

9 | ASSESSMENT OF SAFETY, REDUNDANCY AND RESILIENCY OF NETWORK(S): AT&T

Principal observations and takeaways

- The only AT&T central offices that provide physical route diversity to the Public Switched Network are those that also perform tandem switching functions.
- PSAPs are being hosted by only about a third of AT&T central offices and, except for those that are connected to COs that also support tandem switching functions, most PSAPs have no physical or logical route diversity to the public switched network or in their connection to the communities they serve.
- 45 AT&T central offices that host or otherwise provide connections to PSAPs fail to meet the minimum back-up power required by FCC regulations (72 hours).
- AT&T has sufficient procedures to address nationwide service outage emergencies but is unable to identify a minimum threshold for response. There is a strong basis to conclude that AT&T California lacks the resiliency to proactively withstand disasters.

ASSESSMENT OF SAFETY, REDUNDANCY
AND RESILIENCY OF NETWORK(S): AT&T

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Introduction

In response to Communications Division Data Requests made in connection with this study, AT&T California has provided limited data and documents related to its policies, practices and procedures regarding AT&T network safety, redundancy and resiliency of infrastructure, facilities and resource management in Outside Plant Engineering, Construction & Engineering, Technical Field Services and Central Office departments.¹⁹⁵ In this chapter, we assess AT&T's resiliency based upon the information that has been provided.

Central office and PSAP redundancy

Central office connection redundancy

Most AT&T California central offices that serve end user customers (known as "Class 5 central offices" or "end offices") are connected to the public switched network ("PSN") via a single physical transport facility linking the central office to another switching facility within the local network. This is usually a so-called "tandem" switch, through which calls can be routed to other Class 5 offices within the local area or via other tandem switches to more distant end offices that are served by the same or different ILECs, or via transport facilities that connect the ILEC's local network to other local, wireless, and/or long distance (interexchange) carriers. Tandem switching functions may be housed in a stand-alone switch entity that performs only these interoffice connections, but are often combined with end office functions supported by the same physical switch. The PSN is organized in a hierarchical structure. The lowest level in the switch hierarchy is the local end office, designated as "Class 5" in the PSN architecture. Successively higher levels carry successively lower numeric class designations (see Figure 9.1). Each successively higher level in the PSN switch hierarchy controls access to a successively broader geographic area.



The only AT&T central offices that provide physical route diversity to the Public Switched Network are those that also perform tandem switching functions.

195. AT&T Response to Data Request 05-A, at 1

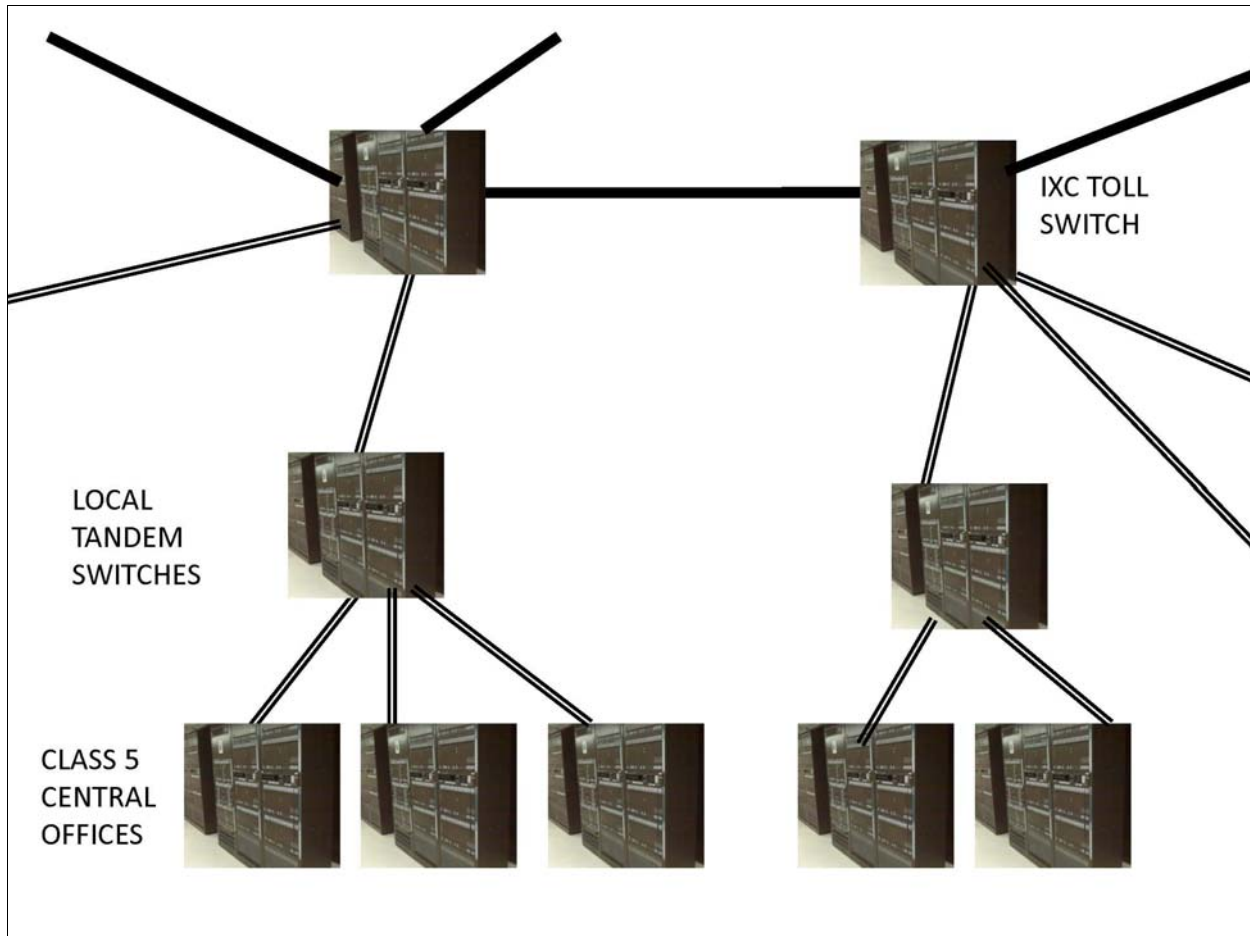


Figure 9.1. The AT&T Public Switched Network is organized in a hierarchical structure.

Interoffice and interexchange connections are typically accomplished utilizing “carrierized” transport facilities where multiple individual or “logical” voice channels are combined (“multiplex”) onto a single physical transport facility. The most commonly used carrier technology is known as “time-division multiplexing” (“TDM”) whereby individual “analog” voice signals are converted to digital form and assigned fixed “time slots” within a rotating “carousel” of time slots in a high-capacity digital transport facility. For example, analog voice channels are converted to 64 kilobits per second (“kbps”) “voice-grade-equivalent” (“VGE”) digital signals, 24 of which are then combined into a single 1.544 megabits per second (“mbps”) digital datastream for transmission. Multiple 1.544 mbps channels (known as T-1 or DS-1 channels) can then be combined for higher capacity transport where high volumes of traffic are involved. Long distance networks typically utilize transport facilities capable of carrying datarates in the multiple terabit (billions of bits per second) range. In recent years, higher level elements of the PSN have been migrated away from circuit-switched TDM technology to packet-switched Internet Protocol (“IP”) technology. TDM data is converted to IP format for transport, and then converted back to TDM for delivery to the end user if that individual is being served

via legacy circuit-switched technology. Such “IP-in-the-middle” arrangements are largely transparent to users of the PSN.

While there is extensive redundancy and routing diversity designed into the interoffice and interexchange levels of the PSN, in most cases, there is only a single “umbilical” connection between an individual Class 5 end office and the tandem switch that serves as a gateway to the rest of the world. If that connection is interrupted, the connection from that end office to the public switched network is severed, thus isolating the end office and its customers until a repair can be made. “Physical Diversity” and “Logical Diversity” are defined at 47 CFR §12.4(a)(8) as follows:

Circuits or equivalent data paths are Physically Diverse if they provide more than one physical route between end points with no common points where a single failure at that point would cause both circuits to fail. Circuits that share a common segment such as a fiber-optic cable or circuit board are not Physically diverse even if they are logically diverse for purposes of transmitting data.

“Physical Diversity” for this purpose means that connectivity exists from the Class 5 central office to at least two *different* connection points on the PSN, typically tandem switches, as illustrated in Figure 9.2 below:

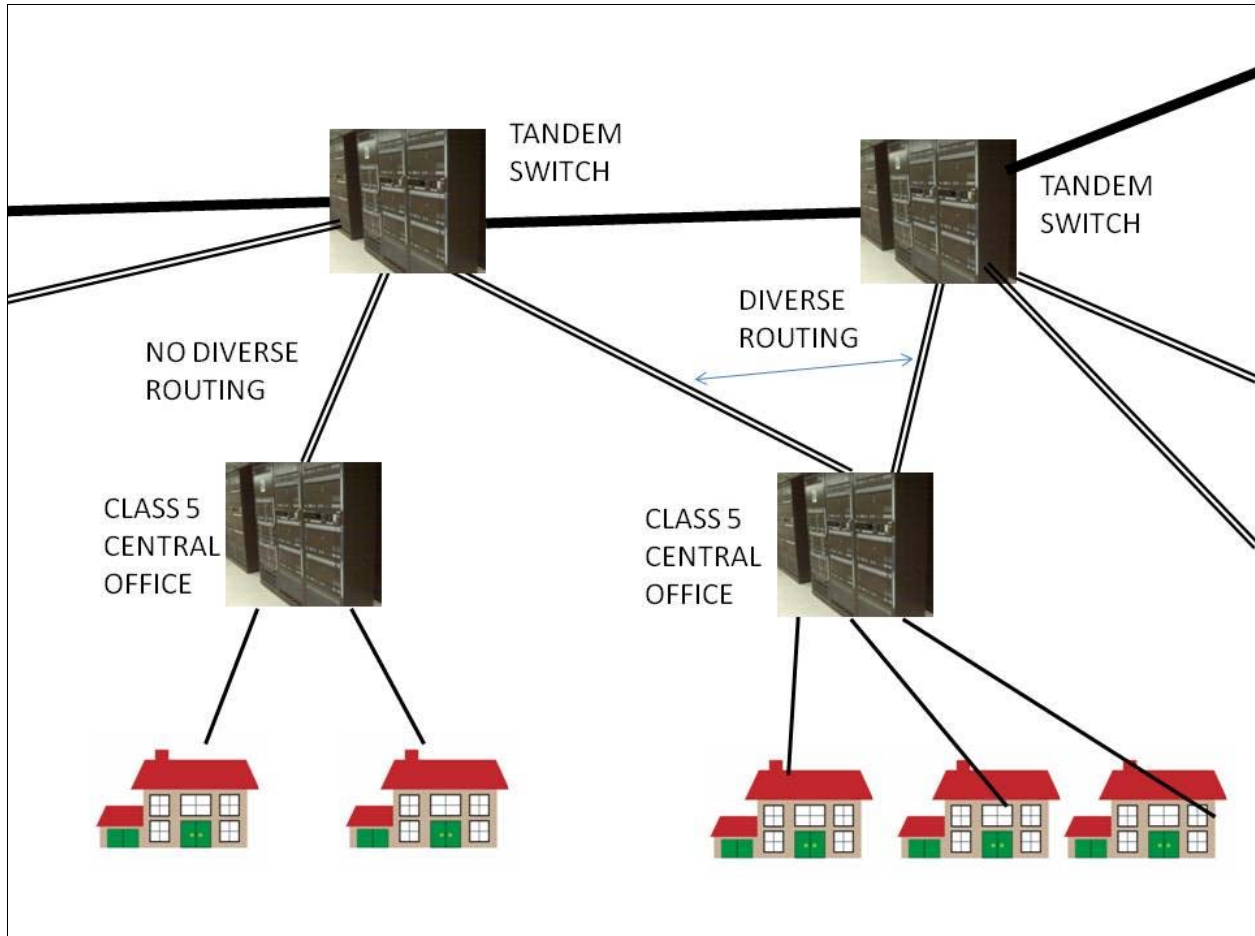


Figure 9.2. Diverse physical routing. Class 5 central office (on right) has connectivity to two different tandem switches (diverse routing); Class 5 central office (on left) has connectivity to only one tandem (no diverse routing).

AT&T was asked to “[p]rovide a list of Central Offices (by CLLI code and name) that shows the Central Offices with physical and/or logical diverse connections to the Public Switched Telephone Network.” In response, AT&T identified a total of 36 central offices that perform tandem switching functions as having any physical and/or logical diverse connections to the PSN.¹⁹⁶ *No Class 5 end offices that do not also perform tandem switching functions were identified as having any such physical or logical route diversity.* Additionally, although AT&T’s response did not indicate whether the diversity was physical or logical, it is reasonable to assume that, since all of these COs are *tandem* switches, the diversity to the PSN is *physical*. Thus, with the exception of these 36 central office switches, all remaining end offices have no physical or logical route diversity in their link to the PSN. The 36 offices that do have such route diversity are identified in Table 9.1 below.

196. AT&T response to DR-05A, Request 1.

Public Safety Answering Point connection redundancy

A “Public Safety Answering Point” (“PSAP”) is a facility that receives emergency “9-1-1” type calls and dispatches police, fire, medical or other emergency assistance as needed. PSAPs are typically operated by a local city, county or other government entity, typically by the police, sheriff or fire department, and serve defined geographic areas. PSAPs are supported by a customer database that contains detailed name and location information that is keyed to the calling telephone number. When a 911 call is placed from a legacy wireline (circuit-switched) or fixed VoIP telephone line, the calling number and associated customer name and location data is displayed at a 911 operator terminal.¹⁹⁷

Because PSAPs need to be reached immediately when an emergency arises and need to provide immediate assistance, they have a special requirement for route diversity. Calls placed to the majority of PSAPs in California involve an interoffice connection of some sort, underscoring the need for network route diversity. In addition, if a PSAP becomes overloaded (e.g., in the case of a natural disaster that affects large numbers of people) or becomes disabled (e.g., by the natural disaster itself), the ability to route 911 calls to an alternate PSAP is critical.

197. Due to their mobile nature, the precise geographic location of a mobile wireless phone at the time that it places a call to 9-1-1 cannot be known with anywhere near the degree of accuracy or precision afforded fixed wireline services. The FCC describes the capabilities and limitations of wireless 9-1-1 as follows:

Basic and Enhanced Wireless 911 Rules

FCC wireless 911 rules aim to provide Public Safety Answering Points with meaningful, accurate location information so that local emergency responders can be dispatched to quickly provide assistance to wireless 911 callers.

The FCC’s basic 911 rules require wireless service providers to transmit all 911 calls to a PSAP, regardless of whether the caller subscribes to the provider’s service or not.

Phase I Enhanced 911 (E911) rules require wireless service providers to provide the PSAP with the telephone number of the originator of a wireless 911 call and the location of the cell site or base station transmitting the call.

Phase II E911 rules require wireless service providers to provide the latitude and longitude of callers to PSAPs. This information must be accurate to within 50 to 300 meters depending upon the type of location technology used.

The FCC permits exclusions for location accuracy requirements where wireless carriers determine that providing location accuracy is limited, or technologically impossible, because of either heavy forestation or the inability to triangulate a caller’s location. Wireless service providers are required to file with the FCC a list of counties, or portions of counties, that they seek to exclude from these requirements. Wireless carriers must report any changes to their exclusion lists within 30 days of such changes. The exclusion lists and changes must be reported in the record of the FCC’s docketed proceeding, PS Docket No. 07-114, which is publicly available online.

The FCC’s wireless 911 rules apply to all wireless licensees, broadband Personal Communications Service licensees and certain Specialized Mobile Radio licensees. Mobile Satellite Service providers are excluded.

<https://www.fcc.gov/consumers/guides/911-wireless-services> (accessed 10/18/18)

Table 9.1		
AT&T CALIFORNIA CENTRAL OFFICE SWITCH ENTITIES WITH ROUTE DIVERSITY TO THE PUBLIC SWITCHED NETWORK		
Tandem Name	Tandem CLLI	Type of Switch
AUBURN	AUBNCA01DS0	5ESS
BAKERSFIELD MAIN	BKFDCA12DS0	5ESS
CHICO	CHICCA01DS1	5ESS
EL CENTRO	ELCNCA01DS0	5ESS
FRESNO MAIN	FRSNCA01DS0	5ESS
JACKSON	JCSNCA01DS1	5ESS
MILLBRAE	MLBRCA11DS0	5ESS
MODESTO MAIN	MDSTCA02DS0	5ESS
ORINDA	ORNDCA11DS0	5ESS
REDDING ENTERPRISE	RDNGCA11DS0	5ESS
RIALTO	RILTCA11DS0	5ESS
SACRAMENTO MAIN	SCRMCA01DS0	5ESS
SALINAS MAIN	SLNSCA01DS0	5ESS
SAN ANDREAS	SNADCA11DS1	5ESS
SAN LUIS OBISPO	SNLOCA01DS1	5ESS
SANTA ANA	SNANCA12DS0	5ESS
SANTA CLARA	SNTCCA11DS0	5ESS
SANTA CRUZ MAIN	SNCZCA01DS0	5ESS
SONORA	SNRACA13DS1	5ESS
EUREKA	EURKCA01DS0	DMS
HOLLYWOOD	HLWDCA01DS0	DMS
LAKEPORT	LKPTCA02DS1	DMS
MADISON	LSANCA02DS3	DMS
MARYSVILLE	MYVICA01DS0	DMS
MILL VALLEY	MLVYCA01DS0	DMS
NORTHRIDGE	NORGCA11DS0	DMS
PLACERVILLE NIAGARA	PLVLCA12DS0	DMS
San Diego MIRA MESA	SNDGCA16DS0	DMS
SAN GABRIEL	SNGBCA01DS0	DMS
SANTA ROSA	SNRSCA01DS1	DMS
SHERMAN OAKS	SHOKCA01DS0	DMS
STOCKTON MAIN	SKTNCA01DS0	DMS
UKIAH	UKIHCA01DS0	DMS
VALLEJO	VLLJCA01DS1	DMS
VENTURA FIR	VNTRCA02DS0	DMS
VISALIA	VISLCA11DS0	DMS
Source: AT&T Response to DR-05A, Request 1(a)		

Routing of 911 calls to the applicable PSAP is accomplished initially at the Selective Router to which the central office that serves the caller's access line has been assigned. As shown in Table 9.2, it appears that there are 368 PSAPs within AT&T California's operating area, and that these are hosted by 233 AT&T Central Offices.¹⁹⁸ AT&T has identified a total of 406 "Central Offices with diverse connections that host PSAPs."¹⁹⁹ However, of these 406 central offices, only 206 are included in AT&T's response to DR-05A, Request 1(b) list of "Central Offices that host PSAPs" with the remaining 200 central offices identified in response to DR-05A, Request 1(c) as offering some type of diverse connections that *do not* appear to "host PSAPs." Moreover, since there are only 206 out of the 233 central offices identified by AT&T as "hosting PSAPs" that AT&T has identified as providing some type of "diverse connection," it would appear that there are 27 central offices (i.e., 233 – 206) that host PSAPs but that *do not* provide for diverse connections. There are 34 Selective Routers in AT&T California service territory.

Central office serving areas do not necessarily correspond with municipal boundaries, and in fact most do not. Customers served by a given central office may live in different towns or even different counties, or be assigned to different PSAPs even within the same municipality. As a result, accurate routing of E911 calls requires that the correct PSAP be associated with each access line based upon the customer's physical address. Selective Routers perform this function. A primary and secondary route has been established for every PSAP, and both are maintained in the Selective Router's database. If one route is unavailable or inoperative, the call will be delivered via the secondary route.²⁰⁰

198. AT&T Response to DR-05A, Request 1(b).

199. AT&T Response to DR-05A, Request 1(c).

200. *See*, National Emergency Number Association (NENA) VoIP E9-1-1 Requirements Working Group, "NENA Generic E9-1-1 Requirements Technical Information Document," Issue 1, July 23, 2004, at § 2.1.3.

Table 9.2

**AT&T CALIFORNIA
CENTRAL OFFICE SWITCH ENTITIES WITH
PUBLIC SWITCHED NETWORK AND PSAP ROUTE DIVERSITY**

Central Office CLLI	Central Office Name	Diversity to PSN	Hosts PSAPs	PSAP Diversity
				X
			X	X
			X	X
				X
				X
				X
			X	X
				X
				X
				X
			X	X
				X
				X
			X	X
			X	
				X
			X	X
		X	X	X
			X	X
				X
				X
				X
			X	X
			X	X
				X
				X
			X	X
			X	X
			X	
				X
				X
				X
			X	
				X

Central Office CLLI	Central Office Name	Diversity to PSN	Hosts PSAPs	PSAP Diversity
		X	X	X
			X	X
				X
				X
			X	X
			X	X
			X	X
				X
			X	X
				X
			X	X
				X
			X	X
				X
				X
				X
			X	X
				X
				X
				X
			X	X
			X	X
			X	X
				X
				X
				X
			X	X
		X	X	X
			X	X
				X
				X
				X
			X	X
		X	X	
			X	X
				X
			X	X
				X
				X
			X	X
			X	

Central Office CLLI	Central Office Name	Diversity to PSN	Hosts PSAPs	PSAP Diversity
			X	X
				X
				X
				X
X		X	X	X
				X
		X		
				X
		X		X
				X
				X
				X
				X
				X
			X	X
			X	X
			X	
				X
				X
				X
				X
				X
				X
			X	X
				X
				X
			X	X
				X
			X	X
				X
				X
				X
				X
				X
			X	X
			X	X
				X
X		X	X	X
			X	X
				X
				X

Central Office CLLI	Central Office Name	Diversity to PSN	Hosts PSAPs	PSAP Diversity
				X
			X	X
				X
			X	X
				X
				X
			X	X
				X
				X
				X
			X	X
				X
			X	X
X				X
				X
				X
				X
				X
X		X		
				X
				X
			X	
			X	X
				X
				X
X		X		X
				X
X		X		X
				X
				X
			X	X
			X	X
				X
				X
			X	X
X		X		
				X
			X	X
				X
				X
				X
				X
				X
			X	X
				X

Central Office CLLI	Central Office Name	Diversity to PSN	Hosts PSAPs	PSAP Diversity
				X
				X
				X
				X
			X	X
			X	X
				X
				X
				X
			X	X
				X
				X
				X
			X	X
				X
				X
				X
				X
				X
		X		X
			X	
			X	X
				X
				X
			X	X
				X
			X	X
				X
				X
				X
			X	X
			X	X
				X
				X
				X
		X	X	X
			X	X
				X
				X
				X
		X	X	X
			X	X
				X
				X
				X
		X		

Central Office CLLI	Central Office Name	Diversity to PSN	Hosts PSAPs	PSAP Diversity
			X	X
				X
		X		X
				X
		X		X
				X
				X
				X
		X		X
				X
				X
		X		X
				X
				X
		X		X
				X
		X		X
		X		X
		X		X
		X		X
				X
X		X		X
				X
		X		X
X		X		X
				X
X				X
				X
				X
		X		X
		X		X
		X		X
				X
				X
		X		X
		X		X
				X
				X
		X		X
		X		X
				X
				X

Source: AT&T Response to DR-05A, Request 1.

The “diverse connections” that AT&T has identified in its response to DR-05A, Request 1(c) appear to refer to different signaling protocols (Signaling System 7 (“SS7”) vs. Multi-Frequency (“MF”) and/or to originating vs. overflow 911 call routing. It is not at all clear, however, that the “diverse connections” being referred to in this response refer to different *physical* routing of 911 calls over physically separate connections between the PSAP and the host central office. If there is an interruption in the physical facility connecting the PSAP with the central office, the diversity of signaling (SS7 or MF) will be of no benefit. It appears that the only central offices that host PSAPs that also offer physical route diversity are those that also provide tandem functions. The overwhelming majority of AT&T end offices do not appear to offer any physical route diversity to the first point of connection to the public switched network.



PSAPs are being hosted by only about a third of AT&T central offices and, except for those that are connected to COs that also support tandem switching functions, most PSAPs have no physical or logical route diversity to the public switched network or in their connection to the communities they serve.

Back-up power requirements and availability

Central offices

FCC regulations specify minimum back-up power requirements for central offices that host or otherwise provide connections to PSAPs.²⁰¹ Two categories of central offices are defined for this purpose based upon whether or not the central office hosts a “selective router.” A “Selective Router” is “[a] 911 network component that selects the appropriate destination PSAP for each 911 call based on the location of the caller.”²⁰²

47 CFR §12.4 (c)(2)(i): With respect to any central office it operates that directly serves a PSAP, a covered 911 service provider shall certify whether it:

(A) Provisions backup power through fixed generators, portable generators, batteries, fuel cells, or a combination of these or other such sources to maintain full-service functionality, including network monitoring capabilities, for at least 24 hours at full office load or, if the central office hosts a selective router, at least 72 hours at full office load; provided however, that any such portable generators shall be readily available within the time it takes the batteries to drain, notwithstanding potential demand for such generators elsewhere in the service provider’s network.

201. – Reliability of covered 911 service providers

202. 47 CFR §12.4(a)(10).

AT&T has provided a tabulation of all of its California central offices, specifying for each the minimum backup power requirement (i.e., 24 or 72 hours) and the number of hours for which back-up power of some sort (apparently mainly from generators) is available at that site. 45 central offices fail to satisfy the minimum back-up power requirement, as shown in Table 9.3:

Table 9.3

**AT&T CALIFORNIA
CENTRAL OFFICE BACK-UP POWER
MINIMUM REQUIREMENTS AND AVAILABILITY**

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available – Required)
		72	274.02	0
		72	282.43	0
		72	18.29	-53.71
		72	220.04	0
		24	101.22	0
		24	178.05	0
		24	147.76	0
		72	1056.89	0
		72	305.75	0
		72	391.94	0
		72	142.55	0
		72	169.2	0
		24	265.92	0
		72	77.25	0
		72	167.08	0
		72	181.87	0
		72	327.27	0
		24	129.94	0
		72	132.9	0
		24	332.99	0
		24	96.79	0
		24	185.32	0
		72	240.57	0
		72	629.82	0
		24	112.69	0
		24	249.94	0
		24	191.37	0
		72	56.62	-15.38
		24	292.43	0
		72	69.27	-2.73
		72	257.04	0
		24	258.11	0
		72	88.19	0
		72	324.1	0
		72	128.57	0
		24	151.15	0
		72	153.53	0
		72	283.61	0
		72	111.05	0
		72	113.23	0
		24	112.77	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available – Required)
		72	206.02	0
		24	122.8	0
		72	282.49	0
		72	322.29	0
		72	5.44	-66.56
		72	652.33	0
		24	171.06	0
		24	461.22	0
		72	112.57	0
		72	263.59	0
		24	199.77	0
		24	124.18	0
		72	122.33	0
		24	174.3	0
		72	649.95	0
		72	591.23	0
		72	1235.44	0
		72	560.6	0
		72	236.69	0
		72	248.33	0
		72	180.24	0
		72	192.82	0
		72	106.12	0
		72	381.46	0
		24	243.22	0
		24	76.21	0
		72	273.24	0
		24	198.02	0
		24	191.93	0
		72	478.81	0
		24	232.24	0
		72	328.31	0
		72	217.49	0
		24	612.77	0
		72	498.04	0
		24	130.83	0
		72	327.61	0
		24	91.69	0
		72	239.27	0
		72	224.27	0
		72	166.14	0
		72	142.47	0
		72	498.95	0
		24	165.22	0
		72	316.69	0
		24	187.02	0
		24	429.48	0
		72	171.12	0
		24	1060.84	0
		72	118.96	0
		72	328.97	0
		72	187.93	0
		72	615.15	0
		72	240.18	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available – Required)
		72	99.23	0
		72	317.21	0
		72	789.51	0
		24	234.2	0
		72	246.49	0
		72	105.18	0
		24	187.45	0
		72	186.94	0
		72	127.2	0
		24	100.99	0
		24	205.39	0
		24	156.33	0
		72	185.33	0
		72	201.41	0
		24	111.89	0
		24	336.2	0
		72	10.86	-61.14
		24	144.47	0
		72	162.95	0
		24	130.33	0
		24	400.2	0
		24	155.04	0
		24	915.04	0
		72	237.63	0
		24	174.3	0
		72	194.2	0
		72	580.22	0
		72	426.06	0
		72	171.12	0
		72	130.31	0
		24	171.86	0
		24	155.87	0
		24	131.13	0
		72	224.09	0
		72	164.44	0
		24	122.67	0
		24	164.91	0
		72	187.6	0
		24	312.62	0
		72	339.46	0
		72	173.32	0
		72	171.44	0
		72	154.21	0
		72	180.88	0
		24	319.33	0
		24	145.6	0
		72	62.74	-9.26
		24	151.37	0
		24	198.64	0
		72	395.8	0
		72	206.67	0
		72	0	-72
		72	178.05	0
		72	338.14	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available – Required)
		72	153.38	0
		24	425	0
		72	176.87	0
		24	313.3	0
		72	213.69	0
		72	178.03	0
		24	136.43	0
		24	190.68	0
		72	136.42	0
		24	209.41	0
		72	98.51	0
		24	173.36	0
		72	300.63	0
		24	105.33	0
		72	158.71	0
		72	92.35	0
		72	137.39	0
		24	106.16	0
		24	448.67	0
		72	105.68	0
		72	239.09	0
		24	144.02	0
		72	100.55	0
		72	2073.7	0
		24	718.18	0
		72	214.38	0
		24	100.8	0
		24	106.73	0
		72	129.65	0
		72	108.48	0
		72	121.06	0
		72	265.63	0
		72	84.16	0
		24	133.14	0
		72	162.49	0
		24	96.56	0
		24	2295.92	0
		72	678.06	0
		72	132.42	0
		72	184.75	0
		72	237.62	0
		72	152.77	0
		72	180.7	0
		72	216.16	0
		24	135.46	0
		72	316.89	0
		72	17207.28	0
		24	149.97	0
		72	133.16	0
		72	180.33	0
		24	135.62	0
		72	112.8	0
		72	414.27	0
		72	121.69	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available – Required)
		72	102.99	0
		72	602.96	0
		72	425.99	0
		72	121.19	0
		24	146.43	0
		24	223.4	0
		24	124.95	0
		24	94.36	0
		24	90.05	0
		72	222.78	0
		24	120.79	0
		72	374.89	0
		72	144.78	0
		72	155.47	0
		72	238.44	0
		72	126.25	0
		72	97.42	0
		72	249.92	0
		72	207.66	0
		24	295.31	0
		24	142.64	0
		72	246.6	0
		72	241.06	0
		72	243.68	0
		72	174.07	0
		24	212.59	0
		72	158.08	0
		72	211.22	0
		24	130.12	0
		24	254.14	0
		72	254.53	0
		72	165.36	0
		72	103.97	0
		72	142.84	0
		72	124.33	0
		72	175.45	0
		72	206.74	0
		72	225.99	0
		24	177.18	0
		72	176.47	0
		72	400.73	0
		72	406.63	0
		24	312.01	0
		24	335.23	0
		72	290.32	0
		72	422.68	0
		72	276.07	0
		24	165.11	0
		72	131.84	0
		72	149.75	0
		72	327.77	0
		72	250.82	0
		72	335.23	0
		72	118.23	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available - Required)
		72	127.03	0
		72	242.94	0
		72	181.52	0
		72	164.17	0
		72	202.36	0
		72	129.55	0
		72	511.16	0
		72	149.13	0
		24	136.08	0
		72	304.24	0
		72	376.03	0
		24	103.79	0
		72	741.6	0
		72	116.19	0
		24	145.17	0
		72	125.37	0
		24	203.67	0
		72	434.34	0
		24	161.31	0
		72	167.04	0
		24	175.43	0
		24	74.86	0
		72	153.96	0
		72	191.77	0
		72	268.63	0
		72	351.95	0
		24	186.02	0
		24	90573.06	0
		72	202.25	0
		24	213.56	0
		24	158.44	0
		72	4.88	-67.12
		24	73.36	0
		24	176.72	0
		24	343.59	0
		72	137.61	0
		72	66.8	-5.2
		24	199.24	0
		72	148.66	0
		72	209.91	0
		72	225.75	0
		72	317.32	0
		72	424.69	0
		72	236.66	0
		24	116.28	0
		72	133.34	0
		72	90.54	0
		24	162.78	0
		72	165.62	0
		72	712.39	0
		72	77.97	0
		72	123.77	0
		72	105.46	0
		72	121.85	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available – Required)
		24	170.57	0
		72	240.85	0
		72	148.27	0
		72	236.25	0
		72	115.48	0
		24	247.03	0
		72	134.18	0
		72	280	0
		24	10.21	-13.79
		24	139.82	0
		24	367.29	0
		72	138.02	0
		72	263.5	0
		72	127.92	0
		72	244.44	0
		72	515.74	0
		72	183.22	0
		24	150.32	0
		24	211.17	0
		72	101.57	0
		72	408.51	0
		72	172.81	0
		72	324.08	0
		24	143.52	0
		24	236.4	0
		72	138.51	0
		72	86.52	0
		24	75.75	0
		24	99.87	0
		24	176.33	0
		72	191.8	0
		24	513	0
		72	98.28	0
		72	7994.85	0
		72	22847.45	0
		72	164.39	0
		72	127.6	0
		72	499.14	0
		72	347.93	0
		72	214.41	0
		72	155.87	0
		72	245.09	0
		72	259.86	0
		72	6019.91	0
		24	138.11	0
		72	192.22	0
		24	159.99	0
		72	173.63	0
		72	286.74	0
		24	235.44	0
		72	178.53	0
		24	101.9	0
		24	197.26	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available - Required)
		72	145.16	0
		24	794.98	0
		72	90.58	0
		72	324.88	0
		24	164.45	0
		24	230.6	0
		72	200.51	0
		72	506.2	0
		72	65.22	-6.78
		72	189.68	0
		72	103.65	0
		72	231.09	0
		24	171.19	0
		72	219.39	0
		72	377.34	0
		24	295.18	0
		72	304.12	0
		24	76.13	0
		72	194.9	0
		24	316.08	0
		72	540.04	0
		72	173.91	0
		72	98.73	0
		72	244.55	0
		24	261.77	0
		72	169.72	0
		72	335.65	0
		72	1051.51	0
		72	297.36	0
		24	185.92	0
		72	280.05	0
		72	372.34	0
		72	189.56	0
		24	157.86	0
		72	142.41	0
		72	102.22	0
		72	119.41	0
		24	109.73	0
		24	123.77	0
		72	216.01	0
		72	179.44	0
		72	166.29	0
		72	96.62	0
		24	93.02	0
		72	159.87	0
		72	160.13	0
		72	351.88	0
		24	237.98	0
		72	86.05	0
		72	361.47	0
		72	455.52	0
		72	86.12	0
		24	144.27	0
		24	375.32	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available – Required)
		72	114.99	0
		72	309.04	0
		72	145.51	0
		72	340.39	0
		72	208.13	0
		24	155.15	0
		24	140.72	0
		72	100.37	0
		24	197.18	0
		24	74.9	0
		72	152.88	0
		72	188.15	0
		72	148.05	0
		24	123.63	0
		72	181.71	0
		72	174.82	0
		72	185.58	0
		72	64.83	-7.17
		72	164.43	0
		24	197.53	0
		72	271.63	0
		72	343.48	0
		24	161.61	0
		24	121.47	0
		72	197.92	0
		24	160.89	0
		72	171.46	0
		72	171.86	0
		72	148.8	0
		72	110.91	0
		72	115.29	0
		72	355.06	0
		24	3317.49	0
		72	205.84	0
		24	173.67	0
		72	358.45	0
		72	212.56	0
		24	398.49	0
		72	377.46	0
		72	1521.66	0
		24	202.4	0
		24	1007.06	0
		72	155.47	0
		72	323.07	0
		24	369.56	0
		72	216.07	0
		72	232.07	0
		72	324.37	0
		72	249.21	0
		24	161.1	0
		72	414.44	0
		72	88.12	0
		24	187.23	0
		72	12.3	-59.7

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available - Required)
		72	116.11	0
		24	94.94	0
		72	229.02	0
		24	229.48	0
		24	243.08	0
		72	295.09	0
		72	195.49	0
		72	271.86	0
		24	193.33	0
		24	92.48	0
		72	240.66	0
		72	203.5	0
		72	142.88	0
		72	214.87	0
		72	282.32	0
		72	194.27	0
		72	106.76	0
		72	364.91	0
		72	204.01	0
		72	192.73	0
		24	109.71	0
		24	125.6	0
		72	171.72	0
		72	161.94	0
		24	102.79	0
		72	8.27	-63.73
		24	167782.71	0
		72	331.84	0
		72	8.99	-63.01
		72	194.65	0
		72	176.99	0
		24	152.64	0
		24	151.15	0
		24	279.26	0
		24	117.95	0
		72	172.44	0
		72	2016.78	0
		72	508.7	0
		72	0	-72
		72	274.82	0
		72	424.13	0
		72	280.13	0
		72	433.71	0
		24	297.11	0
		72	344.1	0
		72	742.03	0
		24	165.66	0
		24	208.06	0
		24	158.6	0
		72	269.18	0
		72	209.52	0
		72	168.89	0
		24	256	0
		72	163.72	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available - Required)
		24	162.45	0
		24	154.32	0
		72	167.45	0
		24	121	0
		72	208.22	0
		72	128.46	0
		72	138.7	0
		72	85.48	0
		24	132.7	0
		72	82.26	0
		24	174.82	0
		72	10.52	-61.48
		72	6.85	-65.15
		72	454.23	0
		72	220.23	0
		72	186.9	0
		72	95.4	0
		72	113.23	0
		24	382.04	0
		24	508.75	0
		72	163.82	0
		24	258.56	0
		72	280.71	0
		24	373.88	0
		72	178.04	0
		24	217.48	0
		72	231.78	0
		24	140.78	0
		72	90.88	0
		72	256.78	0
		24	296.77	0
		72	233.09	0
		72	249.53	0
		72	139.2	0
		72	142.28	0
		72	130.63	0
		72	177.41	0
		72	419.77	0
		24	231.29	0
		72	198.87	0
		72	129.15	0
		72	317.08	0
		72	219.81	0
		72	251.78	0
		72	127.76	0
		72	196.23	0
		24	397.23	0
		24	258.91	0
		72	448.69	0
		72	226.93	0
		24	65.02	0
		72	281.39	0
		24	118.34	0
		24	173.06	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available - Required)
		24	134.39	0
		72	159.29	0
		72	199.57	0
		72	245.2	0
		72	195.47	0
		72	260.47	0
		24	183.32	0
		72	118.26	0
		72	355.36	0
		24	139.73	0
		72	2065	0
		72	481.65	0
		72	690.57	0
		72	82.5	0
		72	241.49	0
		72	464.24	0
		24	290.58	0
		72	243.14	0
		72	120.68	0
		72	251.72	0
		72	573.89	0
		72	248.94	0
		24	81.94	0
		72	179.93	0
		72	266.45	0
		72	102.85	0
		72	131.04	0
		72	263.35	0
		24	220.31	0
		72	289.68	0
		72	10.81	-61.19
		72	295.02	0
		24	252.69	0
		24	271.14	0
		24	270.92	0
		72	149.74	0
		72	90.38	0
		72	145.6	0
		24	133.51	0
		72	166.31	0
		72	184.81	0
		72	139.44	0
		24	307.8	0
		24	83.38	0
		72	72.39	0
		72	136.66	0
		72	0	-72
		72	15.79	-56.21
		72	357.95	0
		72	54.9	-17.1
		72	409.09	0
		72	0	-72
		72	24	-48
		72	100	0

CLLI	Central Office Name	Back-up Power Required (Hours)	Back-up Power Available (Hours)	Deficiency (Available – Required)
		72	0	-72
		72	26.76	-45.24
		72	21.63	-50.37
		72	16.5	-55.5
		72	23.1	-48.9
		72	232.16	0
		72	0	-72
		72	13.5	-58.5
		72	6.3	-65.7
		72	5.7	-66.3
		72	651.99	0
		72	0	-72
		72	17	-55
		72	719.54	0
		72	220.9	0
		72	613.2	0
		72	254.2	0
		72	94.22	0
		72	87.55	0
		72	803.22	0
		72	0	-72
		72	86.62	0
		72	986.23	0
		72	5.9	-66.1
		72	22.5	-49.5
		72	99.64	0
		72	602.86	0
		72	0	-72
		72	8.52	-63.48
		72	100	0
		72	0	-72
		72	265.57	0
		72	223.81	0
		72	0	-72
		72	75.46	0
		72	0	-72
		72	181.45	0
		72	0	-72
		72	52.6	-19.4
		72	155.04	0
		72	185.8	0
		72	180	0
		72	219.12	0

Source: AT&T Response to DR-05A, Attachment 2.

The AT&T back-up power data that is shown in Table 9.3 portrays an enormous variation in the number of back-up hours that are available in each case, ranging from a low of zero to a high of 167,782.71 hours in [REDACTED] central office. That translates to more than 19 years of back-up power. While there are no other locations with anything close to this level, there are others that also appear anomalous, such as 22,847.45 hours (i.e., 2 years, 7 months) in [REDACTED] or 90,573.06 hours (i.e., 10 years, 4

months) in [REDACTED]. These could, of course, be data errors, but the fact that there are several such entries may indicate that there is some other explanation.



45 AT&T central offices that host or otherwise provide connections to PSAPs fail to meet the minimum back-up power required by FCC regulations (72 hours).

Electronic field equipment

AT&T did not provide a written response to the Data Request regarding battery back-up systems for field cabinets that house pair-gain systems and various forms of fiber-fed network systems (fiber to the curb, fiber to the neighborhood/node). The following information is drawn from industry standards and verbal inquiries to AT&T staff during field visits. The industry standard for pair-gain systems, such as AT&T's original subscriber loop carrier system (SLC-96) is for the Remote Terminal to operate for a minimum of 8 hours in the event of a loss of commercial AC Power.²⁰³ During physical site visits, TFS Managers informed Communications Division Staff that in the event of a major outage longer than 8 hours, portable generators are used to provide power. In one location, CD Staff observed generators that were placed onsite due to a recent storm that interrupted commercial power.

For the small number of customers served by Fiber-to-the-Premises (FTTP), AT&T's fiber terminates in an Optical Network Terminal that requires electrical power that is locally supplied by the subscriber in order to operate. In most cases, AT&T does not provide battery back-up to subscribers. According to AT&T's Terms of Service, the backup battery solution is the responsibility of the customer and can be chosen from third party manufacturers or retailers.²⁰⁴ The amount of backup provided varies based upon many factors, including battery size, usage and temperature.

Allocation of resources and labor in the event of major emergencies

AT&T was asked to provide internal company standards for the allocation of resources and labor in the event of major emergencies including, but not limited to, the Company's ability to move field staff between regions in states of emergency, its mutual aid agreements with other

203. See, Cho, Y. S., Olson, J. W. and Williamson, D. H. "D4 Digital Channel Bank Family: The SLC™-96 System." *AT&T Bell System Technical Journal* 61, no. 9 (November 1982): 2693. https://archive.org/stream/bstj61-9-2677/bstj61-9-2677_djvu.txt (last accessed 1/28/2019).

204. https://www.att.com/legal/terms.internetAttTermsOfService.html#Schedule_7 (accessed 1/28/19).

states, and its policy that outlines the standard threshold of outages that trigger resource reallocation or mutual aid,²⁰⁵ AT&T responded that:

AT&T has no specific policy outlining standard threshold of outages that trigger resource re-allocation or mutual aid. In the event of major emergencies, decisions on the allocation of resources and labor are made on a case-by-case basis. For instance, as a first course of action, AT&T would increase the overtime hours available to its “in region” technicians. Thereafter, AT&T non-customer facing resources would be allocated to areas with elevated customer demand due to a major emergency. In the event those resources are not sufficient to meet customer demand, AT&T has the flexibility in a state of emergency to move field staff between regions across the AT&T footprint on an as-needed basis.²⁰⁶

AT&T did produce documentation on companywide disaster response procedures. No specific details have been provided as to the actual extent to which these practices and policies are being followed by AT&T California. Notably, however, from our examination of the persistent and recurring relationship between precipitation and service outages in the Los Angeles area over the 2010-2017 study period (as discussed in Chapter 4 above), there is a strong basis to conclude that AT&T’s practices “on the ground” are far more *reactive* than they are *proactive*.



AT&T advises that it has no specific policy establishing a standard threshold of outages that trigger resource reallocation or mutual aid, and that in the event of major emergencies, decisions on the allocation of resources and labor are made on a case-by-case basis.

Redundancy and resiliency processes and procedures in emergencies

West Region Disaster Preparedness

AT&T explains that its West Region disaster response efforts are orchestrated by a team of “War Room Personnel ... control[ing] all fielding, engineering, and construction activities in concert with Business as Usual (“BAU”) Cable Maintenance Center (“CMC”) and Project Management.²⁰⁷ For each district, a First in Assessment Team (FIAT) composed of construction and engineering managers initially assesses the scale of the damage:

205. AT&T Narrative Response to DR 05-A, at 2

206. AT&T Narrative Response to DR-04A, at 5

207. AT&T Response to DR-04A, Attachment F, “AT&T Disaster Preparedness West Region Construction & Engineering,” at 5.

- Are affected poles “H” all or joint with power?²⁰⁸
- Are poles intact or destroyed?
- Are cables down or possibly just damaged?
- From a distance can you determine which way the fire/mud/water is spreading? This will give engineering a chance to plan and prepare fielding packages.²⁰⁹

And then prioritizes service restoration as follows:

- (1) Interoffice Facilities (“IOF”)/Trunk Cables
- (2) Cell Sites/First Net
- (3) Remote Terminals
- (4) Fiber based services
- (5) Escalations
- (6) Local copper based services²¹⁰

Information on generator inventory both in the West and in neighboring regions is readily accessible. The Regional Generator Coordinator ensures efficient regional allocation and, if needed, mobilization from “storage facilities in [REDACTED], CA if the outage is large enough.”²¹¹ Should the outage necessitate a greater response, AT&T employs one of fourteen (14) national Disaster-First Strike Teams.²¹²

208. Poles and pole lines are often jointly owned or jointly used by the telephone and electric power utilities. The individual poles may be jointly owned, or poles may be alternately owned by the two utilities. E.g., the telephone utility may own poles 1, 3, 5, 7 and 9, and the electric utility may own poles 2, 4, 6, 8 and 10 along a given right of way. Third-party “attachees” such as cable TV or other telecommunications carriers may lease space on the poles and pay the owner(s) for their use. Poles that are used jointly by the telephone and electric utilities are organized such that the electric cables are always at the highest level, and are separated from telecommunications cables by a “buffer zone” known as the “Communications Worker Safety Zone”.

209. AT&T Response to DR-04A, Attachment F, at 6-7

210. *Id.*, at 7 - 8

211. *Id.*, at 19

212. AT&T Response to DR-05A, Attachment A, “ATT-TELCO-JA-000-003-359” at 30-31.

Disaster First Strike Team (DFST)

The AT&T Disaster-First Strike Team (DFST) response method originated through regional team collaboration. The volunteer teams are comprised of AT&T employees experienced in disaster relief: “The teams have been trained and equipped to assist ... districts in the assessment, repair, replacement and emergency powering of DEG [Digital Electronics Group] systems. In most instances, the disaster team’s mission will be totally complete within 30 days.”²¹³

Minimally, DFST teams are composed of a Team Lead, an Inventory and Administration Specialist, four (4) DEG Dispatchers, two (2) Generator Dispatchers, and a PGDB [Pair gain database] and RESTORE [Remote terminal outage tracker] Support member.²¹⁴ After setting up a “designated deployment/dispatch center,” DEG, Construction, Core Installation and Maintenance, and Misc. Technicians are dispatched to downed sites to set up and refill generators.²¹⁵

Once generators are in place, DEG Technicians respond to system-wide alarm issues.²¹⁶ In order to repair VRAD [Video Ready Access Device] service, policy response is dependent upon whether the Network Reliability Center is accessible and if all customers are “OK”.²¹⁷ If both conditions are met, no action is necessary until power is restored.²¹⁸ If the VRAD is inaccessible, a DEG tech is dispatched.²¹⁹ AT&T explains further that:

If a customer report is received and the NRC can communicate with the VRAD , the NRC should verify customer provisioning and, if required, dispatch a CIM technician to verify cable pair cross connections, wiring, modem, etc. and correct the problem.

If the VRAD cannot be accessed remotely by the NRC or NO customers are OK, A DEG technician should be dispatched to the site (when safe) to verify that power is actually on. If not verify that local power plant (rectifiers, fuses, breakers) are on and functioning correctly.

213. *Id.*, at 2.

214. *Id.*, at 3.

215. *Id.*, at 46-47.

216. *Id.*, at 47.

217. *Id.*, at 48.

218. *Id.*

219. *Id.*

Attempt to re-seat cards and/or remove and replace power to the VRAD prior to replacing the Network Element. If the Network Element cannot be accessed or re-provisioned, it must be replaced.²²⁰

The documentation AT&T provided failed to address the threshold constituting a national response. Additionally, though the DFST's mission rarely lasts beyond 30 days, no timetable was given for the time span between the emergency driven service outage to the arrival of DFST. Further, AT&T offered no evidence of the efficiency of a regional vs. a national response so ETI is unable to assess AT&T California's resiliency outside of the company response.



AT&T has sufficient procedures to address nationwide service outage emergencies but is unable to identify a minimum threshold for response. There is a strong basis to conclude that AT&T California lacks the resiliency to proactively withstand disasters.

Summary

With respect to the safety, redundancy and resiliency of network, ETI was able to examine AT&T route diversity, finding that the central offices able to provide physical route diversity to the PSN also perform tandem switching functions. Further, only about a third of AT&T central offices host PSAPs and, except for those that are connected to COs that also support tandem switching functions, most PSAPs have no physical or logical route diversity to the public switched network. AT&T provided information regarding central office back-up reserve power and ETI found that 45 COs fail to meet the minimum FCC regulation. However, AT&T has yet to provide further information regarding battery-back up for subscribers served by other technologies, such as available back-up power for fiber to the neighborhood/node (FTTN), fiber to the curb (FTTC), or fiber to the home (FTTH). Finally, AT&T has provided sufficient evidence of its ability to respond in the event of a disaster. However, the absence of a standard threshold triggering a nationwide emergency response and the lack of proactive measures suggests AT&T has room to improve resiliency procedures in the state of California.

220. *Id.*