

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
)	
Reliability and Continuity of)	PS Docket No. 11-60
Communications Networks, Including)	
Broadband Technologies)	
)	
Wireless Service Providers' Safety)	
Measures for their Customers During)	
Disasters in Connection with the)	
Consolidated Appropriations Act of 2021)	

VERIZON COMMENTS

William H. Johnson
Of Counsel

Gregory M. Romano
Robert G. Morse
1300 I Street, N.W.
Suite 500 East
Washington, DC 20005
(202) 515-2400

Attorneys for Verizon

April 26, 2021

TABLE OF CONTENTS

I.	INTRODUCTION.....	1
II.	DISCUSSION	2
	A. <i>Addressing and improving network reliability and the public’s safety in the face of natural disasters</i>	2
	B. <i>Most effective resiliency measures.</i>	4
	C. <i>Improving these measures.</i>	6
	D. <i>Customers’ response to new measures.</i>	8
	E. <i>Steps taken to ensure network resiliency.</i>	8
	1. Back up power in areas prone to planned power outages to mitigate wildfires	9
	2. Pre-storm staging processes.	9
	3. Roaming agreements that can be activated quickly following a natural disaster.	10
	4. Effective coordination with power companies, municipalities, and backhaul providers.	11
	5. Diversification of backhaul options in disaster prone areas.	13
	6. Availability of deployable network assets.	14
	7. Network infrastructure sharing among operators during natural disasters	14
	8. Communicating disaster-related information with customers, particularly members of vulnerable populations, including individuals who are low-income, members of the disabilities community, or non-English speaking.	15
	F. <i>Successful network resiliency policy measures for fixed networks that have been applied to wireless networks.</i>	16
	G. <i>Cost and benefit issues associated with implementing measures to maintain and improve resiliency of mobile wireless networks.</i>	17
III.	CONCLUSION.	19

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
)	
Reliability and Continuity of)	PS Docket No. 11-60
Communications Networks, Including)	
Broadband Technologies)	
)	
Wireless Service Providers' Safety)	
Measures for their Customers During)	
Disasters in Connection with the)	
Consolidated Appropriations Act of 2021)	

VERIZON COMMENTS

I. INTRODUCTION

On April 10, 2021, a severe storm (including at least one tornado) struck the area of Panama City, Florida. While tens of thousands of residents in the area reportedly lost electrical power,¹ Verizon's network remained operational with no fanfare. All of Verizon's voice-capable macro sites continued to work due to Verizon's investments in backup power and overlapping site coverage. And while many smaller data-only sites lost service due to the loss of power, as is typically the case for smaller facilities without room for batteries or diesel generators, overlapping coverage from the operational macro sites continued to provide users with reliable service. While many disaster events are far more destructive and impactful on wireless users, such as the Category 5 hurricane that hit Panama City in 2018, this month's experience in that

¹ See Gulf Power, News Release, *Gulf Power restored essentially all customers affected by severe weather in less than 24 hours* (Apr. 11, 2021), available at <https://www.gulfpowernews.com/customers-restored-in-24-hours/> (more than 57,000 customers affected).

same area illustrates how, in the overwhelming majority of disaster events, Verizon is able to either maintain, or to mitigate disruption to and quickly restore, service.

Due to devastating wildfire, hurricane, tornado and other natural disasters in recent years, and ongoing concern for the impact of climate change on communities, Federal and state policymakers and the consumers they represent understandably seek assurance that communications networks, including wireless networks, are as resilient as possible. Verizon's experience illustrates how it and other wireless providers regularly compete to maintain and restore service during and after disaster events, even as they work collaboratively with each other where possible.

II. DISCUSSION

The Public Safety and Homeland Security Bureau's *Public Notice* asks several questions concerning the wireless industry's network reliability practices, many of which relate to Verizon's commitments under the Wireless Resiliency Cooperative Framework.² Verizon addresses each question below.

A. *Addressing and improving network reliability and the public's safety in the face of natural disasters.*

Verizon has improved its already reliable and resilient wireless network in several ways in recent years. Verizon's most effective means of maintaining a reliable network is not necessarily a "reliability" measure per se, but simply investing in network architecture and

² *Public Safety and Homeland Security Bureau Seeks Comment on Wireless Service Providers' Safety Measures for their Customers During Disasters in Connection with the Consolidated Appropriations Act of 2021*, Public Notice, PS Docket No. 11-60, DA 21-362 (PSHSB 2021) ("*Public Notice*"); Letter to Marlene H. Dortch, Secretary, Federal Communications Commission, from CTIA, AT&T, Sprint, T-Mobile and Verizon, PS Docket Nos. 11-60 and 13-239 (Apr. 27, 2016) (the "Framework").

design so cell sites provide overlapping coverage with one another. This better ensures that users stay connected regardless of whether an outage has occurred. These investments, when combined with investment in resilient and diverse backhaul network, backup power resources, and network maintenance practices, maintain the best level of service during and after disaster events. And Verizon's substantial investments in deployable assets, coordination efforts with utilities, government agencies and other service providers, and training and tabletop exercises, further mitigate the duration and geographic scope of disaster events. Finally, Verizon has supported and taken measures over recent years to enhance its customers' and the public's awareness of significant outages to improve their ability to take appropriate action during and after disaster events.³

Verizon's investments in this area, together with its experiences during recent disaster events and its related efforts to prepare for the impact of climate change on our networks and customers, are summarized in more detail below. These efforts improve the likelihood that consumers and public safety agencies can complete 911 calls and other important communications during disaster events, as well as receive Wireless Emergency Alerts and state and local government text message alerts. And they show how the Commission's and Congress's embrace of initiatives like the Framework, as well as collaborative efforts like the Commission's Broadband Deployment Advisory Committee, have leveraged wireless providers' competitive incentives to "out-resilient" one another to create a workable and nimble policy approach for improving wireless network reliability.

³ See *infra* Section II.E.8.

B. *Most effective resiliency measures.*

The short answer to the question of what constitutes the best resiliency measure is that “it depends.” There is no “silver bullet” or one-size-fits-all method for improving network resiliency. Each disaster event is unique in terms of cause, geography, consumer and network impact, and severity. Individual service providers’ networks themselves vary based on geography, technology choice, and available resources. Particular resiliency measures appropriate for one area make no sense in another. In some cases, a particular method will help maintain service only if deployed in tandem with another. And in yet other cases, a network reliability measure would serve only to preclude a wireless provider from deploying a new facility in the first place—an outcome with its own public safety implications if a user is in a location with no or only marginal service coverage during a disaster or other emergency.

But for major disasters and other significant outage events, four primary and interrelated measures described below typically help: overlapping coverage; resilient backhaul; backup power; and deployable assets.⁴ Service providers’ emergency management and continuity of operations programs should ensure that personnel are trained and provided resources to employ all of these measures as needed to prepare for and recover from disasters.

⁴ Verizon’s comments relate to its policies and practices for its own wireless network, which inure to the benefit of its own customers and those of its resellers. Wireless devices also may enable VoIP communications, including 911 calls, but in those cases the underlying connection is generally provided by a third-party wireline broadband network rather than the wireless network. While public unlicensed Wi-Fi networks are widely available and marketed by their operators, as the Commission explained to Congress recently “in areas where mobile networks are not available due to power outages and/or backhaul failures, service over Wi-Fi or other communications technologies operating on unlicensed spectrum may also be unavailable....” Federal Communications Commission, *Study on Emergency 911 Access to Wi-Fi Access points and Spectrum for Unlicensed Devices When Mobile Service is Unavailable*, Report to Congress, ¶ 24 (2021).

Overlapping cell site network configuration. Today, when a site is out of service, an adjacent site with overlapping coverage may continue to serve users in the area.⁵ During a disaster Verizon can often remotely and dynamically increase power or activate new frequencies at adjacent sites to enhance coverage in the affected area. This approach is particularly effective when combined with a resilient backhaul network (see below). In November 2020, for example, a major fiber cut knocked out service to hundreds of sites in the Midwest. Nearly two-thirds of the sites serving that same area relied on a different backhaul link, however, and remained operational and continued to provide coverage to the affected area, thus minimizing any impact on users.

Backhaul. The vast majority of wireless outages results from the loss of backhaul facilities, whether due to a natural disaster, or a man-made event ranging from a bombing to a construction crew’s backhoe or an automobile colliding with a utility pole. Measures described below that reduce the risk of backhaul loss, enable connections to temporary backhaul assets, and expedite the repair and restoration of those facilities, will all meet this objective.

Backup Power. The availability and targeted deployment of backup power resources such as batteries, fixed and portable generators, and fuel deliveries can be effective in maintaining service for consumers. These investments are particularly important for sites designed for coverage, and stakeholders have generally recognized that not every network configuration and equipment design can accommodate battery or generator. In some cases,

⁵ As the Commission’s published event-specific status reports explain, “[t]he number of cell site outages in a specific area does not necessarily correspond to the availability of wireless service to consumers in that area” in part because “[w]ireless networks are often designed with numerous, overlapping cell sites that provide maximum capacity and continuity of service even when an individual site is inoperable.” See, e.g., Federal Communications Commission, *Status Report for Areas Impacted by Hurricane Zeta*, at 4 (Oct. 31, 2020).

though, an antenna's small size and location, or building/property owner restrictions, do not support a dedicated backup power source. In other cases, state and local facilities siting restrictions will preclude use of an on-site generator.

Deployable Assets. Some disasters will overwhelm parts of even the most resilient network. In those cases, investment in assets such as Satellite Pico Cell on a Trailer (SPOTs), Cell on Wheels (COWs), eFEMTOS (indoor cell sites), portable generators and other deployable resources, as well as spare fiber components available for use during and after disasters, can improve service restoration time and at times are used to support local emergency management and first responders.

C. *Improving these measures.*

Overlapping Site Coverage. Improving cell site density and coverage will primarily depend on the extent of a service provider's commitment to invest dollars in transmission equipment, fiber backhaul, and construction, and to invest the necessary personnel and financial resources to work with property owners and local governments to procure site locations in accordance with applicable laws. But Federal, state and local government siting and regulatory policies that enable service providers to timely deploy and improve wireless facilities, including fiber backhaul where necessary, could improve the effectiveness of these measures. Such measures include reforms that facilitate deployment of backhaul and radio access equipment and the increased availability of spectrum to support wireless networks.

Backhaul. Verizon invests in and deploys fiber backhaul in a resilient ring or hub configuration where possible, and uses forward-looking risk assessments to plan and maintain our fiber backhaul configuration, mitigating the risk of outages. Verizon also limits the geographical impact of an outage due to loss of backhaul by limiting the number of cell sites that

can operate on an unprotected single fiber link and the associated backhaul equipment. And at traffic hubs, where the traffic of more sites is aggregated, we design and maintain fully redundant fiber routes back to our data centers where practical. All of these practices help limit the impact of any single point of failure within the network due to backhaul loss. Improved coordination with electric utility companies and state/local governments over the last few years on activities such as utility pole repair and debris removal has helped to both mitigate the likelihood of fiber cuts and expedite repairs after a disaster. And investment in backhaul-equipped deployable assets is also a relevant component of this strategy.

Backup Power. Improving the availability of backup power will also primarily depend on the extent of a service provider's commitment to investing in those resources. Verizon maintains battery backup with up to 8 hours of backup power at all macro sites, and designs those sites to support backup power through diesel generators that last between 24-72 hours on a single tank of fuel. For critical coverage sites that do not have permanent generators, we deploy portable generators that can be refueled. And we maintain on-site generator resources for buildings that house critical switching, servers and computing equipment. Verizon's investments in backup power have paid dividends to users of our network in California during the state's public safety power shutdown (PSPS) events in the last couple years. Fortunately, service providers already have every incentive to maintain sufficient backup power resources to maintain at least a minimum degree of service during significant outage events to meet the needs of our customers. A blanket mandate for on-site generators, though, does not account for local siting restrictions, space limitations, or coverage versus capacity needs—and thus could hinder a service provider's ability to deploy new spectrum coverage or depth by legally precluding the

installation or upgrade of new facilities in the first instance. As noted earlier, such an outcome has its own detrimental impact on consumers' safety.

Deployable Assets. Improving the availability of deployable assets to respond to disaster events will also primarily depend on a service provider's commitment to invest in those resources. Over the last couple years Verizon has significantly increased its investments in SPOTs, Mobile Command Trailers (MCTs), as well as satellite trailers to assist when normal Ethernet backhaul is impacted. And to support portable generators Verizon uses pre-arranged fuel deliveries, with tankers poised and in position to quickly respond to hard-hit areas in case commercial power is lost.

D. *Customers' response to new measures.*

Customers generally demand and expect that their wireless services will be available to them, so do not weigh in on a service provider's network reliability until service is lost for an extended period of time. Verizon, however, has consistently received high network reliability and coverage rankings from numerous third-party tests and methodologies. RootMetrics has recognized Verizon as the best overall network for 15 consecutive testing periods, measuring overall network performance in five categories: overall, reliability, data, call and text. J.D. Power surveys real consumers to measure satisfaction across categories including call, message, email, and web connection, and Verizon is the most awarded wireless company in the history of J.D. Power. And OpenSignal, which also conducts crowdsourced testing, named Verizon first in 4G Coverage Experience in the most recent Mobile Network Experience Report.

E. *Steps taken to ensure network resiliency.*

Verizon has undertaken all the specific network resiliency steps enumerated in the *Public Notice* to at least a significant degree.

1. Backup power in areas prone to planned power outages to mitigate wildfires.

As noted, Verizon ensures that it maintains battery backup with up to 8 hours of backup power at all macro sites, and where possible designs those sites to support backup power through diesel generators that last between 24-72 hours on a single tank of fuel. This practice applies regardless of geography, including in wildfire-prone areas. For example, with very limited exceptions due to siting limitations, macro sites in California's Tier 2 and 3 High Fire Threat Districts have generators with 24-72 hours of backup power. Verizon closely monitors these assets during power shutdown events and will generally "top off" generators when monitoring systems signal that fuel levels have reached less than 30 percent capacity.

For critical coverage macro cell sites that do not have permanent generators, Verizon deploys portable generators that can be refueled. (Whether to refuel a generator during a particular wildfire will depend, of course, on vehicular access to the area, safety to personnel, and potential impact on the wildfire.) California's recent PSPS events show the effectiveness of Verizon's approach. Verizon pre-positions fuel, portable generators and deployable communications equipment near at-risk locations where an electric utility has notified there will be a PSPS event. In the few instances in which a PSPS event has occurred since California's adoption of the program, our network was well prepared for the event and service was not meaningfully disrupted due to the availability of these backup power resources.

2. Pre-storm staging processes.

Where time allows and when a storm's location and track is more predictable, such as a hurricane, Verizon establishes staging areas as needed. Before Hurricane Harvey, in coordination with state and local authorities Verizon staged deployable assets and personnel in areas west of affected coastal areas. In preparation for Hurricane Michael, Verizon was able to promptly move

deployable assets from the Carolinas (where they were initially moved in preparation for Hurricane Florence), and pre-position them, together with fuel resources, at preplanned staging areas as close as possible to the anticipated landfall location. And during Hurricane Irma, Verizon coordinated the use of staging areas as needed with state and local government agencies.⁶

3. Roaming agreements that can be activated quickly following a natural disaster.

Verizon has formalized its expanded internal procedures and protocols to execute the Framework's disaster roaming commitment. That process worked as designed in Tennessee after tornadoes hit the Nashville area in early March 2020, after the December 2020 bombing in Nashville, and after Hurricanes Laura and Sally in August and September 2020. We are also working toward more formal agreements that specifically address potential roaming needs in disaster situations, though in many cases disaster-based roaming is already a component of our existing commercial arrangements. As part of its internal practices, Verizon has a company-specific decision-making process and criteria for either requesting or accepting disaster-based roaming. These include establishing dedicated points of contact, standardized checklists for requesting, approving and implementing disaster-based roaming, all accounting for factors such as the actual coverage loss (rather than simply sites out of service), the expected service restoration time, projected capacity demands, and users' access to the affected area. Finally, and independent of roaming arrangements, wireless providers and their handset manufacturers for

⁶ Staging areas are not always feasible or necessary. Unlike a hurricane, storm events like tornadoes and the Derecho in Iowa last year hit with little if any indication of time and location. In other cases, such as Hurricane Lane in Hawaii, prepositioned staging areas were unnecessary as Verizon already maintained assets in close proximity to the affected area due to the islands' geography and topography.

many years have required devices to seamlessly connect 911 calls to multiple wireless networks if the user's primary network is not available.

4. Effective coordination with power companies, municipalities, and backhaul providers.

Backhaul providers. Verizon's extensive coordination efforts with other communications providers via the NCC/Comm-ISAC, together with our current trouble ticket and escalation procedures under contractual Service Level Agreements, have proven to be effective in coordinating service restoration efforts with third party backhaul providers. For example, in early March 2020 we worked closely with our backhaul providers in Tennessee to restore service expeditiously in Nashville and Chattanooga after tornadoes inflicted severe damage to wireline networks throughout the central part of the state. Similarly, during a storm-related outage event affecting much of southwestern Georgia in February 2020 we worked effectively with our backhaul provider and the area's electric utility to restore service in less than a day. We worked with our transport provider in Nashville to establish alternate paths when the bombing inflicted significant damage to its transport hub in December 2020. And after Hurricanes Laura and Sally hit the Gulf Coast region, we coordinated with backhaul providers to restore service and target areas where temporary satellite-based backhaul would be most-effective. Also, our Service Level Agreements with third party backhaul providers give us an ongoing dialogue with those providers during outage events.

Electric Utilities. The COVID-19 pandemic has complicated broad cross-sector initiatives but progress continues on all sides. The Communications ISAC and the Electricity ISAC have held a number of meetings in response to initiatives from various companies in New England, the Mid-Atlantic and Southeast. Verizon has also participated in numerous meetings with the Tri-Sector (Comm, Electric, and Finance) Working Group on developing and

documenting procedures for situational awareness and informational exchanges during an incident response. FEMA, the National Coordination Center (NCC), and Department of Energy also conduct meetings and/or exercises in this area, and several individual power companies, regional consortia, and state emergency management agencies have conducted such exercises in which communications companies have participated. Verizon has also contributed to and supports CTIA's ongoing initiative with the Edison Electric Institute to establish practices and protocols for coordination between service providers and electric utilities. Verizon works with other critical infrastructure stakeholders on a cross-sector basis via the All Hazards Consortium (<https://www.ahcusa.org/>). With respect to particular disaster events, coordination with Florida P&L after Hurricane Irma was a model for cross-sector coordination. Verizon also applied many lessons learned in the aftermath of Hurricane Michael, closely coordinating with the electric utilities in California during PSPS events, and on debris removal matters in the Gulf coast region after Hurricanes Laura and Sally.

Municipalities. State government emergency management agencies typically play the primary role in coordinating state and local government disaster response. (For example, Verizon communicated with CalOES throughout PSPS events in the state.) This makes sense; most natural disasters affect multiple counties and municipalities, and state governments generally maintain more full-time emergency management personnel and other necessary resources. In some cases, though, larger municipal and county governments with more resources are more directly engaged. Physical or virtual participation at the public sector entity's Emergency Operations Center (EOC) is typically based on the EOC's preferred operating model. For example, Verizon worked closely with EOC personnel in Harris County, Texas after Hurricane Harvey, and with Bay County in Florida after Hurricane Michael. Verizon's decision to publicly

disclose county-specific percentages of sites out of service has proven informative to local governments in our coordination efforts.⁷ And recent Commission initiatives to enhance the availability of outage-related information to state and local governments could help further these efforts.⁸

5. Diversification of backhaul options in disaster prone areas.

Verizon holds disaster recovery reviews with all its backhaul providers before every storm season. We review fiber routes, discuss lessons learned from previous storm seasons, and establish strategies for approaching and responding to potential threats to network integrity. As noted above, Verizon has further improved the effectiveness of an already resilient network architecture by using a fiber ring configuration where possible and limiting the geographical impact of an outage due to loss of backhaul by limiting the number of cell sites that can operate on an unprotected single fiber link and associated backhaul equipment. And at traffic hubs, where the traffic of more sites is aggregated, we design and maintain fully redundant fiber routes back to our data centers where practical. All of these practices mitigate the impact of any single point of failure within the network due to backhaul loss. Finally, we have invested heavily during the last few years in temporary deployable assets that support backhaul, such as SPOTs and other facilities that can support Ethernet-level backhaul via satellite and microwave links.

⁷ See <https://www.verizon.com/about/news/disaster-information-reports>.

⁸ See *Amendments to Part 4 of the Commission's Rules Concerning Disruptions to Communications*, Second Report and Order, PS Docket No. 15-80, FCC 21-34 (2021) (permitting state agencies to share NORs and DIRS information “downstream” with local emergency management agencies, subject to confidentiality and use restrictions).

6. Availability of deployable network assets.

As noted earlier, in the last couple years we have significantly increased our investments in portable SPOTs and MCTs, as well as satellite trailers to assist with Ethernet backhaul. We also use pre-arranged fuel deliveries in case of a major storm, with tankers poised and in position to quickly respond to hard-hit areas in case commercial power is lost as well as portable generators. These were critical to our effective responses to, for example, hurricane and wildfire events in 2019 and 2020, the March 2020 tornado event in Nashville, Tennessee, and the statewide power outage in Texas in February 2021. In some cases, notably during wildfire events, Verizon has re-engineered *existing* sites to add additional capacity to support first responders and consumers in the affected areas, without the need for separate deployable assets—which, in turn, enables us to focus deployable assets elsewhere. We also used deployable assets to support some hospitals and testing sites throughout the country early in the COVID-19 pandemic, even as we responded to tornadoes and severe storm events in the Southeast during that same period.

7. Network infrastructure sharing among operators during natural disasters.

In a highly competitive market like mobile wireless, facilities-based service providers design and deploy their networks independently and as stand-alone networks. Providers' ability to fully "share" infrastructure is thus limited, and in an extreme case could adversely affect incentives for vigorous facilities-based competition.⁹ As described earlier, however, Verizon

⁹ The Communications Security, Reliability and Interoperability Council explained that "there is little or no common, last-mile transport infrastructure that access providers could share." CSRIC IV, Working Group 9, *Infrastructure Sharing During Emergencies*, Report, § 4.2.6 (Dec. 2014).

maintains roaming arrangements with other wireless providers that largely serve this same purpose. We also cooperated with a wireline provider to establish an alternative backhaul path in Panama City, Florida after Hurricane Michael and frequently coordinate our fuel deliveries and availability with other wireless providers. And as noted earlier, we maintain ongoing coordination with third party backhaul providers during and after disaster events.

Other “mutual aid” type arrangements generally are implemented on a case-by-case basis through informal discussions between providers’ network operations and continuity of operations personnel. Service providers coordinate these efforts by participating in venues such the NCC and state and local emergency management agencies, and on an ad hoc basis through direct discussions among service providers’ personnel “on the ground.” Participation at the NCC entails a commitment to support the NCC’s function of “shar[ing] critical communications information and advice in a trusted environment to support the NCC’s national security/emergency preparedness communications mission.”¹⁰ And Verizon routinely cooperates with other providers to assist in service restoration on matters like debris removal and fuel deliveries.

8. Communicating disaster-related information with customers, particularly members of vulnerable populations, including individuals who are low-income, members of the disabilities community, or non-English speaking.

To provide consumers with convenient, one-stop access to disaster-related information, Verizon has created an Emergency Resource Center on its website (accessible to individuals with disabilities) to provide consumers with event-specific information about service status, benefits for customers affected by disasters, and steps that consumers themselves can do to prepare for

¹⁰ See www.cisa.gov/national-coordinating-center-communications.

disasters, which has been in place since Hurricane Florence in September 2018. Information on the site concerning the status, location, and cause of outages, including our service restoration efforts, has become more detailed over time. Wireless Emergency Alerts and state and local agencies' text message alerts are available to individuals with disabilities via accessible wireless phones and, subject to alert originators' capabilities, on Spanish language-capable devices.

In fall 2019, Verizon committed to publish our total percentage of sites out of service for a county covered by a DIRS activation on our public website, and did so throughout the 2020 hurricane season and for the 2020 Derecho storm in Iowa.¹¹ Beginning in late 2019 through earlier this year, we rolled out a system of outage-related communications to our wireless customers by providing ongoing updates on the status of network outages via customer-facing IVR, website, chat, and other care systems.¹² Our outage notification is proactive and incorporates text messaging and uses a device's My Verizon app as well. Finally, Verizon provides public information relating to disaster events in Spanish language on a case-by-case basis, depending on the nature of the event and the demographics of the affected area. (We did so for Hurricane Irma in southern Florida and Hurricane Maria in Puerto Rico.) And Verizon maintains 24/7 customer care for Spanish-speaking customers.

F. *Successful network resiliency policy measures for fixed networks that have been applied to wireless networks.*

For the most part, industry and CSRIC best practices are service- and technology-agnostic and do not distinguish between wireless and wireline networks. Wireless and wireline networks each maintain core network facilities, "edge" facilities closer to customers, and

¹¹ See *supra* note 7.

¹² See *Verizon mobile network notification and outages FAQs*, available at <https://www.verizon.com/support/network-outage-faqs/>.

transport facilities in between. And each has significant incentives to ensure that transport facilities (including backhaul) meet important resiliency standards. These typically include factors like: dual diverse entrances into switching facilities; service level agreements with prompt notification and repair benchmarks when cuts occur; and minimum reliability standards for both underground (conduit), and aerial fiber deployment. For conduit, this includes minimum depth, conduit material and thickness parameters, and appropriate safeguards for conduits that cross roads, railways, and bridges. For aerial fiber, this includes material and sag/tension standards and compliance with applicable pole attachments rules. And in all cases this would include minimum standards for emergency repair (including 24/7 availability and monitoring). In an important respect, though, wireless networks have advantages not available to wireline networks. If a remote terminal or cable or wiring in the last mile is cut, a residence or business may be without service until the repair is complete; if a cell site is out of service, an adjacent site often will continue to serve the same area.

G. *Cost and benefit issues associated with implementing measures to maintain and improve resiliency of mobile wireless networks.*

Each of the four reliability measures described above shows how a service provider's network reliability decisions will invariably involve economic, public safety, and public policy trade-offs. And each measure underscores how wireless providers' network planning, engineering and operations personnel will continue to require flexibility in designing and deploying network reliability measures.

Overlapping Site Coverage. In most areas, Verizon customers benefit from overlapping cell site coverage. But whether to deploy a new cell site, or to add capacity to an existing site, will depend on a variety of factors including projected voice and data traffic, population density and business activity, zoning approvals, and the equipment, transport, labor and construction

costs involved. For these reasons, wireless site coverage in more rural areas may resemble more of a “string of pearls” configuration than a Venn diagram with overlapping coverage areas. But in the former case, critical access to wireless service *is* available to consumers for 911, alerting and other important communications, and because of their critical status these macro sites will generally have an on-site backup generator.

Backup Power. Backup power involves a similar tradeoff. Maintaining on-site backup power is not always feasible and may be precluded by state or local zoning or environmental restrictions. For this reason, there is wide stakeholder acknowledgement that regulators should not expect service providers to maintain on-site backup power such as diesel generators and battery arrays at all transmitter sites. In some cases, battery but not generator backup is a viable option. But requiring backup power at all sites would make many technically infeasible due to space and engineering constraints, and in extreme cases could legally preclude the deployment of new facilities due to siting or environmental restrictions. And such a policy would adversely affect the deployment and availability of new 5G services that rely heavily on smaller facilities inconspicuously installed in more dense urban and suburban areas.

Backhaul. Different backhaul measures present their own tradeoffs. For example, while one might presume that stringing fiber through underground conduit is more resilient than aerial fiber on utility poles, an underground fiber cut may take substantially longer to repair and be more vulnerable to flooding. And underground deployment can require construction activities that more adversely affect commuter traffic and business activities in the community. Wireless providers can generally install aerial fiber more quickly and less expensively, making new competitive 4G and 5G services more economically viable and available sooner in a community, but utility poles may be more vulnerable to wind damage during a hurricane or tornado. And in

some cases the high winds and storm surge of a major hurricane can affect both, as it did for Verizon in Hurricane Michael.

Deployables. Investments in deployable assets are based on a number of factors beyond just cost, including actual use of deployables in prior disaster events and an area's vulnerability to particular weather events like hurricanes or tornadoes. Where those assets are housed is based on similar factors. Verizon's policies enabled it to quickly move large numbers of assets from the Carolinas to Florida during Hurricane Michael, and around the Gulf Coast during the multiple consecutive hurricanes that struck in the fall of 2020.

In recent years, though, some state and local governments have suggested or inquired whether service providers maintain an adequate stock of equipment in a particular state, or urged that service providers send a particular deployable asset to a particular location or community. But providers can often maximize their coverage to a disaster-affected area through not only deployables, but by activating transmitters already installed at a site or increasing power to sites that remain in service. In other cases it is necessary to target deployable assets to particular area to support public safety emergency management activities. For example, Verizon has sent assets to support firefighting stations during wildfires, and to staging areas during hurricanes to support state and local government coordination efforts. Providers require the flexibility to transport deployable assets to locations where they provide the most benefit to users, governments, and to use alternative measures to restore service.

III. CONCLUSION.

No network is ever completely impervious to a major disaster's impact. But with lessons learned from each new event Verizon continually enhances the resiliency and reliability of its networks, and improves its ability to mitigate and quickly respond to disruptions. The

Commission's and Congress's current approach enables service providers to improve the reliability of their networks through this iterative process. This approach enables service providers to nimbly target personnel and capital resources toward measures best equipped to address risks, while preserving incentives to compete vigorously through the reliability of their networks. This approach will enable providers to continue to meet the challenges of climate change and to support the safety of consumers.

Respectfully submitted,

/s/ Robert G. Morse

William H. Johnson
Of Counsel

Gregory M. Romano
Robert G. Morse
1300 I Street, N.W.
Suite 500 East
Washington, DC 20005
(202) 515-2400

Attorneys for Verizon

April 26, 2021