10 ASSESSMENT OF SAFETY, REDUNDANCY AND RESILIENCY OF NETWORK(S): FRONTIER

Principal observations and takeaways

- In rural areas and over a number of years, multiple stand-alone central office switches have been consolidated into "host/remote" configurations, offering minimal route diversity within each such consolidation.
- Stand-alone switches and tandem routing of interoffice calls, rather than host/remote configurations, are used in more densely populated urban and suburban areas.
- Frontier advises that 170 out of its 270 central offices in California currently support diverse connectivity to the Public Switched Network.
- 135 Frontier central offices, serving approximately 100,000 access lines, do not currently have redundant physical connections to the Public Switched Network.
- Only 41 out of the 93 PSAPs hosted at Frontier central offices currently have confirmed diverse connections.
- Frontier identified 241 central offices that have been equipped with at least 8 hours of back-up power; however, FCC regulations specify 24 or (for COs that support Selective Routers for 911 calls) a minimum of 72 hours of back-up power.
- Frontier did not provide sufficient data on back-up power reserves to support any conclusions as to Frontier's resiliency or ability to meet FCC regulations.
- Frontier indicated it can mobilize national resources in the event of a major emergency but failed to provide realistic measures of how that is accomplished.

ASSESSMENT OF SAFETY, REDUNDANCY AND RESILIENCY OF NETWORK(S): FRONTIER

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Introduction

In response to Communications Division Data Requests made in connection with this study, Frontier has provided data and documents related to its policies, practices and procedures regarding Frontier network safety, redundancy and resiliency of infrastructure, facilities and resource management in its outside plant ("OSP") construction, engineering, and maintenance organizations.[221] In this chapter, we assess Frontier's resiliency based upon the information that has been provided.

Central office and PSAP redundancy

Central office connection redundancy

Frontier employs several approaches to network design and to configuration of its various central offices. Historically, central office switches were placed in central locations within their designated service areas so as to minimize the cost of the local subscriber outside plant feeder and distribution facilities that connect the central office to customers. In the pre-electronic era, electromechanical switches were physically big and complex machines that required large amounts of floor space and height. Telephone exchanges varied in size from a few hundred customers to upwards of 100,000 or more. Typically, one or more central office switches were located in each such "exchange." Outside plant feeder and distribution facilities connected individual subscribers to the central office switch, and the building in which the switch or switches was (were) located served as the homing point for these local outside plant facilities. When electronic switches were introduced in the 1980s, the new electronic switches were far more compact and smaller in size than their electromechanical counterparts.

When first introduced, the most complex and expensive component of an electronic central office switch was the central processing unit ("CPU"), a special purpose computer that provided the "intelligence" that controlled the various switching functions of individual "switching modules," each of which could serve up to a few thousand subscriber lines. These "switching modules" could be physically located in the same building as the CPU, or could be housed in remote locations with digital transport facilities connecting them to the CPU. In many smaller communities, it became more efficient to consolidate the switching requirements of a number of relatively nearby towns into a single switching system. The stand-alone electromechanical switches in many smaller exchanges were replaced by "remote service units" ("RSUs"), that were connected to the remotely-located host CPU by one or more digital transport facilities, such as T-1s (DS-1s) (each with a potential capacity of up to 24 voice-grade channels) or DS-3s (each one of which had a capacity of up to 672 individual voice-grade channels). However, the individual wire center *buildings* in each of these remotely-served communities were still needed to act as central homing points for the subscriber outside plant distribution networks.

221. Frontier Response to DR 05-F.

☞ In rural areas and over a number of years, multiple stand-alone central office switches have been consolidated into "host/remote" configurations, offering minimal route diversity within each such consolidation.

The RSU itself was both physically and functionally similar to the switching modules that would be housed together with the host CPU. For the most part, the transport facilities connecting the host with each RSU are single "umbilical" type connections that have no redundancy or alternative routing capability in the event that the transport facility becomes disabled for any reason. That same condition still prevails today in most locations. This type of network configuration can be seen in an extract taken from a map of Frontier's California network. Figure 10.1 provides a legend of the map symbols. Figure 10.2 below illustrates the use of host/remote switch configures in the more rural portions of Frontier's territory.

The solid red lines connecting the various host switched (green circles) and remotes (green half circles) indicate the use of fiber optic transport facilities. However, these are *physical* connections that do not necessarily represent *logical* routing arrangements. As the legend (Figure 10.1) notes, "actual physical facility diversity can only be determined from outside plant and central office records. What appears diverse on this map may have commonality." In other words, the fact that a transport link physically passes through a wire center building does not necessarily mean that connectivity to that link is available at that building.[222]

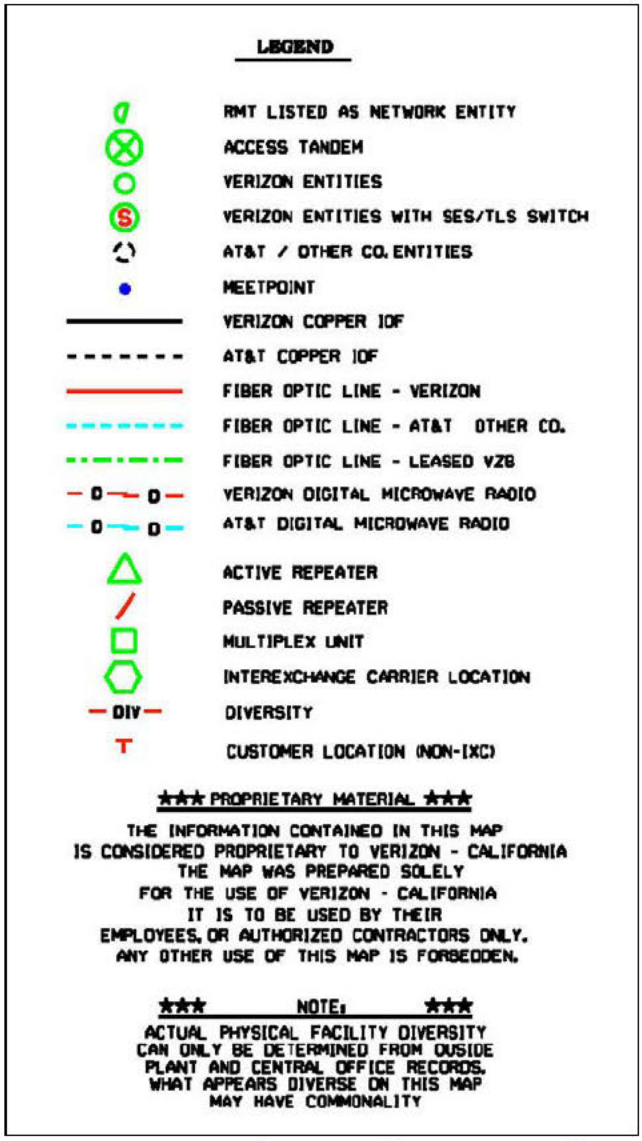

Figure 10.1. Frontier Network Map Legend

222. Figures 10.1, 10.2, 10.4, 10.5 and 10.6 herein were extracted from Frontier's response to Communications Division data request 06 in A.15-03-005.

Figure 10.2. Portion of Frontier network in rural areas of central California.

"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.

For example, in the central California map extract (Figure 10.2) above, there are five (5) remote switch units serving communities mainly in Fresno County that are identified on the corner of this map extract – all of which are connected to a host switch at RSUs can only communicate with the host, and not directly with each other except via the host. Thus, and as illustrated in Figure 10.3 below, while the *physical* transport facility connecting an RSU to the host central office may pass through one or more *buildings* in which RSUs are located en route to the host switch, the *logical* channels from each

remote to the host are likely configured as "home runs" directly to the host switch with no connectivity or alternate routing at the intermediate "pass-through" locations.

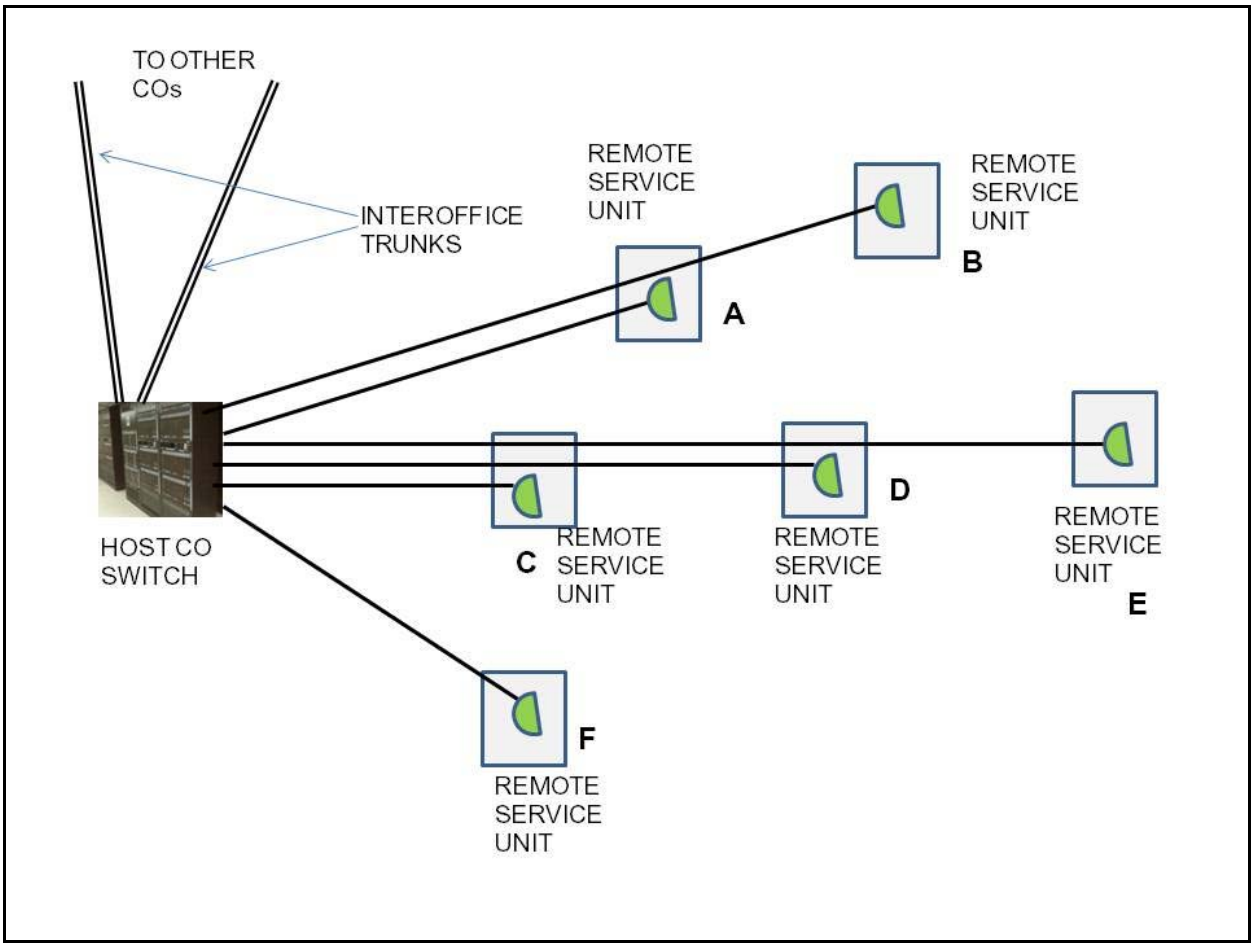

Figure 10.3. Illustrative host/remote central office configuration.

In this illustration, the transport facility connecting RSU "E" to the host central office physically passes through wire centers "C" and "D", yet no connectivity is provided for RSU "E" at either of these locations. All communications among the six RSUs served by the host must pass through the host, and all connections involving any of the RSUs to the rest of the world must also pass through the host, which is the only source of connectivity to the PSTN.

While such host/remote configurations are the norm in rural and low-density areas, they are not typically used in the more densely populated urban and suburban communities, where there are a sufficient number of subscribers and traffic volumes at each wire center to support one or more stand-alone switches. Figure 10.4 is an extract from Frontier's California network map covering the company's larger exchanges in Los Angeles and Orange Counties. The vast majority of the central offices in this region are served by stand-alone switches. As in the rural area map (Figure 10.2) above, one cannot tell directly from this map where logical transport

facility terminations are present vs. pass-through channels that have no direct connectivity in the building.

Another architectural distinction between rural and urban/suburban networks is the use of tandem switches to route interoffice traffic. Multiple end-office switches are connected to the tandems, where calls are routed to other switches subtending the same tandem or, via trunks to other tandem switches, to more distant end-offices. Also present in the more densely populated areas are multiple interchange points between the Frontier and AT&T ILEC networks.

Figure 10.4. Portion of Frontier network in Los Angeles and Orange Counties.

* Stand-alone switches and tandem routing of interoffice calls, rather than host/remote configurations, are used in more densely populated urban and suburban areas.

In response to a data request, Frontier has identified 170 central offices in its California network that have "physical and/or logical diverse connections to the Public Switched Telephone Network."[223] These are provided in Table 10.1 below. Frontier has not indicated the nature of the diverse connections or the diverse routings that each such connection is capable of supporting.

☞ Frontier advises that 170 out of its 270 central offices in California currently support diverse connectivity to the Public Switched Network.

* 135 Frontier central offices, serving approximately 100,000 access lines, do not currently have redundant physical connections to the Public Switched Network.

223. Frontier response to DR-05, Request 1(a).

Table 10.1 (page 1)

FRONTIER CALIFORNIA CENTRAL OFFICES WITH PHYSICAL AND/OR LOGICAL DIVERSE CONNECTIONS TO THE PSTN

CLLI	CO Name	CLLI	CO Name	CLLI	CO Name	CLLI	CO Name
ADLNCAXFDS0	ADELANTO	CRCRCAXFDS0	CORCORAN	DWNYCAXG80G	IMPERIAL	MNTTCAXF96K	MONTECITO
SLBHCAXF43J	ALAMITOS	COVNCAXF33M	COVINA	INDICAXGDS0	INDIO	MRHLCAXFDS0	MORGAN HILL
NRWLCAXGDS0	ALONDRA	COVNCAXF01T	COVINA - TANDEM	LAHBCAXFDS0	LA HABRA	MUGUCAXF48G	MUGU
LNCSCAXFDS0	ANTELOPE	CRLNCAXF33X	CRESTLINE	LAPNCAXGDS0	LA PUENTE	MURTCAXF67J	MURRIETA
APVYCAXF24J	APPLE VALLEY	CCMNCAXF98K	CUCAMONGA	LAQNCAXG56L	LA QUINTA	MSCYCAXF88K	MUSCOY
ARHDCAXF33H	ARROWHEAD	CCMNCAXFDS1	CUCAMONGA	LVRNCAXF59H	LA VERNE	NWPKCAXF49K	NEWBURY PARK
ARTSCAXF86S	ARTESIA	TRNCCAXF54K	DEL AMO	LGBHCAXF49K	LAGUNA BEACH	SNBRCAXNDS0	NORTON
BLPKCAXFPSA	BALDWIN PARK	PDRYCAXF82A	DEL REY	LNCSCAXG94K	LANCASTER	NRWLCAXF92S	NORWALK
BNNGCAXF84L	BANNING	DHSPCAXF32X	DESERT HOT SPRINGS	SNBBCAXGDS0	LAS POSITAS	ONTRCAXF98K	ONTARIO
BRSWCAXHDS0	BARSTOW	DMBRCAXF86M	DIAMOND BAR	LMLNCAXF79L	LOMA LINDA	ONTRCAXMDS0	ONTARIO AIRPORT
BUMTCAXF84L	BEAUMONT	DWNYCAXF86K	DOWNEY	LMPCCAXF73K	LOMPOC	ONTRCAXP01T	ONTARIO TANDEM
BELRCAXF47K	BEL AIR	EDMTCAXF65H	EDGEMONT	LNBHCAXFDS0	LONG BEACH	OXNRCAXF48K	OXNARD
BLFLCAXF86K	BELLFLOWER	RDBHCAXF37K	EL NIDO	LNBHCAXSDS0	LONG BEACH STADIUM	PCPLCAXF45K	PACIFIC PALISADES
BRDNCAXF34G	BERMUDA DUNES	ELRICAXFDS0	EL RIO	LNBHCAXP01T	LONG BEACH TANDEM	PACMCAXF89A	PACOIMA
BBLKCAXFDS0	BIG BEAR LAKE	EKGVCAXGPS2	ELK GROVE	LSSRCAXF59J	LOS SERRANOS	PLDSCAXF34A	PALM DESERT
BSHPCAXG87X	BISHOP	ELWDCAXFDS0	ELLWOOD	LNBHCAXLDS0	M.L.KING	PLSPCAXG32G	PALM SPRINGS
LSGTCAXA35E	BLOSSOM HILL	ELSNCAXF67N	ELSINORE MAIN	MALBCAXG45A	MALIBU	PLSPCAXGDS0	PALM SPRINGS
ORCTCAXG93K	BRADLEY	ETWNCAXF89L	ETIWANDA	MMLKCAXF93F	MAMMOTH LAKES	PLSPCAXG88T	PALM SPRINGS TANDEM
WLANCAXH82J	BUNDY SANTA MONICA	EXTRCAXFDS0	EXETER	MNBHCAXF54K	MANHATTAN BEACH	TRNCCAXG37J	PALOS VERDES
WLANCAXHDS1	BUNDY WEST L.A.	BLGRCAXF92K	FLORENCE	MNTCCAXG82A	MANTECA	PERSCAXF65X	PERRIS
HNBHCAXH96A	BUSHARD	FWLRCAXF83K	FOWLER	OXNRCAXG98M	MANTILLA	WHTRCAXJ69L	PICO
CLMSCAXF79G	CALIMESA	GRVLCAXF92E	GARBERVILLE	LAPNCAXLDS0	MAPLEGROVE	POMNCAXF62E	POMONA
CMRLCAXF48K	CAMARILLO	GLRYCAXFDS0	GILROY	CLCYCAXG39K	MAR VISTA	QUVYCAXF24K	QUAIL VALLEY
CRPRCAXF68K	CARPINTERIA	GLNDCAXF33M	GLENDORA	LNBHCAXH42P	MARKET	QZHLCAXF94K	QUARTZ HILL
CHNOCAXF62J	CHINO	GOLTCAXF96K	GOLETA	SNBRCAXH88K	MARSHALL	RNCACAXF67X	RANCHO CALIF
CLMTCAXF62G	CLAREMONT	GRHLCAXF36J	GRANADA HILLS	MENTCAXF79X	MENTONE	RNMGCAXFDS0	RANCHO MIRAGE
LNBHCAXMDS0	CLARK	HEMTCAXF65C	HEMET	MNRVCAXG35K	MONROVIA	RDLDCAXF79K	REDLANDS
CCHLCAXF39L	COACHELLA	HSPRCAXFDS0	HESPERIA	LSGTCAXF35K	MONTEBELLO	HRBHCAXA37K	REDONDO BEACH
THOKCAXH49K	CONEJO	HNBHCAXG96L	HUNTINGTON BEACH	LSGTCAXFDS0	MONTEBELLO	RDLYCAXF63K	REEDLEY

Source: Frontier response to DR-05F, Request 1.a.

Table 10.1 (page 2)

FRONTIER CALIFORNIA CENTRAL OFFICES WITH PHYSICAL AND/OR LOGICAL DIVERSE CONNECTIONS TO THE PSTN

CLLI	CO Name	CLLI	CO Name	CLLI	CO Name	CLLI	CO Name
RDGCCAXGDS0	RIDGECREST	SNMNCAXPPSA	SANTA MONICA	TMCLCAXGDS0	TEMECULA	VTVLCAXADS0	VICTORVILLE
PCRVCAXFDS0	RIO HONDO	SNMNCAXP01T	SANTA MONICA TANDEM	TMCLCAXHPSA	TEMECULA	WLNTCAXFDS0	WALNUT
RLHLCAXF79L	ROLLING HILLS	SLVNCAXG68K	SANTA YNEZ	LNBHCAXT43K	TERMINO	HNBHCAXL84S	WARNER
LAPNCAXF91K	ROWLAND	SPLVCAXF89K	SEPULVEDA	THOKCAXF49J	THOUSAND OAKS	SNBRCAXLDS0	WATERMAN
LAPNCAXFDS1	ROWLAND	SPLVCAXFDS1	SEPULVEDA	THOKCAXFDS1	THOUSAND OAKS	WVVLCAXGDS0	WEAVERVILLE
SNBRCAXK88E	SAN BERNARDINO	SRMDCAXF35K	SIERRA MADRE	THPLCAXFDS0	THOUSAND PALMS	WLANCAXFDS1	WEST LOS ANGELES
SNDMCAXF59C	SAN DIMAS	HNBHCAXF84C	SLATER	WLANCAXJDS0	UNIVERSITY	WMNSCAXFDS0	WESTMINSTER
SNFNCAXG36K	SAN FERNANDO	ONTRCAXG94L	SOUTH ONTARIO	UPLDCAXF98G	UPLAND	WLANCAXG47G	WESTWOOD
SNJCCAXG65F	SAN JACINTO	SNCYCAXF67K	SUN CITY	LNBHCAXGDS0	UPTOWN	WHTRCAXF69M	WHITTIER SOUTH
SNJQCAXFDS0	SAN JOAQUIN	SNLDCAXF35K	SUNLAND	LSANCAIODS0	USC OLIN HALL	WHTRCAXG94C	WHITWOOD
SNGRCAXF87A	SANGER	SNYMCAXF92F	SUNNYMEAD	VLVSCAXF92X	VALLE VISTA	YUCPCAXF79M	YUCAIPA
SNBBCAXF96K	SANTA BARBARA	SNMNCAXJ31K	SUNSET	WHTRCAXH94K	VALLEY VIEW	YCVYCAXG36X	YUCCA VALLEY
SNTMCAXF92K	SANTA MARIA	SYLMCAXF36K	SYLMAR	VTVLCAXA79T	Victor Vill 79T	MALBCAXF45K	ZUMA
SNMNCAXGDS0	SANTA MONICA	TAFTCAXFDS0	TAFT				

Source: Frontier response to DR-05F, Request 1.a.

In Advice Letter 12802 dated December 17, 2018, Frontier advised the Commission "that 1,439,542 of 1,545,090 (93.1 %) working lines within the Frontier California footprint are currently served via Exchanges with redundant physical connections."[224] In that same Advice Letter, Frontier has identified approximately 135 central offices that do not currently have any route diversity, explaining, for each, that there is "No financially-viable solution available."[225] As shown on Table 10.2 below, these 135 central offices serve approximately 100,000 access lines:

224. Advice Letter 12802, December 17, 2018, submitted "[i]n compliance with CPUC Decision No.l5-12-005, Ordering Paragraph 9," Attachment A.

225. Note that there may be an inconsistency between Frontier's responses to DR-05F and the information it has provided the CPUC in Advice Letter 12802. As noted above, in response DR-05F, Response 1(a), Frontier identified 170 central offices in its California network that have "physical and/or logical diverse connections to the Public Switched Telephone Network." That would leave 100 central offices with *no* physical redundancy to the PSTN. However, Advice Letter 12802 lists 135 individual central offices with no redundant physical connections.

Table 10.2

FRONTIER CALIFORNIA
CENTRAL OFFICES WITH NO DIVERSITY

County	Central Office	CLLI	Lines	Sile Type	CUrrent Topology	Diversity Solution/Issue
Colusa	[redacted]		1,226	Remote Office	Single-Threaded FTR fiber	No financially-viable so lution available
Colusa			2,287	Base Office	Single-Threaded FTR fiber	No financially-viable solution available
Colusa			136	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Colusa			473	Remote Office	Single-Threaded FTR fiber	No financially-viable solutlon available
Colusa			177	Remote Office	Single-Threaded FTR fiber	No financially-viable solullon available
Colusa			1,413	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Del Norte			197	Remote Office	Single-Threaded FTR fiber	No financially-via ble solutlon avallable
Del Norte			248	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Del Norte			504	Remote Office	Single-Threaded FTR fibe r	No financially-viable solution available
Del Norte			150	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Fresno			105	Remote Office	Single-Threaded FTR copper	No financially-viable solution availabk!
Fresno			329	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Fresno			335	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
Fresno			121	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Fresno			191	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Fresno			181	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Fresno			648	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Fresno			237	Remote Office	Single-Threaded FTR fiber	No financially-via ble solution available
Humbolt			127	Remote Office	Single-Threaded FTR copper	No financially-viable solution available
Humbolt			787	Remote Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Humboll			764	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
Humboll			336	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Humboll			750	Remote Office	Single-Threaded Digital Rad io	No fina ncially-viable solution available
Humbolt			1,161	Remote Office	Single-Threaded Digital Rad io	Fiber route Weaverville to Willow Creek
Kern			29	Remote Office	Single-Threaded FTR copper	No financially-viable solution available
Kern			1,627	Remote Office	Single-Threaded FTR fiber	Diverse Radio System planned for 2018
Ke rn			2,054	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Kern			474	Remote Office	Sing le-Threaded Digital Radio	No financially-viable solution available
Kern			1,240	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
Kern			1,784	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
Kern			404	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Kern			191	Remote Office	Single-Threaded FTR fiber	No financially-viable so lution available
Kern			699	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
lassen			405	Remote Office	Single-Threaded FIR fiber	No financially-viable solution available
lassen			245	Remote Office	Single-Threaded Analog Radio	No finan cially-viable solution available

Table 10.2 (page 2 of 4)

County	Central Office	CLLI	Lines	Sile Type	CUrrent Topology	Diversity Solution/Issue
lassen	[redacted]		495	Remote Office	Single-Threaded Analog Radio	No financially-viable solution available
lassen			894	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
lassen			1,203	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Lassen			63	Remote Office	Single-Threaded Analog Radio	No financially-viable solution available
lassen			363	Remote Office	Single-Threaded FTR fiber	No financial ly-viable solution available
Lassen			5,176	Base Office	Single-Threaded FTR fiber	No financially-viable solution available
Lassen			566	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
los Ange les			892	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Marin			5,232	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution avai lable
Mendocino			615	Base Office	Single-Threaded Digital Radio/ copp	No financially-viable solution available
Mendocino			887	Base Office	Single-Threaded Digital Radio	No financially-viable solutIon available
Mendocino			108	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
Merced			928	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Merced			2,770	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Merced			200	Remote Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Modoc			252	Remote Office	Single-Threaded FTR fiber	No finan cially-viable solution available
Modoc			2,621	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Modoc			542	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Mono			150	Remote Office	Single-Threaded FTR fiber	Planned Interconnection with Digital 395
Mono			683	Remote Office	Single-Threaded FTR fiber	Planned Interconnection with Digital 395
Mono			444	Remote Office	Single-Threaded FTR fiber	Planned Interconnection with Digital 395
Mono			226	Remote Office	Single-Threaded FIR fiber	Planned Interco nnection with Digital 395
Mono			428	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Monterey			73	Remote Office	Single-Threaded FTR fiber	No financia lly-viable solution available
Placer			1,089	Base Office	Single-Threaded FTR fi ber	No financially-viable solution available
Placer			523	Remote Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Plumas			1,172	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Plumas			1,295	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Plumas			77	Remote Office	Single-Threaded FTR copper	No financially-viable solution available
Plumas			661	Remote Office	Single-Threaded Analog Radio	No financially-viable solution available
Riverside			608	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Riverside			3,509	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Riverside			59	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
Riverside			136	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Riverside			1,568	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Riverside			1,121	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Riverside			425	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Riverside			254	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available

Table 10.2 (page 3 of 4)

County	Central Office	CLLI	Lines	Sile Type	CUrrent Topology	Diversity Solution/Issue
Riverside	[redacted]		637	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Sacramento			624	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Sacramento			697	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Sacramento			515	Remote Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Sacramento			772	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			63	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			252	Remote Office	Single-Threaded Analog RadiO	No financially-viable solution available
San Bernardino			269	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			211	Remote Office	Single-Threaded Analog Radio	No financially-viable solution available
San Bernardino			698	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			1,013	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			1,533	Base Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			295	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Berna rd ino			3,101	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			984	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
San Bernardino				Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			580	Remote Office	Single-Threaded FTR fiber	Diverse Radio System planned for 2018
San Bernardino			1,468	Base Office	Single-Threaded FTR fiber	No financially-viable solution available
San Bernardino			1,626	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Joaquin			323	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Joaquin			180	Remote Office	Single-Threaded FTR fibe r	No financially-viable solution available
San Joaquin			796	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
San Luis Obispo			700	Base Office	Single-Threaded Fiber to Carrier Me	No financially~viable solution available
Santa Barbara			212	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
Santa Barbara			1,426	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Santa Barbara			593	Remote Office	Single~Threaded FTR fibe r	No financially~viable solution available
Shasta			1,155	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Shasta			2,283	Base Office	Single-Threaded FTR fiber	No financially~viable solution available
Shasta			1S34	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Shasta			463	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Shasta			933	Remote Office	Single-Threaded FTR fib er	No financially-viable solution available
Shasta			2,486	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Siskiyou			552	Remote Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Solano			3,397	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Sonoma			455	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Sonoma			486	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Sonoma			1,328	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Sonoma			482	Remote Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available

Table 10.2 (page 4 of 4)

County	Central Office	CLLI	Lines	Sile Type	CUrrent Topology	Diversity Solution/Issue
Stanislaus	[redacted]		3,708	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Sutter			95	Remote Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Tehama			219	Remote Office	Single-Threaded Analog Radio	No financially-viable solution available
Tehema			1,948	Remote Office	Single-Threaded Analog Radio	No financially-viable solution available
Trinity			763	Remote Office	Single-Threaded Digital Radio	No financially~viable solution available
Trinity			275	Remote Office	Single-Threaded Digital Radio	No financially-viable solution available
Tulare			118	Remote Office	Single-Threaded FTR fiber	No financially~viable solution available
Tulare			95	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Tulare			362	Remote Office	Single-Threaded FTR copper	No financially-viable solution available
Tulare			114	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Tulare			2,270	Base Office	Single-Threaded FTR fiber	No financially-viable solution available
Tulare			627	Remote Office	Single-Threaded FTR fiber	No financially-viable solution available
Tuolumne			1,280	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Ventura			3,545	Base Office	Dual fiber common conduit	No financially-viable solution available
Yolo			338	Remote Office	Single-Threaded FTR fiber	No financially-viable so[utlon available
Yolo			709	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
Yolo			221	Base Office	Single-Threaded Fiber to Carrier Me	No financially-viable solution available
TOTAL			**110,618**			

Source: Frontier Advice Letter 12802 December 17, 2018

Public Safety Answering Point routing redundancy

A "Public Safety Answering Point" ("PSAP") is a facility that receives emergency "911" 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 such as the police, fire department, or sheriff, 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.[226]

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 than 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.

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 10.3, Frontier has identified 93 PSAPs within Frontier California's operating area that are "hosted" by 79 Frontier central offices.[227] All calls to 911 are first sent to a Selective Router which, after identifying the appropriate PSAP, physically routes the call to that PSAP. Some central offices host more than one PSAP, and the diversity status apparently may differ even among the several PSAPs hosted by the same CO. Of the 93 PSAPs that Frontier has identified, 41 have diverse connections, 17 have connections that are described as "Not Diverse," 42 are shown as having "Non-FTR Segments-Inconclusive," and 3 have connections that Frontier states it is currently reviewing.[228] 32 connections are diverse under Frontier but are transported using a third party and it is unknown whether those connections remain diverse.[229] There are only 11 Selective Routers in Frontier's California service territory.

226. 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. See Chapter 9, footnote 197.

227. Frontier Response to DR-05F, Attachment 2.

228. *Id.*

229. Frontier explains that it "uses a 3rd party to carry some of the transport. The Frontier portion is diverse, but Frontier cannot commit that the 3rd party is diverse."

Table 10.3

FRONTIER CALIFORNIA
PUBLIC SAFETY ANSWERING POINTS (PSAPs) AND HOST CENTRAL OFFICES

City	PSAP Name	PSAP Serving Office	Diverse
[redacted]			Diverse
			Diverse
			Diverse
			Diverse
			Diverse
			Diverse
			NON FTR Segments-Inconclusive (note 1)
			Diverse
			Diverse
			Not Diverse
			Not Diverse
			Diverse
			Under Review
			Diverse
			NON FTR Segments-Inconclusive (note 1)
			Diverse
			NON FTR Segments-Inconclusive (note 1)
			Diverse
			Not Diverse
			Diverse
			Not Diverse
			NON FTR Segments-Inconclusive (note 1)
			NON FTR Segments-Inconclusive (note 1)
			NON FTR Segments-Inconclusive (note 1)
			Not Diverse
			Diverse
			Diverse
			Under Review
			NON FTR Segments-Inconclusive (note 1)
			Diverse
			Diverse
			Diverse
			Diverse

Table 10.3 (page 2 of 3)

City	PSAP Name	PSAP Serving Office		Diverse
[redacted]				Diverse
				NON FTR Segments-Inconclusive (note 1)
				Not Diverse
				Not Diverse
				Not Diverse
				Not Diverse
				Diverse
				NON FTR Segments-Inconclusive (note 1)
				Under Review
				Diverse
				Not Diverse
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				Diverse
				Not Diverse
				NON FTR Segments-Inconclusive (note 1)
				Not Diverse
				Diverse
				Diverse
				NON FTR Segments-Inconclusive (note 1)
				Not Diverse
				Diverse
				NON FTR Segments-Inconclusive (note 1)
				Diverse
				Diverse
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				Diverse
				Diverse
				Diverse
				Diverse

Table 10.3 (page 3 of 3)

City	PSAP Name	PSAP Serving Office		Diverse
[redacted]				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				Diverse
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				Diverse
				Diverse
				Diverse
				Diverse
				NON FTR Segments-Inconclusive (note 1)
				Not Diverse
				NON FTR Segments-Inconclusive (note 1)
				Not Diverse
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)
				Not Diverse
				Not Diverse
				Diverse
				Diverse
				Diverse
				NON FTR Segments-Inconclusive (note 1)
				Diverse
				NON FTR Segments-Inconclusive (note 1)
				NON FTR Segments-Inconclusive (note 1)

Source: Frontier response to DR-05F, Request 2. Note 1: Frontier uses a 3rd party to carry some of the transport. The Frontier portion is diverse, but Frontier cannot commit that the 3rd party is diverse

Only 41 out of the 93 PSAPs hosted at Frontier central offices currently have confirmed diverse connections.

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.[230] Figure 10.5 below provides a schematic diagram of the PSTN components that are involved in routing calls to the correct PSAP whan a customer dials 911.

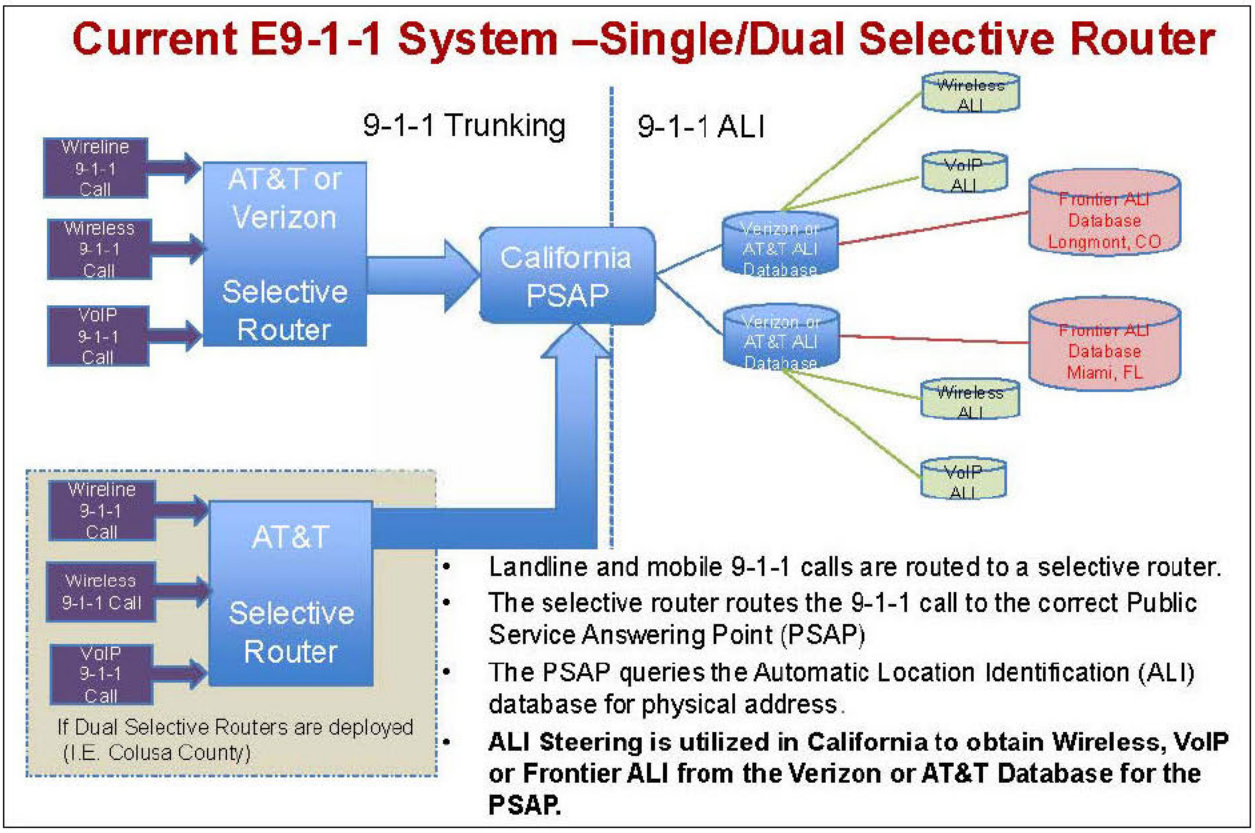

Figure 10.5. Handling of E911 calls via Selective Routers and Automatic Line Identification ("ALI") database lookups.

230. *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.

E911 calls are first routed to the Selective Router that identifies the specific PSAP to which the caller (based upon location) has been assigned, and sends the call, together with the calling number, to the specified PSAP. The calling number is transmitted to one of two Frontier Automatic Location Identification ("ALI") databases, which returns the caller's street address and other geographic location information. The results of this database "dip" are then provided to the PSAP dispatcher for display on a terminal. According to this diagram, Frontier maintains only two (2) ALI databases nationally, one located in Longmont, Colorado and the other in Miami, Florida. These remote databases, and the ability of service providers to gain access to them, are critical to the functioning of the E911 emergency reporting system. On December 27, 2018, an outage occurred at an ALI database operated by CenturyLink that served a number of wireless carriers nationwide. The outage essentially shut down wireless E911 service in sections of Arizona, New Mexico, Colorado, Idaho, Wyoming, Massachusetts, Missouri, Oregon and western Washington state, among other places.[231] Its occurrence underscores the potential vulnerability of all E911 services to remotely-located – and seemingly nonredundant – ALI databases.

231. "A nationwide CenturyLink outage is disrupting 911, and the FCC is investigatin,g" *Washington Post*, December 28, 2018. Available at https://www.washingtonpost.com/technology/2018/12/28/nationwide-centurylink-outage-is-disrupting-fcc-is-investigating/?noredirect=on&utm_term=.f78e8257d621 (accessed 1/22/19)

Figure 10.6 below provides a map of the Frontier network in the Central Valley and indicates the two PSAPs to which all E911 calls originated within this area must be routed.

Figure 10.6. Frontier's network and PSAPs connections serving California's Central Valley.

PSAPs are hosted at only two (2) of the fourteen (14) central offices shown on this diagram. Referring back to Table 10.2 above, nine (9) of these fourteen (14) central offices are identified as having no route diversity or redundancy, with the explanation that there is "[n]o financially-viable solution available."[232] Additionally, according to this diagram, several connections involve routing via AT&T facilities, although the specific route details are not provided.

In addition to their primary routing function, Selective Routers can also support Alternate, Overflow and Default PSAP routing. If an Alternate PSAP is specified, E911 calls will be routed to that site if the primary PSAP is unavailable for any of several reasons (e.g., an all-trunks busy condition, a preestablished alternate PSAP when the primary PSAP is not in operation). A Default PSAP may also be specified where the calling telephone number is not available (and hence the caller's location cannot be definitively established).[233]

232. The nine Central Valley central offices identified as having no redundancy are

233. NENA Generic E9-1-1 Requirements , at § 2,3,1,2,

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.[234] 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."[235]

> 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.

Frontier provided a tabulation of 241 California central offices with back-up power in excess of eight (8) hours, derived from a combination of battery and back-up generator power sources.[236] These central offices are listed in Table 10.4 below. Frontier did not specify the minimum backup power requirement (i.e., 24 or 72 hours) for each CO or the actual number of hours for which back-up power is available at that site. ETI is thus unable to determine how many Frontier central offices meet the FCC requirements.

Frontier identified 241 central offices that have been equipped with at least 8 hours of back-up power; however, FCC regulations specify 24 or (for COs that support Selective Routers for 911 calls) a minimum of 72 hours of back-up power.

234. 47 CFR §12.4 (c)(2)(i) – Reliability of covered 911 service providers

235. 47 CFR §12.4(a)(10).

236. Frontier Response to DR-05F, Attachment 3.

Frontier did not provide sufficient data on back-up power reserves to support any conclusions as to Frontier's resiliency or ability to meet FCC regulations.

Table 10.4 (page 1)

FRONTIER CALIFORNIA CENTRAL OFFICES WITH AT LEAST 8 HOURS OF BACK-UP POWER

CLLI	CO Name	CLLI	CO Name	CLLI	CO Name	CLLI	CO Name
ADLNCAXFDS0	ADELANTO	BTNWCAXF	BUTTON WILLOW	ELMGCAXFH01	EL MIRAGE	KRVLCAXFH01	KERNVILLE
SLBHCAXF43J	ALAMITOS	CHSPCAXF	CALIF HOT SPRINGS	RDBHCAXF37K	EL NIDO	KNLDCAXF	KNIGHTS LANDING
ALPNCAXF	ALDERPOINT	CLMSCAXF79G	CALIMESA	ELRICAXFDSO	EL RIO	LAHBCAXFDSO	LA HABRA
NRWLCAXGDS0	ALONDRA	CMRLCAXF48K	CAMARILLO	ELWDCAXFDSO	ELLWOOD	LAPNCAXGDSO	LA PUENTE
ALPGCAXF	ALPAUGH	CNCKCAXF	CANTUA CREEK	ELSNCAXG67K	ELSINORE GRAND	LAQNCAXG56L	LA QUINTA
LNCSCAXF	ANTELOPE	CRPRCAXF68K	CARPINTERIA	ELSNCAXF67N	ELSINORE MAIN	LVRNCAXF59H	LA VERNE
APVYCAXF24J	APPLE VALLEY	CZDRCAXGDS0	CAZADERO	ETWNCAXF89L	ETIWANDA	LGBHCAXF49K	LAGUNA BEACH
ARHDCAXF33H	ARROWHEAD	CHLKCAXF	CHINA LAKE	EXTRCAXFDS0	EXETER	LNCSCAXE	LANCASTER
ARHDCAXF92F	ARROWHEAD	CHNOCAXF62J	CHINO	FRTNCAXFH01	FARMINGTON	LNCSCAXG94K	LANCASTER
ARTSCAXF86S	ARTESIA	CLMTCAXF62G	CLAREMONT	FLWSCAXF	FELLOWS	SNBBCAXGDS0	LAS POSITAS
AZUSCAXF33K	AZUSA	LNBHCAXMDS0	CLARK	BLGRCAXF92K	FLORENCE	LTHPCAXF	LATHROP
AZUSCAXF33K	AZUSA	CLEMCAXFH01	CLEMENTS	FTIRCAXFH01	FORT IRWIN	LYVLCAXFDS0	LAYTONVILLE
BLPKCAXF33K	BALDWIN PARK	CCHLCAXF39L	COACHELLA	FWLRCAXF83K	FOWLER	LVNGCAXFH01	LEE VINING
BNNGCAXF84L	BANNING	CLFXCAXF34E	COLFAX	GRVLCAXF92E	GARBERVILLE	LGGTCAXF	LEGGETT
BRSWCAXHDS0	BARSTOW	THOKCAXH49K	CONEJO	GLRYCAXFDS0	GILROY	LMCVCAXFH01	LEMON COVE
BUMTCAXF	BEAUMONT	CRCRCAXFDS0	CORCORAN	GLNDCAXF33M	GLENDORA	LNWDCAXFH01	LENWOOD
BELRCAXF47K	BEL AIR	CVELCAXF	COVELO	GLVLCAXF	GLENNVILLE	LNDNCAXF	LINDEN
BLFLCAXF86K	BELLFLOWER	COVNCAXF33M	COVINA	GOLTCAXF96K	GOLETA	LNDSCAXF56K	LINDSAY
BNTNCAXFH01	BENTON	CRLNCAXF33X	CRESTLINE	GRHLCAXF36J	GRANADA HILLS	LMLNCAXF79L	LOMA LINDA
BRMSCAXF	BERRENDA MESA	CRLKCAXFH01	CROWLEY LAKE	HYFKCAXF	HAYFORK	LMPCCAXF73K	LOMPOC
BBCYCAXFH01	BIG BEAR CITY	CCMNCAXF98K	CUCAMONGA	HEMTCAXF65C	HEMET	LNPNCAXFH02	LONE PINE
BBLKCAXFDS0	BIG BEAR LAKE	CUYMCAXF	CUYAMA	HSPRCAXFDS0	HESPERIA	LNBHCAXFDS0	LONG BEACH MAIN
BGPICAXF	BIG PINE	TRNCCAXF54K	DEL AMO	HMLDCAXF92H	HOMELAND	LSSRCAXF59J	LOS SERRANOS
BSHPCAXG87X	BISHOP	PDRYCAXF30K	DEL REY	HOPACAXF	HOOPA	LSHLCAXF	LOST HILLS
LSGTCAXA35E	BLOSSOM HILL	DHSPCAXF32X	DESERT HOT SPRINGS	DWNYCAXG80G	IMPERIAL	LCVYCAXF	LUCERNE VALLEY
BORNCAXFH01	BORON	DSKNCAXF	DESERT KNOLLS	INDPCAXF	INDEPENDENCE	MDRVCAXF	MAD RIVER
ORCTCAXG93K	BRADLEY	DMBRCAXF86M	DIAMOND BAR	INDICAXGDS0	INDIO	MALBCAXG45A	MALIBU
BRPTCAXFH01	BRIDGEPORT	DSPLCAXFDS0	DOS PALOS	INYKCAXFH01	INYOKERN	MMLKCAXF93F	MAMMOTH LAKES
WLANCAXH82J	BUNDY WLA	DWNYCAXF86K	DOWNEY	JNLKCAXFH02	JUNE LAKE	MNBHCAXF54K	MANHATTAN

Source: Frontier response to DR-05F, Request 3.a.i .confidential attachment DR 5 Attachment 3

Table 10.4 (page 2)

FRONTIER CALIFORNIA CENTRAL OFFICES WITH AT LEAST 8 HOURS OF BACK-UP POWER

CLLI	CO Name	CLLI	CO Name	CLLI	CO Name	CLLI	CO Name
OXNRCAXG98M	MANTILLA	OXNRCAXF48K	OXNARD	SNFNCAXG36K	SAN FERNANDO	TRNQCAXF	TRANQUILITY
LAPNCAXLDS0	MAPLEGROVE	PCPLCAXF45K	PACIFIC PALISADES	SNJCCAXG65F	SAN JACINTO	TWPLCAXF36K	TWENTYNINE PALMS
CLCYCAXG39K	MAR VISTA	PACMCAXF36K	PACOIMA	SNJQCAXF	SAN JOAQUIN	WLANCAXJDS0	UNIVERSITY
MRCPCAXF	MARICOPA	PLDSCAXF34A	PALM DESERT	SNMGCAXFDS0	SAN MIGUEL	UPLDCAXF98G	UPLAND
LNBHCAXH42P	MARKET	PLSPCAXG32G	PALM SPRINGS EAST	SNGRCAXF	SANGER	LNBHCAXGDS0	UPTOWN
SNBRCAXH88K	MARSHALL	TRNCCAXG37J	PALOS VERDES	SNBBCAXF96K	SANTA BARBARA	VLVSCAXF92X	VALLE VISTA
LNBHCAXL	MARTIN L KING	PRFDCAXF	PARKFIELD	SNTMCAXF92K	SANTA MARIA	WHTRCAXH94K	VALLEY VIEW
MCFACAXFH01	MCFARLAND	PERSCAXF65X	PERRIS	SNMNCAXGDS0	SANTA MONICA	VTVLCAXADS0	VICTORVILLE
MCKTCAXF_	MCKITTRICK	WHTRCAXJ69L	PICO	SNPLCAXF52A	SANTA PAULA	WLNTCAXFDSO	WALNUT
MECCCAXF	MECCA	PIRCCAXF	PIERCY	SNPLCAXF52K	SANTA PAULA	HNBHCAXL84S	WARNER
MRMNCAXFRS4	MIRAMONTE	PNCKCAXFH01	PINECREEK	SLVNCAXG68K	SANTA YNEZ	BRDNCAXF34G	WASHINGTON STREET
MNRVCAXG35K	MONROVIA	POMNCAXF62E	POMONA	SERNCAXGDS0	SEA RANCH	SNBRCAXLDS0	WATERMAN
LSGTCAXFDS0	MONTEBELLO	QUVYCAXF24K	QUAIL VALLEY	SPLVCAXF89K	SEPULVEDA	WVVLCAXGDS0	WEAVERVILLE
MNTTCAXF96K	MONTECITO	QZHLCAXF94K	QUARTZ HILL	SRMDCAXF35K	SIERRA MADRE	WLDNCAXF	WELDON
MRHLCAXFDSO	MORGAN HILL	RNCACAXF67X	RANCHO CALIFORNIA	HNBHCAXF84C	SLATER	WLANCAXF47K	WEST LOS ANGELES
LSGTCAXGRS1	MOUNTAIN	RNMGCAXF32L	RANCHO MIRAGE	SNNGCAXG	SNELLING	WMNSCAXFDS0	WESTMINSTER
MUGUCAXF48G	MUGU	RNBGCAXF	RANDSBURG	BRSWCAXJ	SOUTH BARSTOW	WLANCAXG47G	WESTWOOD
MURTCAXF67J	MURRIETA	TMCLCAXHDS0	REDHAWK	LNBHCAXS	STADIUM	WHTNCAXF	WHITEHORN
MSCYCAXF88K	MUSCOY	RDLDCAXF79K	REDLANDS	SNCYCAXF67K	SUN CITY	WHTRCAXF69M	WHITTIER SOUTH
NWBRCAXF	NEWBERRY	HRBHCAXA37K	REDONDO	SNLDCAXF35K	SUNLAND/TUJUNGA	WHTRCAXG94C	WHITWOOD
NWPKCAXF49K	NEWBURY PARK	RDLYCAXF63K	REEDLEY	SNYMCAXF92F	SUNNYMEAD	WWCKCAXF	WILLOW CREEK
NEDWCAXF	NORTH EDWARDS	RDGCCAXGDS0	RIDGECREST	SNMNCAXJ31K	SUNSET	WRWDCAXF	WRIGHTWOOD
SNBRCAXNDS0	Norton	PCRVCAXFDS0	RIO HONDO	SYLMCAXF36K	SYLMAR	YERMCAXF	YERMO
NRWLCAXF92S	NORWALK	RIPNCAXF	RIPON	TAFTCAXFDS0	TAFT	YUCPCAXF79M	YUCAIPA
NOVTCAXFDS0	NOVATO	RBNSCAXG	ROBBINS	TMCLCAXGDS0	TEMECULA	YCVYCAXG36X	YUCCA VALLEY
OLNCCAXFH01	OLANCHA	RLHLCAXF54A	ROLLING HILLS	LNBHCAXT43K	TERMINO	MALBCAXF45K	ZUMA
ONTRCAXMDSO	ONTARIO AIRPORT	LAPNCAXF91K	ROWLAND	THOKCAXF49J	THOUSAND OAKS 2	GVTACAXA	
ONTRCAXF98K	ONTARIO MAIN	RNSPCAXF	RUNNING SPRINGS	THPLCAXFDS0	THOUSAND PALMS	SRVYCAXF	
ONTRCAXG94L	ONTARIO SOUTH	SNBRCAXK88E	SAN BERNARDINO	TMCVCAXH	TIMBER COVE	WDFRCAXF	
ORLNCAXF	ORLEANS	SNDMCAXF59C	SAN DIMAS	TVVYCAXFL01	TIVY VALLEY	WEWRCAXF	
ORMACAXF	ORO LOMA						

Source: Frontier response to DR-05F, Request 3.a.i .confidential attachment DR 5 Attachment 3

Electronic Field Equipment

Frontier was asked to provide company standards for parallel power system for equipment (either video-ready access device (VRAD) or fiber to the premises (FTTP)) and for battery back-up at individual subscriber locations. Frontier responded that for VRAD (also known as, FTTN, fiber to the neighborhood/node) it utilizes "commercial AC converted to DC power with battery backup at node. POTS service is conventional at the customer end and doesn't require additional powering at the customer premise." For FTTP, Frontier similarly uses "commercial AC converted to DC power with battery backup," now at the central office, and it is "passive (no line power) from the Central Office to the customer premise."

In response to the matter of battery back-up at subscriber locations, Frontier does not provide customer premises back-up for POTS or VRAD (FTTN) service. However, Frontier does require eight hours of back-up power for central offices. For POTS service, the company requires back-up reserves in both battery and generator power, but for VRAD (FTTN), only battery back-up is utilized. For FTTP at the customer premises, Frontier requires "8-24 hours of battery backup based on [the] customer's purchase of offered backup options."[237]

Additionally, Frontier was asked to provide company standards for the number of hours of battery back-up for subscribers served by copper-based POTS (line-powered from the central office), for FTTN, for fiber-to-the-curb ("FTTC") and for fiber-to-the-premises (FTTP). The company advises that it requires eight hours of back-up power at central offices for copper-based POTS. For FTTH back-up power, Frontier conforms to FCC requirements of "backup battery options of eight to 24 hours."[238] However, for central offices that host a selective router, the FCC requirement calls for 72 hours of back-up power. As noted above, Frontier has 73 central offices that host PSAPs; yet its response re DR-05F Request 3 regarding back-up power does not identify any central offices equipped for 72 hours of back-up power. Frontier noted that back-up power to FTTN and FTTC is not applicable.

Allocation of resources and labor in the event of major emergencies

Frontier 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 during states of emergency, its mutual aid agreements with other states, and its policy that outlines the standard threshold of outages that trigger resource reallocation or mutual aid,[239] The company responded that:

237. Frontier Narrative Response to DR-05F Request 3, at 2.

238. *Id.*, at 3.

239. *Id.*, at 2.

> Frontier activated the California Emergency Operational Center (EOC) in response to the recent wildfires and the Montecito mudslide. An Emergency Management Plan (EMP) was executed during these events, and resources from other cities were moved to the impacted areas for support of the restoration.
>
> a. When the need arises, resources – including company trucks and vehicles – can be moved from cities within the same state or from other states as required.
>
> b. Resources from other states can be moved anytime as needed.
>
> c. Additional resources can be allocated at any time as restoration efforts or trouble ticket levels demand.[240]

Frontier did not provide processes or procedures for executing an Emergency Management Plan nor did it indicate the threshold for which additional resources would be allocated from Frontier operations outside of California.

Frontier indicated it can mobilize national resources in the event of a major emergency but failed to provide realistic measures of how that is accomplished.

Redundancy and resiliency processes and procedures in emergencies

As noted above, Frontier's resiliency procedures for a given disaster are known as an Emergency Management Plan. The EMP is a component of Frontier's Business Continuity program, which is intended to ensure efficient outage resolution such that "Frontier Communications is capable of conducting its essential missions (people, product and profit) and can operate under all threats and conditions."[241] Frontier California did not provide guidelines for designing and implementing the State Emergency Plan, offering the following explanation:

> While the severity and consequences of an emergency cannot be predicted, effective contingency planning can minimize the impact on Frontier's mission, personnel, and facilities and rapidly increase resilience programs. All Emergency Response Centers within Frontier follow the same process, shared practices, contacts and procedures for redundancy.[242]

240. *Id.*, at 3.

241. *Id.*, at 1.

242. *Id.*

With respect to Frontier's capability in the wake of a natural disaster, Frontier failed to provide internal policies or procedures, responding instead that:

> Each State Emergency Management Plan applies to the functions, operations and resources necessary to ensure the continuation of Frontier's critical business processes in the event its normal operations are disrupted or threatened with disruption. The State Emergency Management Plan applies to all Frontier operations and personnel who must be familiar with the Business Continuity Plan in their respective roles and responsibilities.[243]

Frontier has not provided either the California Emergency Management Plan or the Business Continuity Plan.

Summary

With respect to the safety, redundancy and resiliency of network, Frontier has provided limited information and data that provides less than a complete picture of the network attributes that ETI has been asked to examine. We have been advised as to the central offices that provide for diverse routing, but have not been able to obtain any information as to the specific nature of the routing alternatives or how they are activated. Similarly, we have been advised as to the availability of routing diversity and redundancy for PSAPs, but have not been provided with the details of the redundant routing arrangements. Frontier has identified 241 central offices that are equipped for at least 8 hours of back-up power, but the company has not provided the actual number of hours of back-up power available at each such location. Finally, while Frontier has assured us that it does have emergency response procedures and stand-by capability in place, it has thus far declined to provide specific details or written practices.

Accordingly, to the extent that the Commission believes that more details as to all of these subjects are necessary, it should pursue this further with Frontier.

243. In Data Request 04-F dated June 1, 2018, and in Data Request 05-F dated June 7, 2018, Frontier was asked to "provide Frontier internal policies and procedures for maintenance and emergency response to catastrophic events, i.e., wildfires, storms, earthquakes, mudslides etc" and to "provide overview and internal practices and procedures for redundancy and resiliency processes and procedures that are followed in emergencies", respectfully. As of January 18, 2019, Frontier has not yet furnished a sufficient response to either request, stating only the existence of such resiliency procedures without providing the supporting documentation.