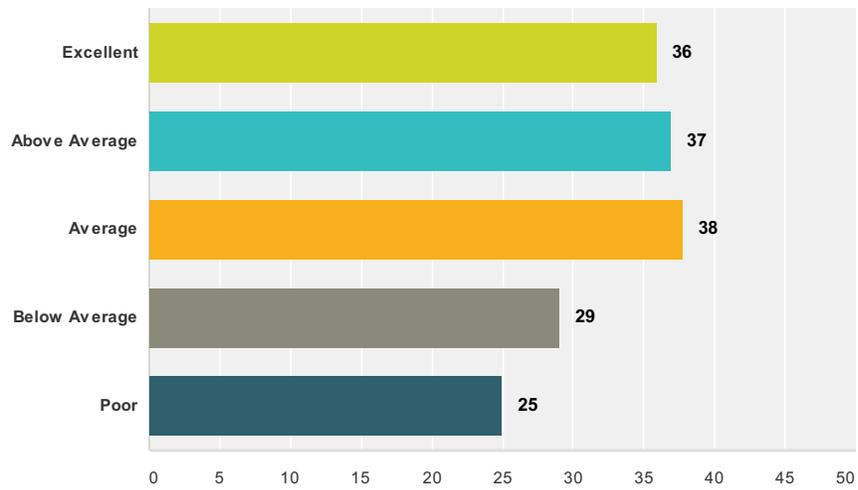
Answered: 345 Skipped: 59



Answer Choices	Responses	Count
Clear	64.64%	223
Digital sound (e.g. squeal) but understandable	42.61%	147
Static but understandable	30.14%	104
Digital sound (e.g. squeal) and unreadable	22.90%	79
Static and understandable	13.04%	45
No signal	6.38%	22
Other (please specify)	6.09%	21
<b>Total Respondents: 345</b>		

**Q10 How would you rate, on a percentage basis (do not enter the "%" sign, just the number describing the percent), the quality of Radio - Portable communications transmitted TO dispatch?**

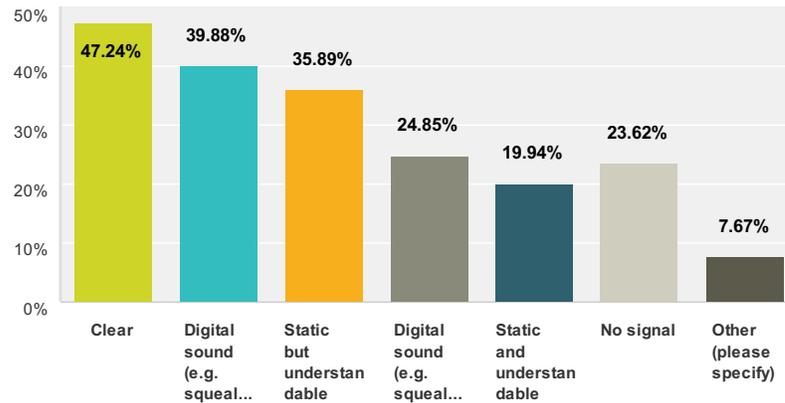
Answered: 323 Skipped: 81



Answer Choices	Average Number	Total Number	Responses
Excellent	36	5,357	149
Above Average	37	7,952	215
Average	38	9,257	245
Below Average	29	5,866	202
Poor	25	3,868	155
<b>Total Respondents: 323</b>			

**Q11 Please describe sound received by dispatch from your communications (Select all that apply).**

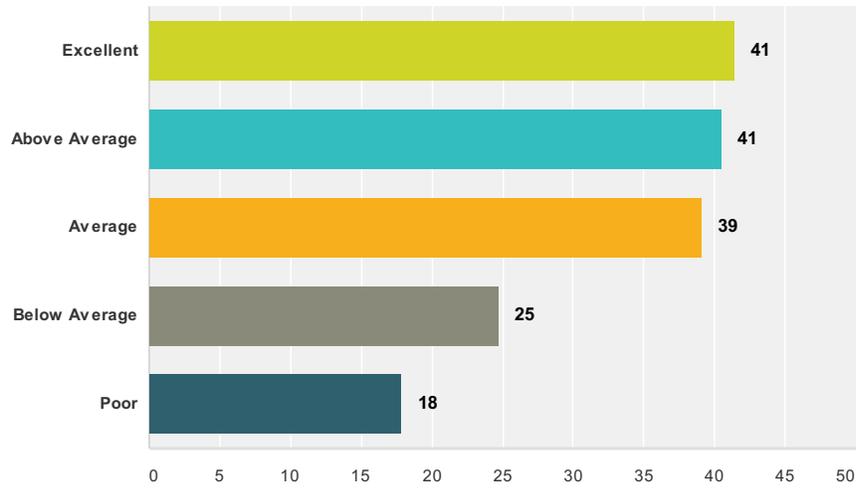
Answered: 326 Skipped: 78



Answer Choices	Responses	Count
Clear	47.24%	154
Digital sound (e.g. squeal) but understandable	39.88%	130
Static but understandable	35.89%	117
Digital sound (e.g. squeal) and unreadable	24.85%	81
Static and understandable	19.94%	65
No signal	23.62%	77
Other (please specify)	7.67%	25
<b>Total Respondents: 326</b>		

**Q12 How would you rate, on a percentage basis (do not enter the "%" sign, just the number describing the percent), the quality of the Radio - Portable communications transmitted FROM dispatch?**

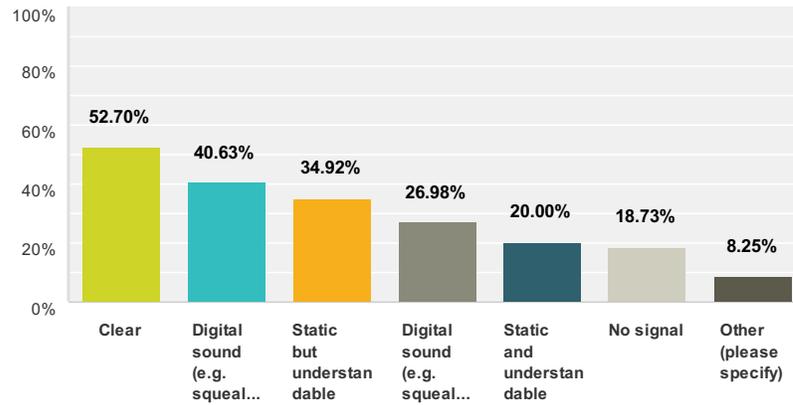
Answered: 314 Skipped: 90



Answer Choices	Average Number	Total Number	Responses
Excellent	41	6,630	160
Above Average	41	8,880	218
Average	39	8,969	228
Below Average	25	4,555	184
Poor	18	2,466	138
<b>Total Respondents: 314</b>			

**Q13 Please describe sound received from dispatch communications by you (Select all that apply).**

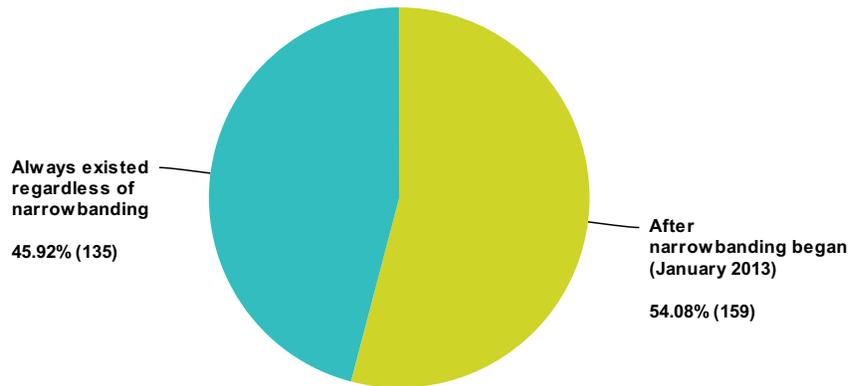
Answered: 315 Skipped: 89



Answer Choices	Responses	Count
Clear	52.70%	166
Digital sound (e.g. squeal) but understandable	40.63%	128
Static but understandable	34.92%	110
Digital sound (e.g. squeal) and unreadable	26.98%	85
Static and understandable	20.00%	63
No signal	18.73%	59
Other (please specify)	8.25%	26
<b>Total Respondents: 315</b>		

**Q14 If you are experiencing communications issues, when did they begin?**

Answered: 294 Skipped: 110



Answer Choices	Responses	
After narrowbanding began (January 2013)	54.08%	159
Always existed regardless of narrowbanding	45.92%	135
<b>Total</b>		<b>294</b>

**Q15 Do you have any other comments, questions, or concerns?**

Answered: 117 Skipped: 287

## Land Mobile Radio Study - Funding Status

The following outlines individual amounts committed toward the \$200,000 goal.

STEPS Committee (911 subcommittee)	\$80,000
Department of Emergency Services	\$45,000
Highway Patrol	\$25,000
Department of Transportation	\$20,000
Information Technology	\$10,000
Fire Chiefs Association	\$ 2,000
Emergency Managers Association	<u>\$ 1,000</u> (requires vote)
911 Association	\$ 500 (requires vote)
ND APCO	\$ 3,000
ND Firefighters Association	Letter of Support
ND Peace Officers Association	<u>\$ 2,000</u>
<b>Total</b>	<b><u>\$188,500</u></b>
ND Sheriffs Association	TBD
ND Police Chiefs Association	TBD

## Radio Network Assessment Project

**Scope:** The depth and breadth of the project will be shaped by the overall goals and objectives, the budget, the schedule, and the availability of the stakeholder to make their time and information available.

**Approach:** The approach would include interviews, surveys, data collection and analysis, information research, presentations and a report

### Project Overview

- End user survey of State, Local, Regional and Tribal entities
  - Requirements assessment
    - Coverage
    - Capacity
    - Features
    - Interoperability (local, regional, statewide, inter-state)
  - Legacy network assessment based on the requirements
  - Gap analysis based on the inability of the legacy network to meet the requirements
- Existing/legacy radio network assessment
  - Radio networks
  - Data networks
  - Site locations
    - Technical site data (height, antenna type, output power, frequencies, etc.)
  - Coverage predictions to determine and assess current versus future coverage requirements
  - Life cycle analysis of existing networks (radio and environment equipment assessment)
- Findings and Recommendations
  - Near, medium and long term solutions and approach to advance radio goals and objectives
  - Analysis to include
    - Technical
    - Tactical
    - Administrative
    - Governance
    - Frequency planning
  - Rough order of magnitude budget and implementation timeframe
    - Capital expenditures
    - Operational expenditures



Televate Proposal for  
State of North Dakota  
Department of Governmental Services

*Consulting Services for Communications Systems Study*

TELEVATE

8229 Boone Blvd M: 703-639-4200  
Suite 720 F: 703-992-6583  
Vienna, VA 22182 [www.televate.com](http://www.televate.com)

07/17/2014

Mr. Duane Schell  
Director  
State of North Dakota Information Technology Department  
600 East Boulevard Ave, Room 103  
Bismarck, ND 58505

July 17, 2014

Dear Mr. Schell,

Televate, LLC is pleased to submit our proposal to the State of North Dakota (“the State”) for Services to Conduct a Communications Systems Assessment. With an open and proactive approach, the State is taking crucial steps to assess statewide end user requirement and communications systems to define options and recommendations to enhance public safety land mobile radio (LMR) communications throughout the State. The ultimate objects of this program is to conduct a comprehensive statewide survey and assessment of existing LMR networks, define end user requirements, and provide network enhancement recommendations that will advance the critical communication needs of the State’s first responders, and further enhance statewide and regional public safety communications interoperability.

As a leading public safety communications solutions company, Televate offers unsurpassed expertise in voice and data interoperability, land mobile radio (LMR) system design, implementation and operations, wireless broadband networks for public safety, and internet protocol (IP) networks and applications. Our engineers and consultants have expert skills in the fundamental aspects of tactical and technical public safety communications, ensuring that the State project will yield the viable solutions for migrating to a sustainable and interoperable mission critical communications system, if deemed appropriate.

We have constructed an organized approach to support all project activities as a cohesive program that delivers a comprehensive solution meeting executive stakeholder expectations. Televate will accomplish this by allocating our most experienced and qualified professionals, retaining key personnel throughout the process, and leveraging our extensive knowledge of best practices and experiences gained across the country. Most importantly, we will carefully listen to your user community to clearly identify any gaps and articulate corresponding specifications in support of an open and fair network procurement process.

We understand that the State’s public safety and public service agencies are only as effective as the mission critical systems that support them. In partnership with the State project managers and stakeholders, we will develop a set of requirements that articulate the users’ needs. We are excited to submit our proposal and are confident that our team, in partnership with the State and regional partners, will assist the State with the legacy radio network assessment, the definition of requirements, and the crafting of an actionable radio upgrade strategy that best meets the public safety communication objectives, and will ensure that the solution is cost effective, interoperable and sustainable.

Sincerely,



A. Richard Burke  
Managing Partner  
Televate, LLC  
Email: [rburke@televate.com](mailto:rburke@televate.com)  
Phone: 703-639-4201 | Fax: 703-992-6583

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## 1. Executive Summary

Televate’s response highlights our experience and qualifications, and presents a detailed approach and schedule to the scope of work required to gather and assess relevant information to support the development of recommendations to evolve the State’s mission critical radio communications systems. Televate will evaluate existing statewide radio network (“State Radio”) and various local radio networks that support communications requirements for 22 Public Safety Answering Points (PSAPs) within the State. Our approach includes conducting thorough on site and industry focused research, assessing end user requirements through direct interviews and surveys, and to provide various long-term sustainable technical solutions and associated costs that address the end user agencies’ tactical and interoperability needs. Throughout the project, we will solicit participation from, and engage system stakeholders, to ensure that the final recommendations align with the State’s overall vision and budget. Their participation and sharing of essential information is fundamental to the success of the program.

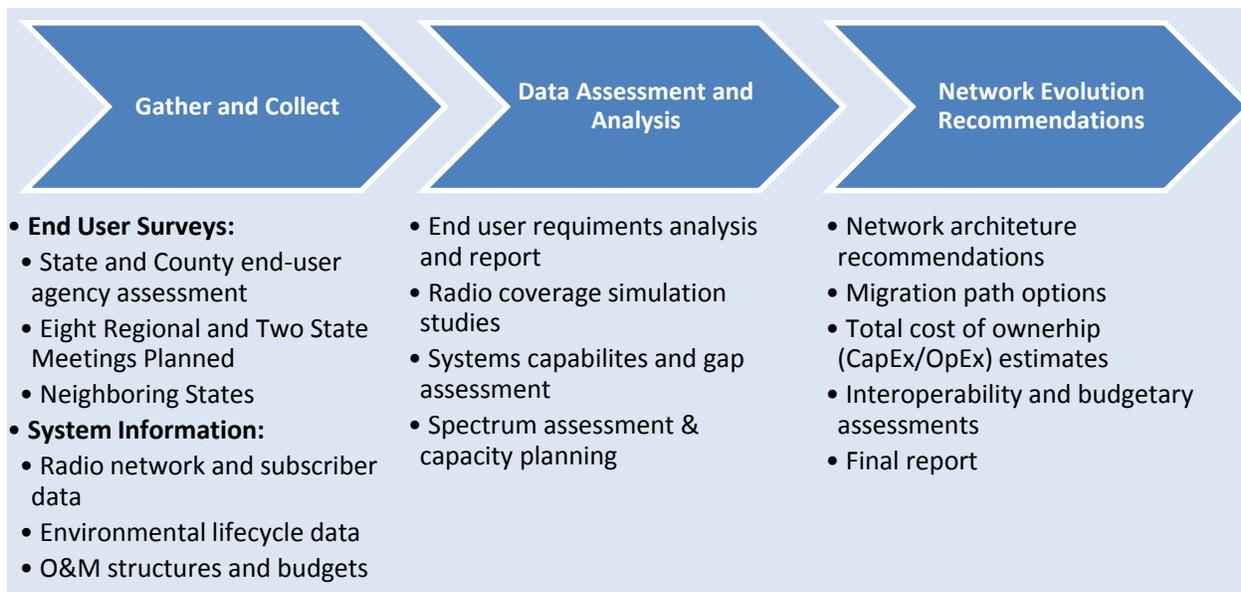


Figure 1: High Level Televate Activities

Figure 1 illustrates a high level overview of the proposed program approach and activities required to:

- Gather and access legacy radio network data and end user requirements
- Assess and analyze system data and user requirements
- Develop radio network evolution recommendations based on the assessment

The State of North Dakota currently operates the State Radio network that primarily provides statewide VHF radio communications to State Patrol. This State Radio network additionally supports interoperable communications with County and local jurisdiction end users. A number of Counties and independent jurisdictions also operate independent radio networks, more of which are affiliated with one or more of the 21 independent PSAPs functioning in the state. The State also operates a single PSAP that supports 911 call taking and dispatch functions for State agencies and for 24 of the State’s 53 counties.

The State has expended significant energy and resources over the lifecycle of the State Radio network under a restricted budget to enhance the coverage and performance of the network as well as to extend interoperable communications throughout the State. As the State and local community radio networks face lifecycle challenges affecting the longevity of their operations, and as the requirement and objectives to further enhance statewide communications interoperability expand, the State needs to examine their options to evolve radio communications based on end user requirements and available radio technologies. With a critical objective to define and examine available options, and to determine the most viable approach to evolve statewide radio communications, the eventual plan would be presented to the State legislature for adoption and funding considerations.

Televate developed a comprehensive program approach and methodology to ensure that salient data is gathered, assessed and organized into an executive summary report detailing findings, recommendations, rough order of magnitude (ROM) capital land operational budgets, and next steps to achieve the goals established by the State. Table 1 provides a list of the primary tasks and subtasks that will be undertaken to conduct and conclude the program. The associated project schedule is aggressive in order to meet the State’s end of November 2014 final report delivery deadline. Ongoing participation and collaboration of State, County and local jurisdiction stakeholders underlies the program success and ability to meet the aggressive schedule. Immediately upon the receipt of a notice to proceed, Televate will initiate the project kick-off meeting and issue a survey to radio network operator stakeholders to begin collecting radio network information. Prior to the kick-off meeting, we are requesting that the State assemble and provide the primary stakeholder contact information. It will be critical to jumpstart the project and immediately interacting with the key State, County and local jurisdiction stakeholders to get them engaged.

<b>Program Management</b>
Weekly conference calls
Develop Project Plan + kickoff meeting presentation
Prepare contacts database
Kickoff Meeting (on-site)
<b>Existing Network Research and Documentation</b>
Develop radio system collection survey
Process radio site data (Radio Sites, Controllers, Dispatch)
Develop site database and prepare propagation studies
Follow-up on radio system survey
Existing operational revenue and expenditure assessment
Current Architecture Review, Past Reports Review; Familiarization
FCC License Review, Summary and Recommendations
Ancillary Systems Review & Impact Analysis
Capacity Assessment Technical + Needs Based
Backhaul system data collection and review
Subscriber device data collection and review
<b>State and Regional User Needs Assessment</b>
Develop In-Person & Online Questionnaires
Schedule interview sessions and stakeholders

On-site stakeholder interviews (8-Regions + 2-State meetings)
Follow Needs Assessment
Summarize Needs Assessment
Regional partners interview (state neighbor discussions)
Follow-up calls, finalize and distribute minutes
Summarize Needs Assessment findings summary
<b>Executive Report and Presentation</b>
Research radio network evolution options
Discuss and strategize radio network options
Develop draft report
Review and refine report with State (on site)
Final report production
Develop presentation
Deliver findings and recommendations (on Site)
Final edits

**Table 1: North Dakota State Radio Assessment Project Overview**

The following sections provide Televate’s corporate overview information and a detailed description of the project methodology and cost proposal.

## 2. Relevant Qualifications and Experience of the Firm

### History and Overview

Founded in 2001, Televate, LLC is a leading public safety technology and engineering consultancy delivering sustainable, interoperable land mobile radio, wireless broadband networks and applications, and information technology and communications solutions to power mission critical requirements.

As champions of public safety communications interoperability, Televate is comprised of engineers and program managers who are not just radio and IT technology experts—they are advocates for public safety who have dedicated much of their careers to enhancing interoperable voice and data networks for communities often underserved by technological advancement and budgetary funding. Televate continues to work as a liaison between the public safety community and the legislative bodies that govern them to ensure that the needs and concerns of public safety are voiced and addressed.

Televate understands the issues impacting our nation’s critical communications and data sharing systems and successfully designs and manages programs targeting these issues. We manage solution implementations and assist in the assessment, design and development of sophisticated interoperable systems to ensure the operational continuity of these networks and systems.

Based in Vienna, VA, Televate has grown to include a diverse staff of public safety communications experts and has amassed tremendous experience supporting local, state and federal agencies, public authorities, and others on numerous diverse communications programs. We also provide a host of specialized technical and programmatic management consulting services, in areas such as communications planning, standard operating procedures (SOP), Concept of Operations (ConOps), and Continuity of Operations Planning (COOP) development to the public safety and critical infrastructure industry.

### Team Statement of Qualifications

For over a decade, Televate’s team of engineers and consultants has resolved many of our nation’s mission critical communications challenges. We have provided a variety of technical and program management services for numerous land mobile radio (LMR) systems. We have also provided communications planning services to achieve improved tactical and functional operational results from existing systems and developed comprehensive interoperability plans in the process. These experiences provide us with a wealth of knowledge regarding how public safety needs to communicate, with whom, when and where. Televate’s consultants have partnered with state, local and federal agencies and other public authorities on some of the nation’s key interoperable technology programs and services. A highlight of our experience, strengths, and capabilities include:

- Digital and analog LMR systems assessments, planning, implementation, operations, testing and troubleshooting
- Technical and systems expertise and in-depth knowledge of the APCO P25 TIA-102 suite of standards, legacy analog systems and corresponding vendor products
- Proven end user agency needs assessment and requirements gathering experience and methodologies
- In-depth knowledge of network performance parameters and engineering design of analog, digital and P25 voice and data systems

- Spectrum management, FCC licensing and regional coordination support
- RF and coverage engineering design of land mobile radio and broadband communications systems
- Extensive experience in legacy and P25 LMR and Long Term Evolution (LTE) system specifications development, network implementation and vendor management
- System migration Capital and Operational expenditure funding strategies and approach
- Identification of grant programs and associated development of grant applications in support of public safety LMR and 700 MHz broadband wireless networks
- Oversight and project management of mission critical network deployments
- Project management processes anchored on Project Management Institute's (PMI) Body of Knowledge (PMBOK)
- Operations and Maintenance (O&M) structures for public safety land mobile networks and corresponding budgetary needs
- Extensive cost modeling and operational system analysis (CapEx and OpEx) of communications and IT systems including land mobile radio systems, broadband networks, CCTV and Wi-Fi networks
- Public safety communications standard operating procedures (SOP), training and table-top exercises
- Communications plan development including disaster recovery plans and incident command planning
- Multi-jurisdictional and multi-functional public safety voice and interoperability applications
- Inter-governmental agreements and cost and operational obligations sharing schemes
- Planning, designing and troubleshooting interfaces between local and federal agencies for interoperability and collaboration purposes (Fiber, T1, Microwave)
- Enterprise architecture standards and information technology system including security system requirements

## 2.1. Staff Assignment to the Project

The Televate team is comprised of an experienced and talented team to support the State of North Dakota for this program with subject matter experts (SME) in each of the required functional project areas including project management, engineering design, system planning, operations assessment and procurement support. The proposed personnel have direct experience in the design, implementation and optimization of public safety land mobile radio systems and are currently supporting various projects in the State of North Dakota. Our proposed staff plan includes key individuals that will support the program locally, as appropriate, and remotely from our offices in Virginia. Throughout the project, Televate will draw additional resources from our talented pool of experts to execute specific tasks as required.

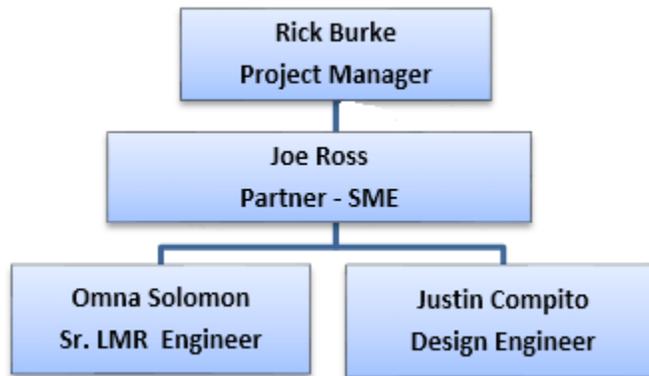


Figure 2: Key Project Team Members Organization Chart

The following table provides a high level set of qualifications for these key personnel. Complete personnel resumes are included in *Appendix I*.

## Key Personnel Roles and Qualifications Overview

Personnel	Project Role (Project Phase)	Relevant Qualifications
<b>Rick Burke</b> Project Manager  <i>Years of Experience</i> <b>Industry: 30+</b> <i>Education:</i> <b>B.S., MSc.</b>	<ul style="list-style-type: none"> <li>■ Overall program management</li> <li>■ Stakeholder survey and assessment</li> <li>■ System implementation oversight</li> <li>■ Network migration planning</li> <li>■ Draft radio network evolution strategy</li> </ul>	<ul style="list-style-type: none"> <li>■ Extensive LMR needs assessments experience</li> <li>■ Management of multiple land mobile radio system analysis and deployments</li> <li>■ Communications plans development for large scale events</li> <li>■ Radio network capital and operations budgeting</li> <li>■ Communications system funding models</li> <li>■ Vendor management and network operations</li> </ul>
<b>Joe Ross</b> Subject Matter Expert/Partner  <i>Years of Experience</i> <b>Industry: 20+</b> <i>Education:</i> <b>BSEE, MBA</b>	<ul style="list-style-type: none"> <li>■ Stakeholder survey and assessment</li> <li>■ Network CapEx/OpEx estimates</li> <li>■ Regional entities assessment</li> <li>■ Network migration planning</li> <li>■ Draft radio network evolution strategy</li> </ul>	<ul style="list-style-type: none"> <li>■ Expert in public safety voice and data system design, analysis, and evaluation</li> <li>■ Extensive stakeholder needs assessments experience</li> <li>■ Public safety and government systems procurement</li> <li>■ Management and planning of public safety network migrations and operations</li> <li>■ Vendor management</li> </ul>
<b>Omna Solomon</b> Senior Engineer  <i>Years of Experience</i> <b>Industry: 8</b> <i>Education:</i> <b>BSEE, BA</b>	<ul style="list-style-type: none"> <li>■ Stakeholder survey and assessment</li> <li>■ Data collection &amp; surveys</li> <li>■ Systems analysis</li> <li>■ Network options development</li> <li>■ Migration planning</li> <li>■ Draft radio network evolution strategy</li> </ul>	<ul style="list-style-type: none"> <li>■ P25 radio system design and configuration</li> <li>■ LMR networks drive test and coverage analysis</li> <li>■ LMR traffic engineering and capacity planning</li> <li>■ P25 standards development and applications</li> <li>■ Technical RFP development and evaluation</li> <li>■ Radio template and fleet map development</li> <li>■ LMR systems lifecycle analysis</li> </ul>
<b>Justin Compito</b> Design Engineer  <i>Years of Experience</i> <b>Industry: 5</b>  <i>Education: BSEE</i>	<ul style="list-style-type: none"> <li>■ Develop data collection surveys</li> <li>■ Process radio infrastructure data</li> <li>■ Conduct radio propagation studies</li> <li>■ Conduct research as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>■ LMR network design</li> <li>■ Microwave backhaul design, capacity analysis</li> <li>■ Database development and management</li> </ul>

## 3. Project Plan

### Overview and Schedule

Throughout our experience planning, designing and deploying communication networks for public safety, Televate has developed field-proven design and implementation processes focused on providing end users the wireless communications tools they need within a limited timeframe and at the best value. We have developed an approach that leverages these unique capabilities in support of State of North Dakota's goal to assess and provide recommendations regarding the evolution of the State and local public safety radio communications to enhance inter and intra-State and County interoperability. We are confident that this project methodology, coupled with our recent experiences in both the State of North Dakota and nationwide, will achieve the required results and provide the necessary elements for the State's stakeholders to make informed decisions in achieving an optimal solution. This section provides an overview of our program methodology and provides a high level statement of activities, tasks and the associated project schedule.

Our standard approach to evaluating and designing migration plans for public safety radio systems begins with comprehensive network documentation and end user and operations assessment efforts to characterize the current and future attributes of the State's systems and to document comprehensive end user needs. As the ultimate beneficiaries of the State's future system, defining a set of specifications that aligns with the current and projected needs of the all end user agencies is an important undertaking. User needs will be assessed through direct interviews and online surveys with State, County and local jurisdiction end users and regional interoperable partners to articulate the network gaps, necessary enhancements and interoperability goals. Televate will continue to engage key agency leaders, and importantly, the State Project Team, throughout all project phases in order to align expectations, which may be affected by budget, technology and schedule.

A thorough review of the existing networks and ancillary subsystems allows us to establish a comprehensive list of radio network infrastructure and end user devices that need to be replaced and upgraded, or that can be leveraged within the new network architecture. In addition, this effort will conduct limited assessment of the impact of the migration on other ancillary systems, such as CAD, logging recorders and 911 call-taking systems. Televate will meet with network operators to conduct a preliminary evaluation of the lifecycle status of all radio network related equipment and incorporate their vision into the system recommendations. It is important to note that the project completion timeframe only supports a cursory analysis of primary and backup power, transmission systems, radio towers and other subsystems that may need to be replaced or upgrade in conjunction with the program. The survey will endeavor to collect relevant lifecycle information to integrate into the final report.

Anchored on these findings, Televate will develop prospective network architecture assessments and corresponding cost estimates to be formalized into a recommendations report. Televate will rely on our experience designing public safety systems, and collaborate with State personnel, to fine-tune potential solutions and cost estimates for the future LMR system(s). In addition to providing options for the State executives to draw informed decision, the robust financial benchmark will form a basis against which to evaluate and validate vendor solutions and pricing proposals ensuing phases.

Subsequent sections provide additional detail on the key tasks and Televate's approach.

## Kick Off Meeting and Project Management

In order to efficiently execute the project activities, we propose a kick-off conference call with the State Project Team to refine the project scope and begin collection of pertinent information to identify and schedule pertinent resources for additional on-site information collection and interviews. The preliminary review of documentation will enable us to quickly begin evaluating network equipment specifications, preparing coverage simulation software and test tools, identifying additional information to be collected physically, and refining interview agenda and questionnaires for productive and informed physical discussions. The kickoff meeting (and ensuing project meetings) allows the State and the Televate team members to:

- Review the scope of work and proposed project plan to refine project deliverables including deadlines and scheduled updates
- Develop a communication plan and establish a flow of information that facilitates productivity (status calls/in person meetings, on-line interaction, progress reports)
- Define a formal action item tracking document that will be used to guide meetings and to provide weekly and monthly progress updates
- Begin collection of relevant and readily available system information required for the assessment

Weekly calls will be scheduled to regularly update the project scope and activities and to track progress against the planned schedule. Meetings, guided by a brief but comprehensive agenda and action item table, will ensure that project activities are synchronized and exchanged between our team and the State's Project Team. All proposed modifications to the project scope will be discussed with State project management prior to implementation. This approach, which has guided us in the successful completion of dozens of similar projects, will be used throughout all phases of the program. The following sections describe the important tasks and deliverables to support the State's requirements by Phase.

## Existing Systems Assessment and Alternative Recommendations

### 1. Existing Systems Review

Establishing a comprehensive baseline of current systems and components is an essential initial step in defining the upgrade requirements, evaluating the lifecycle status, and developing a robust set of system upgrade specifications. A thorough understanding of existing assets enables us to identify the strengths and gaps of the current network and to determine the upgrade consequences for each component. In addition, while the State is making network coverage improvements with the addition of multiple radio towers, the FCC's narrowbanding mandate have impacted the State's VHF systems coverage and likely those of the independent regional network operators. Therefore, during our kick-off conference and in ensuing meetings, Televate will conduct an extensive data gathering and assessment effort of existing systems, ancillary features, and interoperability capabilities by:

- Gathering relevant and available system information as tabulated in Table 2 (documenting and accessing all noted data may be time and cost prohibited, but every effort will be made to assemble this information)
- Conducting extensive interviews and working sessions with the network managers, maintenance providers and, if applicable, existing vendors
- Performing data collection of central network and remote base facilities

The data gathered, along with the user needs assessment findings described in the next section, will be a significant input to the alternative solutions analysis, cost estimate development and, ultimately, RFP specifications development efforts. The primary objectives of this exhaustive data collection effort are to:

- Baseline the current systems capabilities, perform limited lifecycle analyses, identify network gaps and evaluate the requirements for their evolution
- Assess the lifecycle impact, or backward compatibility of upgrading various subsystems
- Identify risk mitigation strategies for components that are already beyond vendor support
- Evaluate LMR migration impact on other subsystems such as CAD, logging recorder and call taking, paging systems, fire station alerting
- Evaluate exiting network redundancy schemes and disaster recovery plans (to the extent possible)
- Outline a detailed list of enhancement or replacement requirements for the State Radio network and regional radio networks
- Assemble the required information to perform coverage and limited capacity studies
- Identify components that can be leveraged such as a ‘friendly-assets’ list, and regional fiber and microwave backhaul networks
- Evaluate the status of subscriber devices and consoles and provide replacement cost estimates and fleetmap modification recommendations
- Understand current State operational and maintenance structures, and cost and resource allocations
- Develop ROM based Capital Expenditure (CapEx) and Operational Expenditure (OpEx) projections and budgetary estimates based on the recommended solution

A non-exhaustive list of available information to be gathered is tabulated below:

System Architecture Information
<ul style="list-style-type: none"> <li>■ Overall network diagrams and documentation</li> <li>■ Primary communications systems, network controllers and interfaces to sub-systems</li> <li>■ Radio system connectivity (e.g., Ethernet, circuit, T-1) capabilities at/to data and dispatch centers</li> <li>■ Existing and planned fiber, leased lines or microwave paths to leverage as primary or redundant transport media</li> <li>■ Existing redundant systems and backup strategies</li> <li>■ Network usage and traffic data statistics</li> <li>■ Dispatch console equipment and controllers</li> <li>■ System management tools and operational preferences</li> <li>■ 911 systems, logging records, CAD systems, Fire Station Alerting</li> <li>■ Interoperability capabilities and interfaces (radio gateways, patches, interoperability channels, Radio ID exchanges, etc.)</li> </ul>
Radio Access Network and Subscriber Devices Information
<ul style="list-style-type: none"> <li>■ Radio site locations, base station repeaters, microwave radios</li> <li>■ Antenna model numbers and heights, transmission lines, combiners, multi-couplers,</li> <li>■ FCC license information (Call signs, ERP, etc.)</li> <li>■ Existing drive test coverage studies and known problem areas</li> </ul>

- Distributed Antenna Systems (DAS) or Bi-Directional Antennas (BDA)
- Existing or planned tower facilities and associated connectivity
- GIS layers of critical areas and sites (collaborate with State GIS Team)
- Heating, Ventilation and Air Conditioning equipment status
- DC Power plants status, Uninterrupted Power Supplies (UPS) equipment and batteries status
- Tower loading, structural, site grounding and other recent relevant studies (as may be appropriate)
- Shelter size and space availability
- Detailed subscriber inventory data and feature capabilities; e.g., age, model, standards (Analog, P25, Others), flashcodes, serial numbers, supported spectrum (as documented by the agencies)
- Vehicle types and installation
- Fleetmaps including internal agency and interoperable radio groups, analog channels

#### Operational and Financial Information

- Network CapEx and OpEx plans and expenditure documents
- Backup, failover and Disaster Recovery plans and SOPs
- Operations and Maintenance (O&M) plans and contracts

**Table 2: Information Collection Details**

## Ongoing Executives, Network Operators and Managers Surveys

Televate will survey key network operators and stakeholders within the State to determine current and prospective migration plans, operations and maintenance plans and budgets. In their capacity leading the management and operation of the public safety systems, these stakeholders will have working knowledge of the systems’ performance, their strengths and weaknesses and overall health, and have likely identified a set of needs and requirements. Therefore, during our kickoff trip and subsequent meetings, Televate will interview all pertinent personnel with an override objective, time permitting, to:

- Document and incorporate their overall vision into the network upgrade recommendations
- Discuss turn-key or independent services to deliver the required solutions
- Facilitate discussion on prioritizing key areas for near-term coverage improvement
- Identify the maintenance, support and operational requirements
- Discuss current and desired governance and ownership structures
- Identify existing network usage and cost sharing governance structures and schemes
- Discuss planned regional systems, mutual aid systems, and implementation plans for alignment of goals

## 2. Operational Enhancement Analysis

### User Needs Agency Assessment

As the ultimate beneficiaries of any system improvements and corresponding investments, engagement of the first responder user community is an important effort to ensure future solutions align with their needs in a cost-efficient and sustainable manner. Televate proposes structured interviews over a span of ten (10) days with representatives of State, County, and independent municipality end user agencies as defined by the Statewide Interoperable Executive Committee (SIEC) and local executives. A full day of meetings will be scheduled in each of the eight regions of the State (Fargo, Grand Forks, Jamestown, Devils Lake,

Bismarck, Minot, Dickinson and Williston). Multiple meetings will be conducted in Bismarck to include regional County representatives and a meeting with State agency representatives. In each region, representatives from each PSAP and County within the County will be invited. In the event that a representative from a County or jurisdiction from the region is not available on the scheduled date, they can attend an alternative regional meetings.

Face-to-face interviews may be organized as short one or two hour slots with individuals, or longer group workshops with agencies of similar function would be conducted as appropriate. Televate can also support evening survey sessions with volunteer fire departments to ensure participation by all critical systems users as their schedule allows. As key facilitators of radio communications across the various agencies and the State’s diverse frequency bands, Televate will survey PSAP and dispatch personnel to understand current technical and operational functions and outline future requirements.

Televate also proposes to supplement the face-to-face interviews concurrently with an online survey to foster broader participation by the end user community. This method often simplifies the data collection process, including subscriber inventories and future network features – for the users as they can assemble and provide their responses as their schedules permit (See sample in Figure 4). In addition, the web survey provides agencies that are unable to attend in-person interviews an opportunity to provide their input. The online survey will address the same topics as the in-person interviews and will be open for a specified period of time to ensure timely completion of the scope of services in this solicitation.

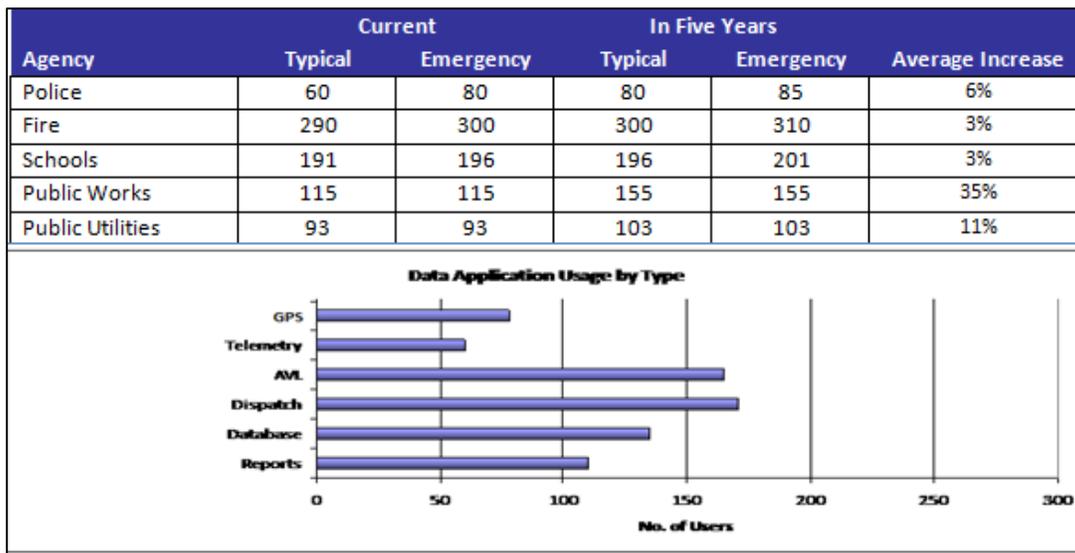


Figure 4: Online Survey Summary Sample

Our team members have conducted and managed several similar information gathering exercises across the nation, and in Counties within North Dakota, and have questionnaire development experience on a variety of public safety topics including private and commercial wireless systems, close-circuit television systems, and incident communications plans. Our detailed understanding of mission critical communications needs and proven engineering expertise uniquely enables us to ask the right questions and translate them into the right technical RFP specifications. Televate will draw upon these experiences to develop and conduct comprehensive end user agency surveys to assess:

- Network coverage requirements at various service levels (in-door, outdoor, hip-level, etc.)
- User base projections to define network capacity and lifecycle requirements
- Subscriber and console device requirements and capabilities
- Status of existing interoperable systems and procedures across agencies and functions
- Required and desired network features such as encryption, geo-location and text messaging
- Tone paging and other station alerting technologies
- Network and subscriber service and maintenance needs to determine modifications to O&M plans
- Annual radio systems and subscriber budgets, as appropriate
- Dispatch and logging systems strengths, weaknesses and future requirements
- Radio subscriber communications capabilities, strengths, gaps and required improvements
- Current and desired interoperability procedures (within the State and regional mutual aid partners), weaknesses and strengths (including dispatch consoles patches and other gateways)
- Training needs to fully exploit the current capabilities and future solutions

Our proposed needs assessment schedule provides sufficient time for the coordination, scheduling and outreach efforts to foster broad participation. In addition, our data collection efforts will familiarize us with the current mission critical systems and facilitate more informed discussions with the end users. Prior to conducting the needs assessment efforts, Televate will also provide a draft of the proposed face-to-face (and online) questionnaires, and will collaborate with the State to finalize the content. Additionally, Televate, in conjunction with the State, will categorize end user needs into a spectrum ranging from “absolutely required” to “desired” and evaluate their impact on potential network solutions and associated capital cost. The final report will summarize the findings from the end user surveys; these findings will be referenced as appropriate to support recommendations throughout other sections of the report.

### **3. Analysis of Alternative Designs and Budgetary Estimates**

The objective of this effort is to develop and analyze robust network design alternatives based upon standardized and scalable solutions that meet State, County and independent jurisdiction end user operational requirements and align with the budgetary capabilities while improving both intra- and inter-State and County interoperability. Having established design criteria based on the needs assessment and the systems analyses, Televate will develop conceptual network design options (and corresponding capital and operational cost estimates) that address these objectives in a phased manner that aligns with the grant funding provisions. These designs will also form a basis against which to measure and validate vendor technical and price proposals and identify costly solutions that are beyond the needs of the State stakeholders.

Televate will consider various network alternative designs that are anchored on standardized technologies to ensure solutions are efficient and align with the State’s budgetary capabilities. While trunked P25 simulcast networks provide seamless wide area coverage and interoperability, the distribution of system users (e.g., in rural areas of the State) may not require the same number of channels to be supported at each radio site. Additionally, certain users such as volunteer fire departments accustomed to analog radios and pagers in the \$300 - \$700 range may be better aligned with other technologies. It is also critical that the ultimate solution improve intra-county agency, inter-county and Statewide interoperability.

As a key deliverable, Televate will provide system architecture options illustrating the major network components, shared subsystems, backhaul transport media, radio channel assignments, dispatch console locations, redundant schemes and preliminary cutover plans. To maximize recent investments in radio communications, the proposed high level architecture will be anchored on existing stakeholder assets and include a preliminary backhaul architecture utilizing fiber and microwave point-to-point links demonstrating connectivity amongst the various network components. For alternatives selected, Televate will:

- Perform coverage study of prospective sites
- Develop preliminary backhaul schemes and architectures
- High level Statewide channel plan
- Identify the long-term capital and operational expenditure plans
- Identify lifecycle critical paths and establish policies for existing and new systems
- Outline the transition period impact to the end users and operators
- Develop a pros and cons matrix with respect to management, operations, near- and long-term budgets, interoperability and other important network attributes

## Radio System Coverage Study

Reliable wide area system coverage is one of the most important attributes of mission critical radio communication systems. Therefore, characterizing the current State radio and regional system coverage, through radio frequency (RF) software simulations, and further exploring alternative coverage enhancement technologies is a key component of Televate's activities. Televate will engage system operators to provide sufficient radio site data to facilitate the propagation study. Televate typically conducts field measurements to quantify radio coverage and imports this empirically derived data into the propagation model to optimize the propagation prediction. Measured data enhances the accuracy of the coverage modeling, however, based on the project timeframe and associated budget, field measurements are not being proposed, but can be performed if determine of value by the State

Televate's radio propagation simulations will include a baseline study of the existing systems and predictive simulations for potential future solutions. A baseline of the existing radio coverage helps correlate information collected from the user needs assessment and identifies additional areas for improvement.

Televate has proven engineering acumen and fine-tuned design parameters to generate realistic service area simulations attainable by major LMR equipment manufacturers. We have fine-tuned several user defined parameters and customized our link budgets to generate reliable service area simulations attainable by major LMR equipment manufacturers. Importantly, we will utilize the drive test data and include available data on the State's land use changes to optimize the propagation

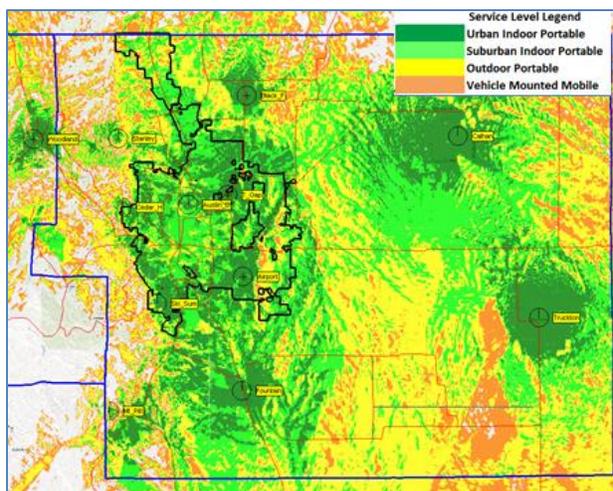


Figure 6: Sample Coverage Simulation Map

model, yielding more realistic simulations. We employ the EDX SignalPro radio propagation modeling tool to conduct the simulation studies. This tool employs the TIA TSB88 recommended Anderson 2D radio propagation model and incorporates simulcast simulations.

Our final simulations will include Google Earth KMZ layers indicating the various device types (portable, mobile, etc.) and coverage levels (in-building, outdoor, etc.) for which service is reliably available. Coverage maps for existing and prospective solutions will be separately provided for the network alternatives identified. These coverage issues and required enhancements (e.g., additional radio sites) will be pertinent in the development of system specifications as the State begins the implementation process.

## Network Cost Projections and Implementation Schedule

Televate will outline detailed capital and operational cost estimates based upon itemized, flexible and granular models for the various radio network evolution recommendations. Over the past decade, Televate has performed detailed research on the cost of vendor equipment (list price, typical discounts and negotiated prices) and understands their product pricing strategies. We will draw from this extensive knowledge and develop a variety of budgets and schedules that illustrate their technical, financial, operational and maintenance impacts. In addition, our budgets will identify and incorporate any costs that may be triggered by the LMR systems migration including paging systems, call taking and log recording systems, CAD interfaces, and other related systems.

Televate will develop itemized capital expenditure (CapEx) and operational expenditure (OpEx) estimates supporting our recommendations. The ROM cost estimates will, at minimum, account for:

Capital Costs	Operational Costs
<ul style="list-style-type: none"> <li>▪ Fixed network radio and backhaul equipment</li> <li>▪ Engineering and system optimization services</li> <li>▪ Site acquisition, permitting, development and construction</li> <li>▪ Subscriber and console type and installation</li> <li>▪ Vendor project management costs</li> <li>▪ Contingency fees</li> </ul>	<ul style="list-style-type: none"> <li>▪ Internal resource O&amp;M costs</li> <li>▪ Software licensing and refresh costs</li> <li>▪ Radio network maintenance costs</li> <li>▪ Site maintenance, utilities and rent</li> <li>▪ Subscriber and console maintenance costs</li> <li>▪ Other professional services</li> </ul>

## Final Recommendations Report

Establishing the evolution and investment of the State’s communications systems is a significant endeavor to the stakeholders, its executives, and, importantly, the end user community. It is essential that this community have the opportunity to review and consider the issues and various options and to make informed decisions supporting the future of public safety communications. Televate will develop an executive report summarizing recommendations to evolve the State Radio and regional networks into an enhanced interoperable radio network based on end user requirements and optimal technology options and solutions.

Televate’s goal is not to produce a report that is merely a compilation of findings, but rather realistic and actionable designs and recommendations focused on the project goals and objectives. Televate recognizes that this report will become the property of the State and may be distributed to a wide variety of audiences. As such, the final delivery format will be defined to address the needs of the stakeholders and prospective

audiences. Televate will develop an outline and draft for submission to the State project team to solicit feedback and incorporate all relevant material in the order and format desired by the State project team. While we pride ourselves in providing an independent review, we advocate and recognize the value gained from engaging customers throughout the process.

The report will preliminarily address the following topics:

- Existing Systems Assessment and Capabilities
- State and Regional End User Needs Assessment Findings
- Network alternatives and recommendations
- Site enhancement recommendations
- System migration and implementation plan overview
- Near and long-term capital and operational plans and ROM cost estimates
- Overview of network acquisition strategies

Televate's executive report and presentation will underscore the importance of the investment the State is making to assess new and enhanced opportunities, and to investigate optimal solutions for the future. Televate has allocated a final meeting to present the findings to system stakeholders and State executives. Broad participation and interaction will ensure the best outcome and Televate is confident that in partnership with the State, we will identify actionable and cost effective recommendations to guide the evolution and enhancement of the State's critical communications systems.

## State of North Dakota Responsibilities

Televate's scope of work and cost proposal assumes that the State and its regional stakeholders will provide information and access to resources identified by Televate to support various task activities and further assumes that the required stakeholders will be available to participate in the efforts outlined in the proposal. Such requests for information and availability for meetings will not be unreasonably delayed to ensure the continuity and completion of the project.

If the scope of work is modified over the course of the project, the cost estimate could potentially be adjusted based on the standard professional staff labor categories and hourly labor fees. Any modifications to the project scope will be discussed in advance between the State and Televate's project manager. If modified, Televate will provide a revised task proposal with associated cost for the State's approval prior to initiating the work. In the event that total cost of any one task is not exceeded, the balance of that cost could be allocated to alternative tasks, if acceptable to the State.

Below are the expected State responsibilities

### General Project

- Assign a project manager, as the single point of contact, with authority to make project decisions and other resources as necessary
- Provide contact information on State and regional stakeholders who have access to the required information and who will solicit participation in the requirements gathering process
- Review and approve Televate team draft documents and final deliverables for modification and/or
- Review and approve deliverables
- Participate in meetings, conference calls as necessary to ensure project continuity
- Provide meeting facilities and support State and regional meeting coordination

## **Project Specific**

- Provide access to radio sites, data centers and inventory documentation and other locations required to assemble the necessary system information
- Provide available infrastructure and subscriber radios inventory documentation
- Provide access to executives and other administrators to facilitate scheduling of resources for agency needs assessments
- Support coordination of meetings with agencies for timely completion of needs assessment meetings
- Provide existing OpEx/CapEx documentation to support financial studies
- Provide FCC licensing access and authorization as necessary

## 4. Cost Proposal

Televate is pleased to submit our cost proposal to the State of North Dakota supporting the Radio Network Assessment and Recommendations Project. The cost proposal reflects the scope of work as described in our response with the clarification that the depth of research on noted network lifecycle elements will be restricted, and that the degree of legacy network assessment will be tempered based on the depth of data readily provided. We value our commitment to the Public Safety Community and the State, and have priced our services in a manner that offers the best value to the State. The estimated project costs as detailed below is \$200,000.

Televate’s cost proposal assumes that the State and its stakeholders will fulfill the responsibilities and provisions outlined in “State of North Dakota Responsibilities” section of our proposal to avoid delays and ensure the continuity of the project. If the scope of work is modified over the course of the project, the cost estimate could potentially be adjusted based on the standard professional staff labor categories and hourly labor fees presented in Table 5, while Table 4 provides a breakdown of travel related expenses.

Televate will invoice monthly based on the professional work completed and approved by the State together with associated expenses as appropriate. Expenses for all three project phases are based on GSA per diem rate schedule.

Task Breakdown	Total Cost
Project Management	\$15,250.00
Existing Network Research and Documentation	\$65,750.00
State and Regional User Needs Assessment	\$63,000.00
Executive Report and Presentation	\$56,000.00
	<b>\$200,000.00</b>

Table 3: Proposal Project Budget

Phase	Purpose of Trip	Program Manager/SME		Senior Consultant	
		# of Trips	Days	# of Trips	Days
I	Kick off and On-Site Data Collection	1.00	2.00	1.00	2.00
	City and Regional Needs Assessment	1.00	11.00	1.00	11.00
	Progress Meetings and Presentations	1.00	1.00	1.00	1.00
	Presentation of Finding and Recommendations	1.00	2.00	1.00	2.00

Table 4: Projected In-Market Days By Activity

Personnel	Hourly Rate
Partner	\$200.00
Project Manager / Subject Matter Expert	\$175.00
Senior Consultant / Communications Engineer	\$150.00
Design Engineer	\$110.00
Project Coordinator	\$75.00

Table 5: Televate Fee Structure

## Appendix I - Key Team Member Resumes

### 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 30 years of experience in wireless telecommunications and information technology, Rick has extensive system engineering and operational experience with land mobile radio, broadband wireless, commercial cellular, and other voice and data networks. Accomplished in all facets of network capital investment and operational cost modeling and assessment, and in facilitating network operational governance and cost sharing analysis.

#### CORE COMPETENCIES

- |   |  |  |
|---|--|--|
| <ul style="list-style-type: none"> <li>■ Fiber and wireless network design, deployment and operations and comprehensive information exchange via these secure transport networks</li> <li>■ Implementing large scale, multi-jurisdictional and multi-agency programs providing public safety communications network governance</li> </ul> | <ul style="list-style-type: none"> <li>■ Program planning, scheduling, requirements gathering, budgetary management, procurement, technology development oversight, operational governance and Concepts of Operations build-out</li> <li>■ Public safety radio system planning and strategy development</li> <li>■ Federal and state grant application strategy and preparation</li> </ul> | <ul style="list-style-type: none"> <li>■ VHF, UHF, 700 MHz and 800 MHz</li> <li>■ Broadband wireless (700 MHz, 2.4 GHz, 4.9 GHz)</li> <li>■ Microwave system engineering (2-38 GHz)</li> </ul> |
|---|--|--|

#### PROFESSIONAL HIGHLIGHTS

- Program managed network assessment and analysis projects to recommend the best solution for the configuration, operation and maintenance of trunked radio communications systems.
- Supported capital and operational cost analysis and modeling together with the development of a multi-county governance framework to facilitate cost sharing and functional governance.
- Performed revenue analysis to seek additional and alternative sources of operational revenues.
- Managed P25 deployments, VHF-UHF narrowbanding programs
- Managed programs including budgeting, implementation, RFP development, proposal evaluation and procurement of multiple public safety radio systems, microwave and fiber networks, public safety broadband networks and applications
- Coordinated stakeholder needs assessments for interoperability events and systems
- Supported creation of regional governance frameworks for land mobile radio and broadband systems
- **Communication Planning**
  - Spearheaded a cross-agency effort to document current agency communications operations, capabilities and solutions including standard operating procedures for each system (Land Mobile Radio, Crisis Information Management Systems, Messaging Systems, Telephony, Data Applications and Information Technology Systems)
  - Provided event-specific support entailing proper voice and data communications solution selection to propagate incident warnings and information across agencies and jurisdictions as well as public notification processes and procedures; communications contingency plans for fail-over support and instruction
- **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 various technology, training, grant development, voice and data interoperable system design and operations, 800 MHz rebanding and other consulting services to a variety of 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
- **Public safety broadband projects**
  - Assisted in developing BTOP grant applications that resulted in more than \$200 million in awards
  - Conducted needs assessment for public safety broadband networks and applications
  - Managed the design, operational and capital budgeting for sustainable broadband networks
- Manage engineering staff for cellular system design, expansion and frequency planning, interconnection, real estate acquisition, and network optimization

## CAREER TRACK

- |   |                  |
|---|------------------|
| ■ Televate, LLC, McLean, VA, <i>Managing Partner</i>                                | ■ 2001 - Present |
| ■ Lumenix, LLC, Annandale, VA, <i>Chief Executive Officer</i>                       | ■ 1999 - 2001    |
| ■ JMS Worldwide, Inc. and MLJ, Inc., Arlington, VA, <i>Executive Vice President</i> | ■ 1998 - 1999    |
| ■ MLJ, Inc., Arlington, VA, <i>President &amp; Chief Operating Officer</i>          | ■ 1992 - 1998    |
| ■ LCC International, Inc., McLean, VA, <i>Director of Engineering</i>               | ■ 1989 - 1992    |
| ■ GTE Mobilnet Inc., Houston, TX, <i>Manager of Engineering, Southern Region</i>    | ■ 1985 - 1989    |

## EDUCATION

- 1980 M.S. Program, Geography**, University of Tennessee, Knoxville, Tennessee  
**1978 B.S. Geography**, Rowan University, Glassboro, New Jersey

## PROFESSIONAL SOCIETIES

- IEEE Member, APCO Member

## JOSEPH J. ROSS

Joe Ross is a performance-driven executive with over 20 years of experience in communications and information technology with nationally recognized wireless system expertise. 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. He recently chaired the Assessment of Future Spectrum and Technology Working Group for the National Public Safety Telecommunications Council (NPSTC) Technology Committee that was created to provide the follow up to the Public Safety Wireless Advisory Committee report of 1996. He consults to a number of clients regarding mission critical wireless networks and applications.

### CORE COMPETENCIES

- P25, Wi-Fi, GSM, CDMA, 1xEVDO, LTE (RAN and EPC) and other wireless technologies
- 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

### PROFESSIONAL HIGHLIGHTS

- As Program Director, provides executive oversight and broadband public safety communications subject matter expertise for concurrent State and Local Implementation Grant Program (SLIGP) projects in both the State of North Dakota and the State of Minnesota.
- Provided comprehensive subject matter expertise for LTE broadband public safety communications to the Los Angeles Regional Interoperable Communications System (LA-RICS), a Joint Powers Authority
- For the Los Angeles Regional Interoperable Communications System (LA-RICS):
  - 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
  - Provided risk assessment and mitigation strategies
  - Reviewed and assessed vendor's technical implementation strategy, phasing, testing plan
  - Advised LA-RICS on all related policy and regulatory matters related to the application of LTE technology to public safety use

- Supported LA-RICS with regulatory and policy activities including the Operator Advisory Committee (and now the Early Builders Advisory Council), FCC and NTIA related matters, and with relevant NPSTC and PSCR activities.
- Provided the early vision for 700 MHz broadband spectrum using commercial technologies and advocated at the national level for 700 MHz broadband spectrum and national broadband interoperability
- Managed District of Columbia and National Capitol Region efforts to secure 700 MHz public safety spectrum access
- Managed the conception, design, advocacy, licensing, implementation, and operations of the nation's first and second 700 MHz broadband public safety networks in the District of Columbia
- Participated in the development of four broadband public safety Requests For Proposal
- Lead technical consultant to the Los Angeles Regional Interoperable Communications System (LA-RICS) supporting the design and implementation of their BTOP grant funded 4G Long Term Evolution (LTE) network; supported the development of the LA-RICS BTOP award of \$155m
- Served as the Project Executive/SME for the Minnesota Public Safety Wireless Data Network Requirement Study in which he:
  - Defined and analyzed the state's high-level performance requirements and objectives for a statewide public safety-grade broadband system
  - Conducted a requirements analysis of state and local public safety agencies to identify their goals and objectives for broadband data services.
  - Analyzed user feedback to determine the aggregate statewide system performance requirements including network availability, coverage levels, service areas, and throughput.
  - Prepared an implementation model for a statewide system to account for a variety of network implementation and operational business models. This implementation model included a full-scale statewide design of the LTE RAN, backhaul, and Evolved Packet Core.
  - Produced a funding and grants requirements document that outlined a path for the financial viability of a public safety statewide broadband solution.
- Extensive experience in the modeling of Capital Expenditure (CapEx) and Operational Expenditure (OpEx) cost of public safety broadband wireless communications and land mobile radio systems and radio spectrum
- Co-chaired the NPSTC working group that created the 700 MHz Broadband Statement of Requirements and was very active in the NPSTC Broadband Task Force
- Chaired the PSWAC Follow-Up working group in NPSTC, the Assessment of Future Spectrum and Technology including national operational requirements gathering, technology analysis, and spectrum modeling
- Co-chair of the NPSTC white paper detailing the process and projected cost to relocate local, state and federal radio licenses out of the land mobile radio (LMR) T-Band spectrum
- 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
- Managed the deployment of a dual-band, single infrastructure network allowing transparent and full featured communication between UHF and 800 MHz
- Built and led engineering teams of over 100 technical staff to engineer and implement comprehensive communications systems
- Managed detailed field study to assess building penetration required to achieve comprehensive public safety radio coverage

- Expert in Analog, Digital, Project 25, 802.11, 3GPP, and 3GPP2 wireless technologies including Long Term Evolution
- Acted as Wireless Programs Manager to provide overall management of the District of Columbia’s wireless data networks and applications development and deployment
- Managed budget in excess of \$50 million to create and implement wireless networks and solutions
- Supervised deployment of multiple interoperable public safety applications including CAD/AVL, messaging, video, 3D GIS, and ChemBio
- Managed remediation and design of complex Distributed Antenna Systems providing service for 100 miles of tunnel and in 47 underground subway stations
- 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

## CAREER TRACK

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| <ul style="list-style-type: none"> <li>■ <b>Televate, LLC, Falls Church, VA</b><br/>Senior Partner</li> <li>■ <b>Lumenix, LLC, Arlington, VA</b><br/>Vice President</li> <li>■ <b>BellSouth Cellular Corp., Atlanta, GA</b><br/>Senior Manager-RF Engineering</li> <li>■ <b>Location Assisted Technologies, Inc., Atlanta, GA</b><br/>President</li> <li>■ <b>MLJ, Inc., Arlington, VA</b><br/>Business Development Executive / Product Manager</li> <li>■ <b>LCC International, Inc., Arlington, VA</b><br/>Project Engineer</li> </ul> | <ul style="list-style-type: none"> <li>■ 2001 – Present</li> <li>■ 2000 – 2001</li> <li>■ 1998 – 2000</li> <li>■ 1996 – 1997</li> <li>■ 1993 – 1997</li> <li>■ 1989 – 1993</li> </ul> |
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## EDUCATION

- 1995 MBA**  
University of Florida, Gainesville, FL
- 1989 BS, Electrical Engineering**  
Virginia Polytechnic and State University, Blacksburg, VA

## OMNA SOLOMON

Omna Solomon is a consultant with demonstrated engineering, technical, management and communication expertise. Experience includes extensive testing, evaluation and deployment of public safety legacy and P25 networks; subscriber deployment; development of governance and interoperability for LMR systems. He is currently contributing as subject matter expert in two-way radio and P25 migration analysis, network cutover plans and system deployments.

### CORE COMPETENCIES

<ul style="list-style-type: none"> <li>■ LMR (P-16) and P25 I and II Network Design, Engineering and Management</li> <li>■ LTE RAN and Backhaul Network Design</li> <li>■ Radio fleetmap development Public safety LMR system deployments and migrations</li> </ul>	<ul style="list-style-type: none"> <li>■ Traffic analysis and capacity planning of LMR and Broadband Systems</li> <li>■ Public safety interoperable communications solutions</li> <li>■ Technical RFP Development</li> <li>■ TIA-102 APCO standards</li> </ul>	<ul style="list-style-type: none"> <li>■ Distributed Antenna Systems (DAS), Bi-directional Amplifiers (BDA), Vehicular Repeater Systems (VRS)</li> <li>■ RF infrastructure, interference testing and trouble shooting</li> </ul>
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### PROFESSIONAL HIGHLIGHTS

- Developed specifications for LMR systems upgrades and supported the evaluation and verification of vendor scope of work, engineering design and pricing proposals for P25 trunked and conventional, and analog systems other public safety systems and applications
- Conducted multiple user needs assessments to identify coverage, capacity, data and inoperability needs for public safety land mobile radio systems and broadband/mobile data applications
- Performed capacity planning and dimensioning for public safety radio networks including fiber optic and microwave backhaul transports
- Developed multicast and simulcast coverage engineering designs for public safety systems legacy and P25 and LTE networks including ancillary systems such as BDAs and VRS
- Assessed and recommended transition plans to P25 to achieve regional synergy, interoperability and seamless roaming through extension of overlay systems and implementation of ISSI
- Developed P25 network costs estimates, options and migration plans for Motorola and Harris networks
- Evaluated deployment paths and implementation strategies for public safety land mobile radio and broadband systems
- Performed lifecycle evaluations of LMR systems and supporting radio infrastructure equipment
- Identified funding sources and drafted grant applications for public safety communications projects
- Prepared migration plans for P25 network and subscriber upgrades, identified operational impact and optimal solutions and timelines
- Supported public safety network funding evaluation studies including grants, vendor financing and other fees
- Coordinated and assisted in project management of multiple public safety LMR system migrations
- Analyzed impact of FCC mandates such as narrowbanding and 800MHz rebanding on large radio fleets and managed complex subscriber inventory data collection projects; provided transition plans on deployment and programming of new subscribers

- Created 1000s of fleetmaps and codeplugs to maintain interoperable communications during migrations
- Was a member of a team of engineers that design LTE networks and prepared grant applications for various BTOP waiver entity LTE awards
- Provided extensive RF troubleshooting and resolution services including field measurements, interference and intermodulation evaluations, equipment alignment studies for various public safety networks improving system performance
- Developed talkgroup sharing MOUs to enhance operational and incident interoperable communications amongst all user agencies

## CAREER TRACK

- Televate, LLC, McLean, VA; *Consultant*
- 2006 – Present

## EDUCATION

- 2006** B.S. Electrical Engineering (Dual Degree Program), Columbia University, New York, NY
- 2004** B.A. Physics, Grinnell College, Grinnell, IA
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## JUSTIN COMPITO

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Justin Compito is a Design Engineer with experience in the design, testing, and evaluation of a wide range of radio and wireless systems and technologies. As part of his work in various projects he has supported the remediation of an underground radio system, evaluates and troubleshoots wireless CCTV systems, conduct LMR to P25 design analysis, and designed broadband 4G networks for both the LTE and backhaul components. In addition to wireless systems he has provided IT support, including the management of a web portal for project communication, and training and outreach coordination support for State and Local Implementation Grant Program (SLIGP) consultation services for both the State of North Dakota and the State of Minnesota.

### CORE COMPETENCIES

- 4G network design
- LMR network design
- Distributed Antenna Systems
- CCTV system evaluation
- Microwave Backhaul Design
- Windows Server 2008
- Microsoft SharePoint
- Microsoft Exchange
- Wireless system and equipment testing
- 802.11 Wireless Network
- Wireless Network Engineering
- IP Engineering

### PROFESSIONAL EXPERIENCE

- Serves as the communications coordinator for concurrent State and Local Implementation Grant Program (SLIGP) projects in both the State of North Dakota and the State of Minnesota. Duties include **outreach and promotion, demand aggregation, adoption, and deployment of broadband infrastructure.**
  - Assists the Project Manager in developing training and outreach programs for the local and state government officials and public safety entities from across each state in order to educate and gather information required by FirstNet.
  - Ensures that the programs meet the goals and objectives of the education and outreach as set forth by FirstNet.
  - Plans regional education and outreach sessions with stakeholders
  - Identifies venues and handles all logistical issues including reserving and paying for conference facilities, reserving and paying for rooms for conference attendees, and arranging for meals as appropriate, etc.
  - Ensures the booking and conduct of the seminars is done in compliance with all State travel policies and federal per diem guidelines. Ensures conference expenses are in accordance with federal guidelines for allowable grant expenditures. Engages with appropriate State personnel to insure all procedures and policies are appropriately followed.
  - Identifies county emergency management personnel, county 911/communications directors, public safety personnel and elected officials.
    - Creates and maintains a mailing list for both electronic mail and traditional mail. Invites public safety personnel and elected officials from mailing list via direct mailings, e-mail, public advertising, and direct phone calls.
    - Creates documentation of all bookings and reservations for venues, rooms, and meals
    - Post meetings, verifies list of actual attendees, their agency and position within the agency, or if elected official, the office which they hold, along with their addresses and contact information.
    - Assesses the present and future communication needs for every county, conducts a comprehensive review, and subsequently, creates a summary of the statewide communication requirements.

- Created, designed, and maintained web portal for the collaboration of project members including a document repository, schedule/calendar and customer support
  - Conducted thorough IP microwave backhaul design for more than 250 individual paths
    - Analyzed and managed the total capacity upon each backhaul ring
    - Optimize backhaul rings for 'five 9's' reliability, were available
    - Minimize length of backhaul routes
    - Utilize fiber points of presence to reduce aggregate capacity
  - Reviewed vendor's microwave system design approach to identify flaws
  - Performed interference and throughput analysis of LTE designs proposed by vendors
  - Designed two-county detailed metropolitan LTE system and performed site surveys
    - Setup LTE design tool with the terrain data and appropriate clutter parameters
    - Customized LTE network design criteria according to customer expectations and network usage
    - Incorporated detailed design into a comprehensive 10 county region LTE system design
    - Designed and dimensioned IP microwave paths according to expected LTE traffic for both the two county and the 10 county system designs region
    - Coordinated and chaired design reviews with customers and stakeholders spanning a 10 County region
  - Designed LTE system spanning over 13 Counties
    - Setup LTE design tool with the terrain data and appropriate clutter parameters
    - Designed LTE Network containing more than 300 sites and analyzed the coverage statistics
    - Customized LTE network design criteria according to customer expectations and network usage
    - Designed and dimensioned IP microwave paths according to expected LTE traffic
  - Conducted coverage prediction for LMR upgrade to P25
  - Planned city-wide drive test route for radio frequency measurement in compliance with TSB-88 standards
  - Conducted radio frequency drive test measurements. Analyzed and incorporate drive test results with existing LMR coverage prediction
  - Detail network design of a phased migration system to a Motorola P25 FDMA/TDMA Integrated Voice and Data system
  - Proposed alternative narrowband/P25 compatible equipment and provided a coverage assessment
  - Performed a narrowband compatibility analysis for client LMR network. Work included:
    - Researching client radio frequency, equipment and infrastructure network components
    - Performing a pre and post narrowband coverage RF analysis
    - Proposed alternative narrowband/P25 compatible equipment and provided a coverage assessment
  - Reprogrammed a variety of hand held and vehicle-mounted Motorola radios
  - Trained additional programming personnel in the operation and programming of Motorola radios
  - Conducted signal level tests for the underground wireless distribution system using scanning receivers and automated audio test equipment.
  - Analyzed performance data to assess the overall performance of the system and determine and document the causes of poor performance.
  - Engineered solutions to remediate poor performing sections of the underground system.
    - Developed reports to communicate issues and overall performance with WMATA
  - Engineered solutions to resolve identified issues DC Water Distributed Antenna System (DAS)
    - Performed tunnel RF propagation field measurements
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- Performed donor antenna signal strength field measurements
- Analyzed field measurement data in support of DAS design
- Conducted off-air testing with 802.11 tools such as AirMagnet and AirPcap
- Performed signal level and coverage analyses
- Analyzed performance data for interference, throughput, and 802.11 conflicts and issues
- Created and implemented system evaluation procedure for CCTV system involving more than 600 separate access points
- Program customer equipment including Wi-Fi access points, radios, servers, and DVRs
- Troubleshoot server, client and wireless system interaction
- IP Engineering
  - Designed IP architectures for DNS and DHCP
  - Configured routers to support 802.1x authentication
  - Managed IP addressing
- Business Applications
  - Installed and configured Windows Server 2008, SharePoint, and Microsoft Exchange
  - Provide high-level support for desktop configuration
  - Maintain, troubleshoot, and institute various Microsoft products, web portals and software

## CAREER TRACK

- **Televate, LLC, Vienna, VA** ■ 5/2010 – Present  
Consultant

## EDUCATION

- **BS, Electrical Engineering**  
Virginia Tech, Blacksburg, VA