PHASE 2 REPORT:

EXAMINATION OF THE LOCAL TELECOMMUNICATIONS NETWORKS AND RELATED POLICIES AND PRACTICES OF AT&T CALIFORNIA AND FRONTIER CALIFORNIA

Study conducted pursuant to the California PUC Service Quality Rulemaking 11-12-001, Decision 13-02-023, and Decision 15-08-041

June 17, 2021

ECONOMICS AND TECHNOLOGY, INC.

ONE WASHINGTON MALL, 7TH FLOOR • BOSTON, MASSACHUSETTS 02108 • (617)-598-2200

PREFACE

In December 2011, the California Public Utilities Commission (CPUC) opened Rulemaking (R.) 11-12-001 to (a) review telecommunications carrier performance in meeting the GO 133 service quality standards and measures in 2010; (b) assess whether the existing GO 133 service quality standards and measures meet the goals of the Commission to adequately protect California customers and the public interest; (c) determine whether the existing GO 133 standards are relevant to the current regulatory environment and market; and (d) determine whether there is a need to establish a penalty mechanism for substandard service quality performance. The Commission's Communications Division was directed to oversee an examination of the network facilities of AT&T California and (then) Verizon California, the state's two principal local wireline telecommunications utilities, and to engage an independent consultant to perform this examination under a contract to be managed by Commission staff.

Economics and Technology, Inc. ("ETI") was selected to perform this study, and we completed our report in April 2019. In January 2020, CD issued a "Secondary RFP to obtain responses from firms qualified to conduct an examination of the telecommunications networks and related policies and practices of AT&T California and Frontier Communications California for the period from 2018 to 2019." ETI submitted a proposal in response to this Secondary RFP, and was selected by CD to undertake this additional "Phase 2" study. This report provides the results of this additional work. ETI did not, and was not required to, undertake to audit or otherwise verify the accuracy or completeness of the data that was provided to us. Various inconsistencies and gaps in the data were identified, and we used our best efforts to resolve them. Where such efforts were not successful, we noted the problems and utilized the data as best we could.

The project was conducted under the direction of Dr. Lee L. Selwyn, President of ETI, with a team consisting of ETI staff members Colin B. Weir, Vice President, and Andrew J. Kearns, Senior Economic Consultant. Our work has greatly benefitted from the extensive input and assistance that we received from the Communications Division Staff, including in particular Kim Hua, who served as Project Manager with respect to the Phase 2 project, and Louise E. Fischer, who had served as Project Manager for the Phase 1 study. We we gratefully appreciate and acknowledge the invaluable assistance they and other CD Staff provided to us. We also appreciate the cooperation that we received from both carriers in the course of this work.

Boston, Massachusetts
June 2021

NOTICE

Nearly all of the information contained in the various AT&T California and Frontier California (including former Verizon California) data files, responses to data requests, and other source material ("ILEC Data") that has been provided to ETI in the course of this examination has been identified by the carriers and/or by the Commission as CONFIDENTIAL AND PROPRIETARY AND SUBJECT TO CPUC GENERAL ORDER 66, PUB. UTIL. CODE SECTION 583 AND D.16-08-024, REGARDLESS OF WHETHER OR NOT A DOCUMENT OR FILE HAS BEEN EXPRESSLY LABELED AS CONFIDENTIAL. Under the terms of our Agreement no. 19NS0853 including the incorporated Confidentiality of Data/Nondisclosure Agreement (Section 9. Exhibit E), all of the contents of this report are, by default, being treated as CONFIDENTIAL AND PROPRIETARY ILEC DATA whether or not expressly identified as such.

In Decision (D.) 20-12-021, the Commission determined that substantial portions of our Phase 1 Report that had tentatively been treated as confidential should be made available for public inspection. It is our understanding that the Communications Division anticipates that a public, redacted version of this report will be released in due course, once determinations have been made by CD Staff and counsel as to which portions of its contents may be made publicly available. However, for the present, THE ENTIRETY OF THIS REPORT IS TO BE TREATED AS CONFIDENTIAL AND PROPRIETARY AND SUBJECT TO CPUC GENERAL ORDER 66, PUB. UTIL. CODE SECTION 583 AND D.16-08-024.

TABLE OF CONTENTS

1: EXECUTIVE SUMMARY AND OVERVIEW OF THIS REPORT 1

Introduction 2

Scope of this Phase 2 Study 2

Organization of this Phase 2 Report 3

Organization of this Chapter 4

Key Conclusions and Recommendations resulting from this study 4

Managing the transition from legacy to current technology services 4

Conclusions 5

Recommendations 8

Chapter Summaries 10

Principal Phase 2 Observations and Takeaways 46

2: INTRODUCTION AND BACKGROUND FOR THIS STUDY – not updated in Phase 2

3: CALIFORNIA ILEC NETWORK OVERVIEW – not updated in Phase 2

4: ILEC RESPONSES TO SERVICE OUTAGES: PHASE 2 UPDATE 55

Introduction: Organization of this Chapter 58

Overview of the results of the Phase 2 service quality analysis 58

Data collection and reporting pursuant to General Order 133-C and subsequent 133-D 60

Trouble Reports, in general 63

The "raw" Trouble Report data 68

The continuing collapse of the California ILEC market environment 68

Identifying long-term trends from actual month-to-month experience 73

Tables and Figures

Table 4.1: Quantities of Trouble Reports and Actual Out-of-service Conditions: AT&T – January 2010 through December 2019 Frontier – April 2016 through December 2019 64

Table 4.2: Quantities of Trouble Reports and Out-of-Service Conditions Adjusted to Exclude Sundays and Holidays per GO 133-C/D: AT&T – January 2010 through December 2019 Frontier – April 2016 through December 2019 65

Table 4.3: Most Common AT&T Cause Codes and the Number of Occurrences 2010-2019 67

Figure 4.1: California ILECs saw a precipitous drop in demand for circuit-switched legacy voice access lines over the 2010-2019 period, only a portion of which were replaced by ILEC-provided VoIP services. 70

Figure 4.2: A substantial share of California ILEC residential line losses was the result of customer migrations to cable MSOs and other ILEC competitors. 70

Figure 4.3: ILEC business customers also migrated to competing service providers that offer SIP trunking, virtual PBX, and other VoIP services. 71

Figure 4.4. ILECs and CLECs have experienced switched access line losses over the 2008-2018 period, but ILEC losses have been far greater. 71

Figure 4.5. The vast majority of the growth in VoIP services from 2008 to 2018 has been in the non-ILEC sector. 72

Figure 4.6: Perhaps the largest source of the shift in demand away from ILEC and other wireline voice services in California has been the mushrooming growth in demand for wireless. 72

Figure 4.7. Sample chart (Average duration of AT&T California service outages, 2010-2019) providing individual trend lines calculated for 2010-2017 (Phase 1), 2018-2019 (Phase 2) and for the full 2010-2019 period. 73

4A: SERVICE QUALITY ANALYSIS UPDATE: AT&T CALIFORNIA 75

Phase 2 2018-2019 Update to the AT&T California Service Quality analysis 82

Access line demand continues to plummet 82

Trouble Reports and POTS Lines in Service – a more granular perspective 85

AT&T Service Quality performance 103

Focus upon 2018-2019 results 103

Out-of-Service conditions overall 103

Out-of-service conditions cleared within 24 hours 110

AT&T has continued to increase rates for its legacy services while service quality continues to be degraded 134

Effects of geographic and other wire center attributes upon performance results 136

Fiber optic upgraded wire centers 153

Wire Center Size 159

Access Line Loss 165

Urban/Suburban/Rural 173

ILEC Organizational Assignment 179

Summary 185

Tables and Figures

Table 4A.1:	AT&T California Drop-off in POTS Demand at Wire Centers of Varying Sizes January 2010 – December 2019	83
Table 4A.2:	AT&T California Out-of-Service Over 24 Hours' Duration per 100 Pots Lines in Service – 20 Poorest Performing and 10 Best Performing Wire Centers 2016-2019	86
Table 4A.3:	AT&T California Average Out-of-Service Duration – 20 Poorest Performing and 10 Best Performing Wire Centers 2016-2019	87
Table 4A.4:	AT&T California Percent Out-of-Service Cleared Within 24 Hours – 20 Poorest Performing and 10 Best Performing Wire Centers 2016-2019	88
Table 4A.5:	AT&T California Days Required to Clear 90% of Out-of-Service Conditions – 20 Poorest Performing and 10 Best Performing Wire Centers 2016-2019	89
Table 4A.6:	AT&T California Trouble Report and Out-of-Service Data for 2016-2019	90
Table 4A.7:	AT&T California Quantities of Actual and Adjusted ("CPUC") Out-of-Service Conditions, January 2010 Through December 2019	110
Table 4A.8(a)	AT&T California Wire Center Performance Trends Over the Period Q2010-4Q2019	114
Table 4A.8(b)	AT&T California Wire Center Performance Trends Over the Period 1Q2018-4Q2019	122
Table 4A.9:	AT&T California Percentages of Actual and Adjusted ("CPUC") Out-of-Service Conditions Cleared Within 24 Hours and Days Required to Clear 90%	130
Table 4A.10:	AT&T California Basic Residential (POTS) Access Line Service Rate Increase History 2006-2020	135
Table 4A.11:	AT&T California Wire Center Attribute Dimensions and Categories	137
Table 4A.12:	AT&T California Wire Center Attribute Classifications	138
Table 4A.13:	Summary of AT&T Attribute Dimension Graphs	153
Table 4A.14:	AT&T California Classifications of Wire Centers by POTS Lines in Service as of January 2010	159

Table 4A.15:	AT&T California Classifications of Wire Centers by POTS Line Loss Percentage January 2010 Through December 2019	166
Table 4A.16:	AT&T California Field Operations West (AFO) Districts Total Wire Centers and Wire Centers Upgraded with Fiber to Support Broadband Services as of December 2019	180
Figure 4A.1:	The decrease in the number of AT&T California out-of-service Incidents has roughly corresponded with the drop-off in access lines in service over the 2010-2019 period	84
Figure 4A.2:	Over the 2010-2017 period, the trend of AT&T California out-of-service incidents per 100 access lines (actual) had been increasing; for 2018-2019, that trend experienced a further increase.	105
Figure 4A.3:	The rate of increase in the average duration of AT&T California out-of-service incidents lasting more than one hour (actual) grew even larger in the 2018-2019 period	105
Figure 4A.4:	The average duration of all AT&T California out-of-service incidents (actual) saw a significant jump during the 2018-2019 Phase 2 study period.	107
Figure 4A.5:	The average duration of all AT&T California out-of-service incidents over 24 hours (actual) increased further over the 2018-2019 Phase 2 study period.	107
Figure 4A.6:	The average duration of all AT&T California out-of-service incidents (adjusted) saw a significant jump during the 2018-2019 Phase 2 period.	108
Figure 4A.7:	The average duration of all AT&T California out-of-service incidents over 24 hours (adjusted) increased further over the 2018-2019 Phase 2 period.	108
Figure 4A.8	2018-2019 saw a 39% increase in the rate of AT&T California out-of-service conditions over 24 hours (actual), as compared with about 12% over the 2010-2017 Phase 1 study period.	109
Figure 4A.9:	AT&T California had not come even close to achieving the GO 133-CD §3.4(c) goal of 90% of all OOS cleared within 24 hours (actual) during the Phase 1 study period, and that metric saw a significant degradation in 2018-2019.	132
Figure 4A.10:	The percentage of all AT&T California OOS cleared within 24 hours (adjusted) has consistently fallen far short of meeting the GO 133-C/D §3.4(c) 90% cleared within 24 hours standard, and got a lot lower in 2018-2019.	132

Figure 4A.11: The number of days required to clear 90% of AT&T California out-of-service incidents (actual) increased considerably in 2018-2019. 133

Figure 4A.12: The number of days required to clear 90% of AT&T California out-of-service incidents (adjusted) also increased in 2018-2019. 133

Figure 4A.13: Wire centers that had not been upgraded with fiber optic facilities experienced further degradation in the number of out-of-service incidents per 100 access lines (actual) in 2018-2019. 135

Figure 4A.14: The average duration for OOS over 24 hours (actual) in wire centers that had not been upgraded with fiber optic facilities grew even longer in 2018-2019. 136

Figure 4A.15: The percentage of all OOS cleared within 24 hours (actual) dropped considerably both in fiber and non-fiber wire centers in 2018-2019. 137

Figure 4A.16: It took AT&T California more days to clear 90% of outages (actual) both in fiber and non-fiber wire centers in 2018-2019. 138

Figure 4A.17: The largest wire centers generally experienced the lowest out-of-service rate per 100 lines in service (actual), but the outage rate increased for all wire center size categories in 2018-2019. 161

Figure 4A.18: The largest wire centers generally exhibited the shortest average duration of OOS over 24 hours (actual); the two largest size categories saw some improvement in 2018-2019, while the two smallest size categories experienced even longer durations than in the Phase 1 study period. 162

Figure 4A.19: The largest wire centers generally exhibited the highest percentage of all OOS cleared within 24 hours (actual), but all five size categories saw significant decreases in this metric in 2018-2019. 163

Figure 4A.20: The largest wire centers generally required the fewest number of days to clear 90% of all out-of-service incidents (actual), but the days -to-clear metric increased across all size categories in 2018-2019. 164

Figure 4A.21: Companywide, AT&T California experienced a net loss of [redacted]% of its POTS access lines in service over the 2010-2019 period. 167

Figure 4A.22: AT&T California wire centers with the fewest POTS line losses have experienced the greatest increase in OOS per 100 lines in service (actual), a disparity that became even greater in 2018-2019. 169

Figure 4A.23: AT&T California wire centers with the largest POTS line losses had been experiencing the shortest average durations of OOS over 24 hours (actual) in the Phase 1 study period, but durations in this category saw a huge spike in the 2018-2019 period. 170

Figure 4A.24: AT&T California wire centers with the largest POTS line losses are experiencing the highest percentages of all OOS cleared within 24 hours (actual), but this metric worsened for all except the smallest line loss category in 2018-2019. 171

Figure 4A.25: AT&T California wire centers with the largest POTS lines losses requires the fewest number of days to clear 90% of all OOS (actual), but days-to-clear 90% increased for all line loss categories in 2018-2019. 172

Figure 4A.26: AT&T California. OOS per 100 lines in service (actual) had been increasing except in the highest density categories, and escalated further in all but one density category in 2018-2019. 175

Figure 4A.27: AT&T California. average duration of OOS over 24 hours (actual) had increased the most in areas with the lowest population density, and saw further increases in 2018-2019 across all density categories 176

Figure 4A.28: AT&T California. pct of all OOS cleared within 24 hours (actual) had remained stable except in areas with the highest population density, but saw decreases in all five density categories in 2018-2019. 177

Figure 4A.29: The number of days required for AT&T California. to clear 90% of all OOS (actual) has increased in all five density categories over the entire 2010-2019 period. 178

Figure 4A.30: AT&T California. OOS per 100 lines in service (actual) varied inversely with the type of area being supported by each AFO district – lowest in the largest metro areas, but saw large increases in the San Gabriel and Southern California districts. 181

Figure 4A.31: The average duration of OOS over 24 hours (actual) is longest – and had been increasing – in AT&T California AFO districts covering non-metro and rural areas, and also saw large increases in the San Gabriel and Southern California districts. 182

Figure 4A.32: The percentages of OOS to be cleared within 24 hours (actual) decreased in all five AFO districts in 201-2019. 183

Figure 4A.33: The number of days required to clear 90% of all OOS (actual) increased in all five AFO districts in 2018-2019. 184

4F: SERVICE QUALITY ANALYSIS UPDATE: FRONTIER CALIFORNIA 187

Introduction 195

Frontier has been hemorrhaging customers almost from the date of the acquisition 195

Trouble Reports and POTS Lines in Service – a more granular perspective 199

Frontier Service Quality Performance: 2018-2019 Update 208

Effect of persistent access line losses on the volume of customer trouble reports 208

Out-of-service conditions 210

Duration of out-of-service conditions 210

Out-of-service conditions cleared within 24 hours 214

Regression analyses covering all Frontier wire centers over time using a "Fixed Effects Panel Model." 227

Effects of geographic and other wire center attributes upon performance results 236

Wire Centers that had been upgraded to FTTP 242

Wire Center Size 249

Access Line Loss 254

Urban/Suburban/Rural 260

ILEC Organizational Assignment. 265

Summary 271

Tables and Figures

Table 4F.1: Frontier California Drop-Off In POTS Demand At Wire Centers Of Varying Sizes – April 2016 - December 2019. 197

Table 4F.2:	Frontier California Percent Out-of-Service Over 24 Hours Durations Per 100 POTS Lines in Service -- 20 Poorest Performing and 10 Best Performing Wire Centers 2Q2016-4Q2017.	200
Table 4F.3:	Frontier California Average Out-of-Service Duration -- 20 Poorest Performing and 10 Best Performing Wire Centers 2Q2016-4Q2017.	201
Table 4F.4:	Frontier California Percent Out-of-Service Cleared Within 24 Hours -- 20 Poorest Performing and 10 Best Performing Wire Centers 2Q2016-4Q2017.	202
Table 4F.5:	Frontier California Days Required to Clear 90% of Out-of-Service Conditions – 20 Poorest Performing and 10 Best Performing Wire Centers 2Q2016-4Q2017.	203
Table 4F.6:	Frontier California Trouble Report Out-of-Service Data for 2Q2016-4Q2017.	204
Table 4F.7:	Percentages Of Actual And Adjusted ("CPUC") Out-of-Service Conditions Cleared Within 24 Hours And Days Required To Clear 90%.	214
Table 4F.8(a):	Frontier California Reporting Unit Performance Trends for the period 2Q2016-4Q2019.	220
Table 4F.8(b):	Frontier California Reporting Unit Performance Trends for the period 2Q2018-4Q2019.	223
Table 4F.9:	Frontier California Fixed Effects Regression Results: Dependent Variable - Percent Cleared within 24 hours (Actual)	229
Table 4F.10:	Frontier California Fixed Effects Regression Results: Dependent Variable – Days Required to Clear 90% (Actual)	229
Table 4F.11:	Frontier California Fixed Effects Regression Results: Dependent Variable – Out of Service per 100 Access Lines-Monthly	230
Table 4F.12:	Frontier California Fixed Effects Regression Results:Dependent Variable -Average Out-of-Service Duration	230
Table 4F.13:	Frontier California Wire Center Attribute Dimensions and Categories.	237
Table 4F.14:	Frontier California Wire Center Attribute Classifications	238
Table 4F.15:	Summary of Frontier Attribute Dimensions Graphs	242

Table 4F.16:	Frontier California Classifications of Wire Centers and Reporting UnitsWith and Without FTTP Upgrades as of April 2016	243
Table 4F.17:	Frontier California Classifications of Wire Centers and Reporting Units by POTS Lines in Service.	249
Table 4F.18:	Frontier California Classifications of Wire Centers by POTS Line Loss Percentage.	254
Table 4F.19:	Frontier California Operating Areas	265
Figure 4F.1:	Frontier California has lost more than half of its POTS Access Lines in Service since taking over the company in 2016.	198
Figure 4F.2:	The number of Out-Of-Service incidents has fallen by a smaller percentage than the drop-off in POTS access lines over the 2016-2019 period of Frontier ownership.	209
Figure 4F.3:	There has been a steady upward trend in the number of out-of-service incidents per 100 access lines in service under Frontier ownership, and a further increase over the 2018-2019 Phase 2 study period.	209
Figure 4F.4:	The number of out-of-service incidents exceeding 24 hours per 100 access lines was initially decreasing under Frontier ownership, but has now been on the rise over the 2018-2019 period.	211
Figure 4F.5:	The average duration (actual) of all out-of-service conditions had been improving during the first two years of Frontier ownership, but that trend has sharply increased over the 2018-2019 period.	211
Figure 4F.6:	The average duration (actual) of out-of-service conditions greater than one hour had been improving during the first two years of Frontier ownership, but that trend has sharply increased over the 2018-2019 period.	212
Figure 4F.7:	Average actual (actual) duration of all out-of-service incidents in excess of 24 hours in duration has been trending upward over the 2018-2019 period.	212
Figure 4F.8:	Average duration of all out-of-service incidents adjusted for Sundays and holidays had been improving during the first two years of Frontier ownership, but that trend has sharply increased over the 2018-2019 period.	213
Figure 4F.9:	Average duration of all out-of-service incidents in excess of 24 hours adjusted for Sundays and holidays has been trending upward over the 2018-2019 period.	213

Figure 4F.10: Percentage of all out-of-service conditions cleared within the first 24 hours (actual) had been improving during the first two years of Frontier ownership, but that trend has sharply decreased over the 2018-2019 period. 216

Figure 4F.11: Percentage of all out-of-service conditions cleared within the first 24 hours (adjusted for Sundays and holidays) had been improving during the first two years of Frontier ownership, but that trend has sharply decreased over the 2018-2019 period. 216

Figure 4F.12: Days required to clear 90% of all out-of-service conditions (actual) had been dropping during the first two years of Frontier ownership, but that trend has been getting longer over the 2018-2019 period. 218

Figure 4F.13: Days required to clear 90% of all out-of-service conditions (adjusted for Sundays and holidays) had been dropping during the first two years of Frontier ownership, but that trend has been getting longer over the 2018-2019 period. 218

Figure 4F.3P: Panel Model Box Diagram: Out-of-Service per 100 Access Lines - Monthly 232

Figure 4F.5P: Panel Model Box Diagram: Average Out-of-Service Duration (Actual) 233

Figure 4F.10P: Panel Model Box Diagram: Percent Out-of-Service Cleared Within 24 Hours (Actual) 234

Figure 4F.12P: Panel Model Box Diagram: Days Requires to Clear 90% of Out-of-Service Conditions (Actual) 235

Figure 4F.14: There have been fewer out-of-service conditions per 100 access lines in wire centers with FTTP upgrades, but both categories have seen increases in OOS rates over the 2018-2019 period. 245

Figure 4F.15: Service outages are shorter in wire centers that have received FTTP upgrades, but following some improvement in FTTP offices following Frontier's takeover, durations have been on the rise in both categories over the 2018-2019 period. 246

Figure 4F.16: FTTP-upgraded wire centers clear a higher percentage of out-of-service conditions within 24 hours, but following improvement in both categories following Frontier's takeover, the percent cleared within 24 hours has been falling in both categories over the 2018-2019 period. 247

Figure 4F.17: The number of days needed to clear 90% of service outages in shorter in FTTP-upgraded wire centers, but following improvement in both categories

following Frontier's takeover, the days needed to clear 90% has been increasing in both categories over the 2018-2019 period. 248

Figure 4F.18: The largest wire centers exhibit the fewest number of out-of-service conditions per 100 access lines, but wire centers in all size categories have seen increases in OOS rates over the 2018-2019 period. 250

Figure 4F.19: Service outages continued to have shorter durations in larger wire centers following Frontier's takeover, but wire centers in all size categories have taken longer to clear over the 2018-2019 period. 251

Figure 4F.20: The largest wire centers tended to clear a higher percentage of out-of-service conditions within 24 hours, but following improvement in all size categories following Frontier's takeover, the percent cleared within 24 hours has been falling in all size categories over the 2018-2019 period. 252

Figure 4F.21: The number of days needed to clear 90% of service outages is shortest in the largest wire centers and had been improving in all but the two smallest size categories following the Frontier takeover, but has been increasing in all size categories over the 2018-2019 period. 253

Figure 4F.22: Wire centers that had experienced the greatest drop-off in demand for POTS services generally exhibited the fewest number of out-of-service conditions per 100 access lines, but that number has been increasing in all line loss categories over the 2018-2019 period. 256

Figure 4F.23: Service outages tended to be shortest in wire centers that had experienced the greatest drop-off in demand for POTS, but durations have been on the rise in all line loss categories over the 2018-2019 period. 257

Figure 4F.24: Access line drop-off rates appear to have had little effect upon the percentage of out-of-service conditions within 24 hours, but after gains in all five categories following Frontier's takeover in 2016, significant degradation in this metric has occurred in all loss categories over the 2018-2019 period. 258

Figure 4F.25: Access line drop-off rates appear to have had little effect upon the number of days needed to clear 90% of service outages, but after gains in all five categories following Frontier's takeover in 2016, significant degradation in this metric has occurred in all loss categories over the 2018-2019 period. 259

Figure 4F.26: Wire centers serving areas with the highest population density exhibit the fewest number of out-of-service conditions per 100 access lines under Frontier management, but wire centers in all density categories have seen increases in OOS rates over the 2018-2019 period. 261

Figure 4F.27: Service outages tend to be shortest in wire centers serving the more densely populated areas, but wire centers in all density categories have seen increases in OOS duration over the 2018-2019 period. 262

Figure 4F.28: Wire centers serving the more densely populated areas tended to clear a higher percentage of out-of-service conditions within 24 hours, but wire centers n all density categories have seen reductions in this metric over the 2018-2019 period. 263

Figure 4F.29: The number of days needed to clear 90% of service outages is shortest for wire centers serving more densely populated areas, but wire centers in all density categories have seen increases in days-to-clear over the 2018-2019 period. 264

Figure 4F.30: Frontier's Desert and Northern Operating Areas, which have responsibility for wire centers serving the least densely populated areas, exhibit the highest number of out-of-service conditions per 100 access lines. 267

Figure 4F.31: Service outages tend to be shorter in those Operating Areas serving more densely populated areas. 268

Figure 4F.32: Operating Areas serving the more densely populated areas have the best record of clearing a high percentage of out-of-service conditions within 24 hours, but these clearance rates experienced significant increases in all six Operating Areas in 2018-2019. 269

Figure 4F.33: The number of days needed to clear 90% of service outages had been improving in all except the Desert Operating Area following the Frontier takeover, but in 2018-2019 all Operating Areas saw significant escalations in outage durations. 270

5: INFRASTRUCTURE POLICIES AND PROCEDURES: AT&T – not updated in Phase 2

6: INFRASTRUCTURE POLICIES AND PROCEDURES: FRONTIER – not updated in Phase 2

7: AT&T CORPORATE AND CALIFORNIA FINANCIALS AND ILEC INVESTMENT POLICIES: PHASE 2 UPDATE 273

Introduction 278

AT&T California remains the underlying provider of most retail local network services being offered under the AT&T California or other AT&T affiliate brand names 279

The AT&T California component of parent AT&T Inc. revenues have been steadily diminishing, as has the share of the overall AT&T capital budget that is being allocated to the California ILEC. 280

AT&T California's response to the rapidly eroding demand for legacy POTS services has not been to cut prices to retard such "cord-cutting," but instead to implement large rate increases so as to "harvest" as much revenue from the remaining POTS customers as long as they continue to retain their service. 284

AT&T California has continued its practice of disinvesting in its California local network infrastructure. 285

Inter-affiliate transactions at non-arm's length transfer prices also contribute to the parent company's pattern of disinvestment in AT&T California operations. 290

Persistent disinvestment, extensive affiliate transactions at self-serving transfer prices, extraordinarily large rate increases, and deteriorating service quality all point to "harvesting" as AT&T California's overarching strategy for its legacy services and customers. 293

AT&T California investment in wireline circuit-switched voice services has continued to diminish over the 2018-2019 period. 293

Investments at individual wire centers 297

GO 133-D §9.7 Alternative Investments 325

Summary and conclusions 399

Tables

Table 7.1: AT&T California and AT&T Inc. Total Operating Revenues 2010-2019 281

Table 7.2: AT&T California and AT&T Inc. Legacy Switched Access Lines in Service 2010-2019 281

Table 7.3: AT&T California Operating Revenues Decreased, but by Far less than the Decrease In Legacy Switched Access Lines 2010-2019 282

Table 7.4: AT&T California Legacy Switched Access Line Revenues Have Decreased by a Greater Percentage than for Total Operating Revenues Generally,

	but Still by Far less Than the Decrease in Legacy Switched Access Lines 2010-2019	283
Table 7.5:	AT&T California Net Income and Dividend Payments to Parent AT&T Inc. 2010-2019	286
Table 7.6	AT&T California Pattern of Investment 2010-2019	287
Table 7.6A:	AT&T California Pattern of Investment 2010-2019 Approximate *Pro Forma* Adjustments as if USOA Accounting Rules Were Still Being Used for 2018 and 2019	290
Table 7.7	AT&T California Affiliate Transactions with Other Units of AT&T Inc. 2010-2019	292
Table 7.8:	AT&T California Gross Plant Additions 2010-2019	296
Table 7.9:	AT&T California Digital Electronic Switching Gross Additions and Retirements 2010-2019	298
Table 7.10:	AT&T California Circuit Equipment Gross Additions and Retirements 2010-2019	299
Table 7.11:	AT&T California Gross Plant Additions 2010-2019	308
Table 7.12:	AT&T California Gross Additions per Access Line in Service – 30 Wire Centers with the Lowest Per-Line Expenditures	316
Table 7.13:	AT&T California Gross Additions per Access Line in Service – 30 Wire Centers with the Highest Per-Line Expenditures	327
Table 7.14:	AT&T California Gross Additions per Access Line in Service	330
Table 7.15:	AT&T California Comparison among Plant Investment Categories 2018-2019	333
Table 7.16:	AT&T California Rehabilitation Expenditures by Wire Center 2018-2019	335
Table 7.17:	AT&T California Comparison of GO 133-D §9.7 "Alternative Proposed Investments" and Total Rehab Expenditures 2018-2019	347
Table 7.18:	AT&T California Comparison of GO 133-D §9.7 "Alternative Proposed Investments" and Total 2018- 2019 Rehab Expenditures (Sorted by Other Rehab Expenditures -- Largest to Smallest)	366

Table 7.19: AT&T California Service Quality Metrics in Wire Centers Receiving GO 133-D §9.7 "Alternative Investments" and Other Rehab Expenditures 2018-2019 (Sorted by Percent Cleared within 24 Hours) 385

8: FRONTIER CORPORATE AND CALIFORNIA FINANCIALS AND ILEC INVESTMENT POLICIES: PHASE 2 UPDATE 401

A lot has happened to Frontier since our Phase 1 Report 404

Verizon California had been experiencing customer drop-offs for years preceding the Frontier acquisition. 413

Verizon California had been consistently disinvesting in its California local network infrastructure, and Frontier has been pursuing a similar strategy. 418

The focus of Frontier California's capital investments over the 2016-2019 period 422

Maintenance and rehabilitation expenses 2018-19 433

GO 133-D §9.7 Alternative Investments 437

Summary and conclusions 437

Tables and Figures

Table 8.1: Frontier Communications Corp.: Customer Counts by Service Category, 2016-2019 404

Table 8.2: Verizon/Frontier California Average Legacy Switched Access Lines in Service, 2010-2019 414

Table 8.3: Verizon/Frontier Operating Revenues Have Decreased, but by Far Less than the Decrease in Legacy Switched Access Lines, 2010-2019 415

Table 8.4: Verizon California (U-1002) Legacy Switched Access Line Revenues Have Decreased Roughly in Proportion to the Decrease in Legacy Switched Access Lines, 2011-2019 416

Table 8.5: Verizon/Frontier California Basic Residential (POTS) Access Line Service Rate Increase History, 2006-2020 417

Table 8.6: Frontier California Pattern of Investment, 2016-2019 419

Table 8.7:	Frontier California Affiliate Transactions with Other Frontier Units, 2016-2019	421
Table 8.8:	Frontier California Gross Plant Additions, 2016-2019 by Plant Account	423
Table 8.9:	Frontier California Distribution of Gross Plant Additions 2018-2019	424
Table 8.10:	Frontier California Gross Plant Additions – 30 Wire Centers with Largest Spend, 2016-2019	425
Table 8.11:	Frontier California Gross Plant Additions, 2016-2019	426
Table 8.12:	Frontier California Gross Plant Additions, 2016-2019 (sorted by highest to lowest wire center expenditure)	429
Table 8.13:	Frontier California Breakdown of Operating Expenses, 2018-2019	434
Table 8.14:	Frontier California Outside Plant Maintenance Expenses, 2018-2019	435
Tzble 8.15:	Frontier California Regulated and Non-Regulated Revenues and Expenses, 2018-2019	436
Figure 8.1:	Frontier Communications Corp. Common Stock share prices, 5-year history.(Source: Google Finance, as of December 16, 2020)	405
Figure 8.2:	Frontier's cumulative five-year total return in comparison to the five-year total return for all S&P 500 Index stocks and for all S&P Telecommunications Services Index stocks.	406
Figure 8.3:	Frontier has financed its succession of ILEC acquisitions primarily through the issuance of debt.	407
Figure 8.4:	Frontier Communications Corp. Revenues, 2005-2019.	408
Figure 8.5:	Frontier Communications Corp. Switched Access Lines in Service 2005-2019	409
Figure 8.6:	Frontier corporate net earnings have plummeted in the years since the 2016 California, Texas and Florida acquisitions from Verizon.	411
Figure 8.7:	Frontier's corporate debt service continued to increase while its operating revenues have plummeted.	413

9: ASSESSMENT OF SAFETY, REDUNDANCY AND RESILIENCY OF NETWORK(S): AT&T – not updated in Phase 2

10: ASSESSMENT OF SAFETY, REDUNDANCY AND RESILIENCY OF NETWORK(S): FRONTIER – not updated in Phase 2

11: ILEC SERVICE QUALITY AND COMMUNITY DEMOGRAPHICS 442

Introduction 447

Median household income, ILEC investment, and service quality 448

Investment 449

Frequency and restoration of service outages 475

AT&T California 475

Frontier California 482

Racial characteristics of the population being served and service quality 489

Conclusion 502

Tables and Figures

Table 11.1: AT&T California and Frontier California Wire Center Serving Area Median Household Income Categories 449

Table 11.2: AT&T California Median Household Income and 2018-29 Gross Plant Additions 450

Table 11.3 AT&T California Wire Center Serving Area Median Household Income Based on 2018 American Community Survey Data 451

Table 11.4 AT&T California and Frontier California Weighted Average Median Household Income in Wire Center Serving Areas with and Without Broadband Service Upgrades Based on 2018 American Community Survey Data 467

Table 11.5:	Frontier California Median Household Income and 2018-29 Gross Plant Additions	468
Table 11.6:	Frontier California Weighted Average Median Household Income in Wire Center Serving Areas With and Without Broadband Service Upgrades Based on 2018 American Community Survey Data	468
Figure 11.1:	AT&T California Service Outages per 100 Access Lines per Month for the Five Median Household Income Quintiles, 2018-2019	476
Figure 11.2:	AT&T California Percent of Service Outages Restored Within 24 Hours for the Five Median Household Income Quintiles, 2018-2019	476
Figure 11.3:	AT&T California Average Duration of Service Outages for the Five Median Household Income Quintiles, 2018-2019	477
Figure 11.4:	California Average Number of Days Required to Restore 90% of Service Outages for the Five Median Household Income Quintiles, 2018-2019	477
Figure 11.5:	AT&T California Service Outages per 100 Access Lines per Month, Long-term trends for the Five Median Household Income Quintiles, 2010-2019	478
Figure 11.6:	AT&T California Percent of Service Outages Restored Within 24 Hours, Long-term trends for the Five Median Household Income Quintiles, 2010-2019	479
Figure 11.7:	AT&T California Average Duration of Service Outages, Long-term trends for the Five Median Household Income Quintiles, 2010-2019	480
Figure 11.8:	AT&T California Average Number of Days Required to Restore 90% of Service Outages, Long-term trends for the Five Median Household Income Quintiles, 2010-2019	481
Figure 11.9:	Frontier California Service Outages per 100 Access Lines per Month for the Five Median Household Income Quintiles, 2018=2019	483
Figure 11.10:	Frontier California Percent of Service Outages Restored Within 24 Hours for the Five Median Household Income Quintiles, 2018=2019	483
Figure 11.11:	Frontier California Average Duration of Service Outages for the Five Median Household Income Quintiles, 2018=2019	484

Figure 11.12: Frontier California Average Number of Days Required to Restore 90% of Service Outages for the Five Median Household Income Quintiles, 2018=2019 484

Figure 11.13: AT&T California Service Outages per 100 Access Lines per Month, Long-term trends for the Five Median Household Income Quintiles, 2010-2019 485

Figure 11.14: AT&T California Percent of Service Outages Restored Within 24 Hours, Long-term trends for the Five Median Household Income Quintiles, 2010-2019 486

Figure 11.15: AT&T California Average Duration of Service Outages, Long-term trends for the Five Median Household Income Quintiles, 2010-2019 487

Figure 11.16: AT&T California Average Number of Days Required to Restore 90% of Service Outages, Long-term trends for the Five Median Household Income Quintiles, 2010-2019 488

Figure 11.17: AT&T California Service Outages per 100 Access Lines per Month by Racial Population Characteristics – Percent Black, 2018-2019 490

Figure 11.18: AT&T California Percent of Service Outages Restored Within 24 Hours by Racial Population Characteristics – Percent Black, 2018-2019 490

Figure 11.19: AT&T California Average Duration of Service Outages by Racial Population Characteristics – Percent Black, 2018-2019 491

Figure 11.20: AT&T California Average Number of Days Required to Restore 90% of Service Outages by Racial Population Characteristics – Percent Black, 2018-2019 491

Figure 11.21: AT&T California Service Outages per 100 Access Lines per Month by Racial Population Characteristics – Percent Hispanic, 2018-2019 492

Figure 11.22: AT&T California Percent of Service Outages Restored Within 24 Hours by Racial Population Characteristics – Percent Hispanic, 2018-2019 492

Figure 11.23: AT&T California Average Duration of Service Outages by Racial Population Characteristics – Percent Hispanic, 2018-2019 493

Figure 11.24: AT&T California Average Number of Days Required to Restore 90% of Service Outages by Racial Population Characteristics – Percent Hispanic, 2018-2019 493

Figure 11.25:	AT&T California Service Outages per 100 Access Lines per Month by Racial Population Characteristics – Percent Non-White, 2018-2019	494
Figure 11.26:	AT&T California Percent of Service Outages Restored Within 24 Hours by Racial Population Characteristics – Percent Non-White, 2018-2019	494
Figure 11.27:	AT&T California Average Duration of Service Outages by Racial Population Characteristics – Percent Non-White, 2018-2019	495
Figure 11.28:	AT&T California Average Number of Days Required to Restore 90% of Service Outages by Racial Population Characteristics – Percent Non-White, 2018-2019	495
Figure 11.29:	Frontier California Service Outages per 100 Access Lines per Month by Racial Population Characteristics – Percent Black, 2018-2019	496
Figure 11.30:	Frontier California Percent of Service Outages Restored Within 24 Hours byRacial Population Characteristics – Percent Black, 2018-2019	496
Figure 11.31:	Frontier California Average Duration of Service Outages by Racial Population Characteristics – Percent Black, 2018-2019	497
Figure 11.32:	Frontier California Average Number of Days Required to Restore 90% of Service Outages by Racial Population Characteristics – Percent Black, 2018-2019	497
Figure 11.33:	Frontier California Service Outages per 100 Access Lines per Month by RacialPopulation Characteristics – Percent Hispanic, 2018-2019	498
Figure 11.34:	Frontier California Percent of Service Outages Restored Within 24 Hours byRacial Population Characteristics – Percent Hispanic, 2018-2019	498
Figure 11.35:	Frontier California Average Duration of Service Outages by Racial PopulationCharacteristics – Percent Hispanic, 2018-2019	499
Figure 11.36:	Frontier California Average Number of Days Required to Restore 90% of Service Outages by Racial Population Characteristics – Percent Hispanic, 2018-2019	499
Figure 11.37:	Frontier California Service Outages per 100 Access Lines per Month by Racial Population Characteristics – Percent Non-White, 2018-2019	500
Figure 11.38:	Frontier California Percent of Service Outages Restored Within 24 Hours by Racial Population Characteristics – Percent Non-White, 2018-2019	500

Figure 11.39: Frontier California Average Duration of Service Outages by Racial Population Characteristics – Percent Non-White, 2018-2019 501

Figure 11.40: Frontier California Average Number of Days Required to Restore 90% of Service Outages by Racial Population Characteristics – Percent Non-White, 2018-2019 501

12: COMMUNICATIONS DIVISION STAFF SITE VISITS – not updated in Phase 2

13: PHYSICAL AND ENVIRONMENTAL FACTORS AFFECTING ILEC SERVICE QUALITY 503

Introduction 506

Effects of precipitation on out-of-service incidents 506

Effects of major wildfires on out-of-service incidents 532

Tables and Figures

Table 13.1: California Census Regions 507

Table 13.2: AT&T California – Relationship Between Precipitation and Out-of-Service Incidents2010-2019 509

Table 13.3: Frontier California – Relationship Between Precipitation and Out-of-Service Incidents 2016-2019 509

Table 13.4: AT&T California – Relationship Between Wildfire Events and Out-of-Service Incidents 2013-2019 533

Table 13.5: Frontier California – Relationship Between Wildfire Events and Out-of-Service Incidents 2016-2019 533

Table 13.6 AT&T California – County-Level Relationships Between Wildfire Events and Out-of-Service Incidents 2013-2019 555

Table 13.7 Frontier California – County-Level Relationships Between Wildfire Events and Out-of-Srvice Incidents 2016-2019 557

Table 13.8: AT&T California Infrastructure Investment in High-risk Wildfire Areas 559

Table 13.9: Frontier California Infrastructure Investment in High-risk Wildfire Areas 561

Table 13.10: Rank Correlations Between Total Wildfire Acres Burned (2013-2020) and ILEC Gross Plant Investments (2018-2019) 562

Figure 13.1 California Census Regions 508

Figures 13.2 – 13.11 AT&T California – Correlation between Monthly Precipitation Rate and the Monthly Rate of OOS Incidents per 100 Access Lines by Census Region 512

Figures 13.12– 13.21 Frontier California – Correlation between Monthly Precipitation Rate and the Monthly Rate of OOS Incidents per 100 Access Lines by Census Region 522

Figures 13.22– 13.31 AT&T California – Correlation between Wildfire Events and and the Monthly Rate of OOS Incidents per 100 Access Lines by Census Region 534

Figures 13.32– 13.41 Frontier California – Correlation between Wildfire Events and the Monthly Rate of OOS Incidents per 100 Access Lines by Census Region 544

Appendix 13-1: AT&T California – County-Level Regression Analyses – Wildfires vs. Telephone Service Outages 563

Appendix 13-2: Frontier California – County-Level Regression Analyses – Wildfires vs. Telephone Service Outages 617

14: ILEC RESPONSES TO SERVICE OUTAGES: VoIP SERVICES 645

Introduction 649

Regulatory status of VoIP in California 650

Principal forms of digital services that support VoIP telephony 651

ILEC VoIP service architecture 653

VoIP service quality metrics: AT&T California 654

Individual wire center VoIP service quality performance 661

VoIP service quality metrics: Frontier California 688

Conclusion 696

Tables and Figures

Table 14.1:	AT&T California VoIP subscriptions and technologies, 2012-2019	654
Table 14.2:	AT&T California VoIP subscriptions and trouble reports, 2012-2019	655
Table 14.3:	AT&T California Average Duration of VoIP Trouble Conditions, 2012-2019	656
Table 14.4:	AT&T California Principal VoIP Trouble Report Cause Categories and Subcategories, 2012-2019	658
Table 14.5:	AT&T California Annual VoIP Trouble Report Incidents by Major Cause Categories 2012-2019	659
Table 14.6:	AT&T California Monthly VoIP Trouble Reports per Hundred Access Lines (TRPH) by Major Cause Category, 2012-2019	660
Table 14.7:	AT&T California Comparison of Average Monthly Out-of-Service Trouble Reports per Hundred Access Lines (TRPH) Legacy POTS vs. VoIP Services, 2018-2019	661
Table 14.8:	AT&T California VoIP Access Lines in Service by Wire Center, Average per Month, 2014-2019	663
Table 14.9:	AT&T California VoIP Trouble Reports per Hundred Access Lines (TRPH) by Wire Center Average per Month, 2015-2019	671
Table 14.10:	AT&T California VoIP Out-of-service Reports per Hundred Access Lines (TRPH) by Wire Center Average per Month 2015-2019	679
Table 14.11	Frontier California POTS and VoIP Lines in Service, 2016-2019	689
Table 14.12:	Frontier California VoIP Lines in Service and VoIP Trouble Reports 2016-2019	691
Table 14.13:	Frontier California VoIP Service Outage Cause Indications	692
Table 14.14:	Frontier California Principal Categories of VoIP Out-of-service Trouble Reports	693
Table 14.15:	Frontier California VoIP Lines in Service and Out-of-service Trouble Reports Associated with Frontier Plant and Equipment Failures, 2016-2019	695
Figure 14.1:	Principal components of an ILEC local distribution network.	652

15: CPUC CONSUMER AFFAIRS BRANCH SERVICE QUALITY COMPLAINTS 697

Introduction 699

Types and quantities of consumer complaints received by CAB 700

VoIP Services 706

CAB complaints vs. carrier trouble reports for legacy services 707

Summary 710

Tables

Table 15.1: CPUC Consumer Affairs Branch – Types of Consumer Complaints Received Relating to AT&T California – 2018-2019 701

Table 15.2: CPUC Consumer Affairs Branch – Types of Consumer Complaints ReceivedRelating to Frontier California – 2018-2019 703

Table 15.3: CPUC Consumer Affairs Branch Principal Categories of Consumer Complaints 2018-2019 705

Table 15.4: VoIP and Legacy Services – Complaints, Trouble Reports and Subscription Counts, 2018-2019 706

Table 15.5: AT&T California – Comparison of Carrier Out-of-Service Trouble Reports vs. Service Quality-Related Complaints Received by CPUC Consumer Affairs Branch – 2018-2019 708

Table 15.6: Frontier California – Comparison of Carrier Out-of-Service Trouble Reports vs. Service Quality-Related Complaints Received by CPUC Consumer Affairs Branch – 2018-2019 709

16: EFFECT OF CAF II SUPPORT UPON POTS SERVICE QUALITY 711

Introduction 713

Limitations of POTS service quality data 713

Conclusion 722

Tables and Figures

Table 16.1: Connect America Fund II Upgraded Locations Deployed in California 718

Table 16.2: AT&T California CAF II-eligible Housing Units as Percent of Total 719

Table 16.3 Frontier California CAF II-eligible Housing Units as Percent of Total 721

Figure 16.1: Example of CAF II Eligibility areas for AT&T and Frontier 715

.

Figure 16.2: Example of Deployed CAF II Locations within Eligibility areas for AT&T and Frontier 716

Figure 16.3: California CAF II Eligibility and Deployment areas 717

17: CONCLUSION AND RECOMMENDATIONS 723

Managing the transition from legacy to current technology services 724

Conclusions 725

Recomendations 728

APPENDICES (Bound Separately)

4A-1 Updated Individual wire center service quality data – AT&T California

4F-1 Updated Individual wire center service quality data – Frontier California

1 EXECUTIVE SUMMARY AND OVERVIEW OF THIS REPORT

TABLE OF CONTENTS

Introduction	2
Scope of this Phase 2 Study	2
Organization of this Phase 2 Report	3
Organization of this Chapter	4
Key Conclusions and Recommendations resulting from this study	4
Managing the transition from legacy to current technology services	4
Conclusions	5
Recommendations	8
Chapter Summaries	10
Principal Phase 2 Observations and Takeaways	46

Introduction

In December 2011, the California Public Utilities Commission ("CPUC" or "Commission") opened Rulemaking (R.)11-12-001 to (a) review telecommunications carrier performance in meeting the General Order (GO) 133-C service quality standards and measures in 2010; (b) assess whether the existing GO 133-C service quality standards and measures meet the goals of the Commission to adequately protect California customers and the public interest; (c) determine whether the existing GO133-C standards are relevant to the current regulatory environment and market; and (d) determine whether there is a need to establish a penalty mechanism for substandard service quality performance.

Economics and Technology, Inc. ("ETI") was selected by the CPUC Communications Division ("CD") to undertake an examination of the facilities of the two largest Incumbent Local Exchange Carriers ("ILECs") in California – AT&T California ("AT&T") and Frontier California ("Frontier") – as directed by the Administrative Law Judge ("ALJ"). In responding to CD's Request for Proposals from consultants to undertake this examination, ETI had outlined a data-driven approach that would rely upon the extensive amount of data regularly being submitted by the two carriers as well as on various other public sources, along with the results of CD Staff's on-site inspections and carrier responses to data requests.

In April 2019, ETI completed this study and delivered a 584-page report to CD covering the 2010-2017 period. On January 24, 2020, CD issued a "Secondary RFP to obtain responses from firms qualified to conduct an examination of the telecommunications networks and related policies and practices of AT&T California and Frontier Communications California for the period from 2018 to 2019." On March 5, 2020, ETI submitted a proposal in response to this Secondary RFP, and was selected by CD to undertake this additional study. Work on this Phase 2 study was commenced on April 27, 2020.

Scope of this Phase 2 Study

The scope of this Phase 2 study involved both extending the Phase 1 analysis to include 2018 and 2019 service qality and financial data, as well as to examine several issues that had received only limited attention in Phase 1. These additional areas of investigation included the following:

- Expansion of the scope of the service quality analysis to include Voice over Internet Protocol ("VoIP") services in addition to the traditional legacy circuit-switched Plain Old Telephone Services ("POTS").

- Expansion of the limited Phase 1 analysis of the relationship between adverse weather conditions and service outages, covering all regions of California.

- Correlation of Service Quality with high-risk wildfire areas.

- Correlation between household income and ILEC network investment.
- Correlation of service quality and network investment with network resiliency metrics in areas with differing racial demographics.
- If possible, determine whether areas receiving Connect America Fund II ("CAF II") support for broadband expansion exhibit improved legacy POTS service quality.

Organization of this Phase 2 Report

Not all of the chapters in the Phase 1 Report have been updated, and several new chapters have been added. For consistency, updated chapters have retained the same chapter numbering as in the Phase 1 Report. The following table summizes the content of this Phase 2 report.

Chapter	Phase 1 Report	Phase 2 Report
1	Executive Summary and Overview	Executive Summary and Overview
2	Introduction and Background for this Study	Not updated
3	California ILEC Network Overview	Not updated
4	ILEC Responses to Service Outages	Updated to include 2018-2019
4A	Service Quality ANALYSIS: AT&T California	Updated to include 2018-2019
4F	Service Quality ANALYSIS: Frontier California	Updated to include 2018-2019
5	Infrastructure Policies and Procedures: AT&T	Not updated
6	Infrastructure Policies and Procedures: Frontier	Not updated
7	AT&T Corporate and California ILEC Investment Policies	Updated to include 2018-2019
8	Frontier Corporate and California ILEC Investment Policies	Updated to include 2018-2019
9	Assessment of Safety, Redundancy and Resiliency of Network(s): AT&T	Not updated
10	Assessment of Safety, Redundancy and Resiliency of Network(s): Frontier	Not updated
11	Conclusion and Recommendations, including preliminary analysis of the relationship between an area's median household income and service quality	ILEC Service Quality and Community Demographics
12	Communications Division Staff Site Visits	Not updated
13		Physical and Environmental Factors Affecting ILEC Service Quality
14		ILEC Responses to Service Outages: VoIP Services
15		CPUC Consumer Affairs Branch Service Quality Complaints
16		Relationship of CAF II funding to POTS service quality
17		Conclusions and Recommendations

Organization of this Chapter

This chapter is organized into three sections that are intended to provide a concise summary of our extensive examination of the network infrastructures of California's two largest ILECs – AT&T California and Frontier California:

(1) Key Conclusions and Recommendations resulting from this study

(2) Executive Summary of each chapter

(3) Principal observations and takeaways

Note that footnote citations have been omitted from this Executive Summary, They can be found in the individual chapters of this report.

Key Conclusions and Recommendations resulting from this study

Managing the transition from legacy to current technology services

As we noted in our Phase 1 report, a substantial source of the persistent service quality shortcomings that have plagued legacy POTS services over the past decade has resulted from a failure to develop and manage the migration from legacy circuit-switched wireline technology to state-of-the-art IP-based and wireless services. Numerous technology transitions have occurred in the telecommunications industry over the past century or more, but the current one is unique in a number of critically important respects.

Past transitions, such as from manual switchboards to dial, from step-by-step to crossbar central office switches, from electromechanical to electronic switches, from analog to digital switching, from baseband twisted-pair copper to frequency-division multiplexing to digital time-division multiplexing, from rotary dial to touch-tone, and from copper to fiber optics, have all occurred through a process that took place in the background, one that was largely invisible to the consumer and which, in most cases, involved little affirmative customer decisions or actions.

This process for technology transition was successful largely because the regulatory regime within which it occurred was technology-blind – i.e., the regulatory model remained the same under the previous and the new technology. But with the onset of competition and deregulation that began in the 1980s, this is no longer the case. When a customer migrates from a legacy circuit-switched service to an IP service such as VoIP or to wireless, the regulatory regime that had overseen the legacy service ceases to apply. The *deregulation* that applies to post-transition services presents the service provider with a radically changed set of financial incentives that essentially compel it, acting in the best interests of its shareholders as it has a fiduciary duty to do, to shift management and financial resources to these potentially far more profitable nonregulated services. Both AT&T and Frontier have been doing exactly that. They have

directed their capital investment away from legacy serivces and over to wireless, to broadband and, most recently, to *content*.

The scope of regulation should apply with respect to the set of *functionalities* that is deemed essential and in need of some level of regulatory protection, and *not* with respect to the particular technology that is involved. Thus, if basic voice and some minimal level of Internet access service is deemed essential, these services should be provided in the most efficient manner in each situation, whether by wireline or wireless, or by circuit- or packet-switching technology. If reliable access to emergency services (911) and connectivity that can remain active in the event of a local power interruption are considered essential minimum service requirements from a public policy standpoint, efficient solutions can be developed under any of the technology platforms or market models.

Fixing this problem is, at bottom, a political matter, and we do not pretend to offer a political solution. However, what is clear is that the existing arrangement is not producing anything close to an optimal result, and needs to be reexamined and revised at a fundamental level.

Conclusions

Following is a brief summary of the principal conclusions resulting from ETI's Phase 2 examination of the network infrastructures and quality of service of AT&T California and Frontier California for the 2018-2019 study period.

- *Ongoing deterioration of ILEC service quality*. The quality of AT&T and Frontier voice services, which had been steadily deteriorating throughout the 2010-2017 Phase 1 study period, has become decidedly worse over the 2018-2019 Phase 2 period; the frequency of service outages has been increasing, as has their average duration.

- *Persistent disinvestment*. The persistent disinvestment, payments of dividends in excess of earnings, and annual depreciation accruals that exceeded gross additions that had characterized the Phase 1 study period have persisted into Phase 2; moreover, the infrastructure investments that both ILECs did make appeared aimed primarily at nonregulated broadband service upgrades rather than at improving legacy service plant.

- *Further decline in the number of POTS customers*. By the end of 2019, 79.1% of the legacy service access lines that were being served by AT&T California at the beginning of 2010 had discontinued their service. Frontier had lost 52.3% of the legacy service customers it had on April 1, 2016, the date on which it took over the California ILEC from Verizon. Both companies have, for all practical purposes, stopped marketing legacy circuit-switched Plain Old Telephone Service ("POTS"), focusing instead on broadband service as their strategy for maintaining and growing their revenue stream while allowing POTS service quality to continue to degrade. This lack of interest in POTS, coupled with the inconsequential financial penalties imposed by GO 133-D for failure to meet minimal

service quality performance metrics, would seem to explain why both ILECs have allowed POTS service quality to erode further. The potential revenue from migrating customers to broadband voice/Internet and video bundles, together with the costs the ILECs avoid by ignoring needed legacy service improvements, easily outweighs whatever financial penalties the Commission may impose for violating minimum service quality standards.

- *A focus upon broadband, not POTS.* Investments that were made during 2018-2019 continue to be primarily directed toward supporting new broadband services that bundle high-speed Internet access, Voice over Internet Protocol ("VoIP"), and Video. These broadband-focused upgrades have nevertheless conferred some benefit in improving POTS service quality in locations where such investments have been made. POTS service quality is decidedly better in such locations, but even in these locations, POTS service quality performance under most General Order 133-D metrics deteriorated even faster after 2017.

- *By the end of 2019, AT&T California had become an even smaller part of the overall AT&T corporate organization that it had been two years earlier.* Over the 2010-2017 period, AT&T California's parent AT&T Inc. had experienced significant growth in its overall gross revenues, rising 29.2% from $124.3-billion in 2010 to $181.2-billion in 2019. The primary sources of AT&T's revenue growth have come from wireless services, where the number of AT&T Mobility connections nationwide grew by 73.9%, from 95.4-million in 2010 to 165.9-million in 2019, and from several key acquisitions, including DirecTV and Time Warner. AT&T California revenues have been moving in the opposite direction. falling from $9.70-billion in 2010 to $6.63-billion by the end of 2019. AT&T California's share of total AT&T Inc. revenues has fallen by an even greater amount, from 7.80% in 2010 to 3.66% in in 2019. The parent company's willingness to allocate capital to the Califronia ILEC has dimished accordingly.

- *Failure to adapt network infrastructure to withstand varying weather and environmental conditions*. The strong correlation between significant adverse weather conditions and the incidence of service outages that we had observed in the greater Los Angeles area in our Phase 1 study has now been confirmed to be occurring statewide. This pattern suggests that the networks of AT&T and Frontier are not as robust as they need to be to withstand weather and climate conditions in the state. The occurrence of extreme weather events in California certainly can be anticipated to a certain degree and should thus be incorporated into the companies' engineering, design and construction, and maintenance practices. These networks must be able to withstand all types of inclement weather and provide safe and reliable service to customers.

- *Effect of wildfires upon service quality and infrastructure investment*. Unlike for weather, we found no identifiable correlation between wildfire events and elevated service outage rates. Service outages are heavily impacted by rainfall, which tends to occur in the late fall and winter, whereas wildfires are most frequent in the summer and early fall, when rainfall is minimal. Restoration of landline telephone service, or even reporting of service outages themselves, is not likely to be of high priority in the aftermath of a destructive wildfire, so

even if service has been interrupted, individual service outages may not be reported. We had also been asked to examine whether the ILECs had directed infrastructure investment to areas that had been heavily impacted by wildfires. However, no such investment pattern has been present for AT&T California, and only a minimal correlation could be identified for Frontier California.

- *Investment focus on higher income communities*. In our Phase 1 Report, we noted that both AT&T California and Frontier California appear to have prioritized their investments in fiber optic feeder and distribution facilities and in other broadband infrastructure to favor higher income communities. And since areas that have received such upgrades tend to perform better with respect to the various GO 133-D service quality metrics, the result is better service quality for these communities as well. This same pattern has persisted into the 2018-2019 study period for Phase 2.

- *Increased focus on areas most heavily impacted by competition*. Both carriers continued to experience a persistent and massive erosion in demand for POTS lines over the 2018-2019 study period. The greatest drop-offs – in some locations of as much as 90% or more – have occurred primarily in the more densely populated urban and suburban areas where customers have a wider choice of available providers and services. Notably, and as we had also observed for the 2010-2017 Phase 1 study period, it is the areas with the lowest POTS drop-off rates that have experienced the steepest deteriorations in service quality. AT&T and Frontier appear to have focused most of their attention in those communities where competition and the potential for loss of customers is greatest. Where POTS demand erosion has been greatest, the availability of broadband has offset some of the revenue losses.

- *Financial Capability*. AT&T Inc. has the financial resources to maintain and upgrade its wireline network in California, but has been pulling capital out of the state rather than putting new capital into its network here. Frontier has a strong interest in pursuing such upgrades, but lacks the financial capacity to make the necessary investments. Moreover, Frontier has suffered a financial meltdown since its 2016 purchase of the Verizon ILECs in California, Texas and Florida. Having grossly overpaid for these assets, the company has been unable to achieve an adequate and sustainable revenue stream, and was forced to seek Chapter 11 bankruptcy protection in April 2020. Even if it is successful in emerging from bankruptcy, the company will have little ongoing ability to raise capital needed to maintain and upgrade its network.

- *VoIP service quality*. VoIP is the principal alternative to legacy POTS for those who want to retain a wireline connection. AT&T VoIP service experiences a slightly higher rate of service outages than AT&T legacy services. Unlike circuit-switched services, VoIP is dependent upon locally-provided power, battery backup, and complex customer premises equipment that is not generally required for legacy circuit-switched services. The seemingly higher incidence of VoIP service outages *vis-à-vis* POTS could well be the result of customer premises conditions that are unique to VoIP. Finally, the so-called "digital divide"

– an issue whose importance has increased as a result of the COVID-19 crisis – raises the potential for the loss of high quality wireline voice services in rural and low-income populations that have not been targeted for broadband upgrades. With the sunset of §710 that went into effect as of the beginning of 2020, a comprehensive regulatory approach that embraces all providers of VoIP type services should clearly be a top priority.

- *CPUC Consumer Affairs Branch (CAB) complaints*. The number of consumer complaints received by the CAB amounts to a minuscule fraction of the total number of trouble reports received and processed by the two ILECs. Moreover, the majority of CAB complaints relate mainly to billing and other business relationship issues, not to service outages. CAB collects geo-coded customer location information, but this is not consistent with the customer of record/account data that is contained in the ILECs' trouble report records, such as the customer's account or billing telephone number, serving wire center, or other location-specific information. As a result, it is not possible to link these CAB complaints with corresponding ILEC trouble reports. That said, complaints relating to Frontier service that CAB received in 2018-2019 were substantially greater on a relative basis than those pertaining to AT&T, which is consistent with the rapidly deterioring service quality that Frontier experienced during these two years.

Recommendations

The overarching result of this Phase 2 examination is that the service quality failures that we had identified and documented in Phase 1 have actually become even more serious. Accordingly, we have expanded, revised and reiterated the specific recommendations that we had offered in our Phas 1 report:

- **Recommendation 1:** Given the enormous rate at which customers have been discontinuing legacy circuit-switched POTS-type services over the past decade, the Commission should reevaluate the role that regulation is to play with respect to legacy as well as current technology services going forward. If assuring universal availability of high quality public switched network access is to remain a central focus of regulatory policy, then advanced services, including VoIP and broadband, should be included within the scope of this policy review. There seems little reason to single out legacy services as the sole focus of service quality regulation.

- **Recommendation 2:** With §710 no longer in effect, GO 133 should be extended to apply to all wireline voice services whether furnished by ILECs or other large service providers.

- **Recommendation 3:** Expand the financial penalties for carriers that fail to meet the minimum GO 133-D service quality standards both with respect to the types of shortcomings that will be assessed and the financial magnitude of the fines or other penalties that will be imposed. We have seen no specific evidence that investments made in lieu of fines as permitted in GO 133-D §7 (a) would not have been made anyway, and (b) have resulted in specific remedial measures aimed at overcoming the service quality shortcomings. The

practical result of these alternative investments is simply to negate the effectiveness of the financial penalty itself, and as such the program should be discontinued.

- **Recommendation 4:** In an effectively competitive market, persistently poor service quality is expected to drive customers to take their business elsewhere. The continuing erosion of both ILECs' legacy customer base that persisted throughout Phase 1 nad that has continued through Phase 2 indicates that competition for and alternatives to legacy POTS-type services has been growing and "cord-cutting" has become even more pervasive. Yet even when faced with growing competition, both ILECs' POTS service quality has been on the decline. Whether due to inertia, the non-availability of cost-effective alternatives, or a perceived need to retain a telephone service that does not require local power, customers who retain their legacy service appear to be more captive to the ILEC than those able to switch. Where competition is limited or not present, continued regulatory monitoring and enforcement of minimal service quality standards remains necessary, and financial penalties imposed due to an ILEC's failure to meet service quality standards should be sufficiently high so as to have the same financial consequences as would poor service quality under competitive market conditions.

- **Recommendation 5:** The GO 133-D maximum Customer Trouble Report Rates of 6%, 8% or 10% (depending upon wire center size) of switched access lines per month remain far too generous, and failure rates as high as these can hardly constitute acceptable service quality. The carriers have had little difficulty in meeting these standards, and they should be revised downward.

- **Recommendation 6:** Fines imposed by GO 133-D §9 are currently applied for aggregate service quality shortfalls calculated on a companywide basis. Instead, these fines and other financial penalties should be imposed with respect to individual wire center service quality performance, and should escalate based upon the extent to which the carrier falls short of meeting the service quality standards for each such wire center. Frontier's practice of administratively consolidating groups of individual wire centers may hae the effect of masking those with particularly poor performance and in so doing potentially escaping the imposition of a penalty. Frontier should not be permitted to continue reporting its results for consolidated "reporting units" rather than separately for each individual wire center. AT&T has not engaged in a similar type of administrative consolidation.

- **Recommendation 7:** Unless carriers can offer technically valid explanations as to how and why smaller wire centers experience the poorest service quality, a uniform set of minimum GO 133-D standards should be applied to each individual wire center.

- **Recommendation 8:** The GO 133-D fines should vary based upon the extent of a carrier's failure to meet any service quality standard, rising in magnitude as the extent of the shortfall increases and/or persists for an extended period of time.

- **Recommendation 9:** The Commission should retain its requirement that URF carriers maintain their Part 32 Uniform System of Accounts ("USOA") regulatory accounting records and continue to submit annual ARMIS-type financial reports using the same accounts and account definitions that they have been required by the CPUC to maintain notwithstanding the FCC's decision to discontinue ARMIS reporting requirements after 2007. If an ILEC wants to substitute GAAP reporting for Part 32 USOA, it should be required, first, to submit a formal application for the right to make this substitution and, in that application, demonstrate that GAAP-type reporting will still meet the Commission's need for financial data sufficient to permit the type of year-over-year monitoring of investment, retirements, depreciation accruals, write-offs and write-downs, operating results, debt and debt service payments, and other financial data necessary for the Commission to carry out its regulatory mission. If the use of GAAP is authorized, the ILEC should be required to retroactively restate its USOA reports consistent with GAAP for a minimum of five (5) prior years. The financial reporting requirement should be extended to also include wire center level accounting data, similar to those that ETI had obtained through multiple data requests in the course of both Phase 1 and Phase 2 of this study. The ILECs should be required to submit these reports separately for each physically distinct wire center rather than for the groups of wire centers that Frontier had administratively consolidated for reporting purposes. The carriers should be required to submit these reports to the Communications Division on a semi-annual basis.

- **Recommendation 10:** The Commission should establish a process to proactively examine the alternatives that would be available to maintain adequate service to Frontier California customers in the event that the parent company no longer has the financial resources to provide safe and reliable services in California.

Chapter Summaries

4: ILEC RESPONSES TO SERVICE OUTAGES

Chapter 4 in this Phase 2 report provides an update to Chapter 4 in our Phase 1 Report to include trouble report and out-of-service activity for 2018 and 2019. The Chapter is organized into three sections. The first provides a general overview of the Commission's Customer Trouble Report and Out-of-Service reporting requirements, the types of data submitted by AT&T California and by Frontier California, as well as ETI's methodologies for analyzing the companies' submissions. The second and third sections provide updated analyses of AT&T and Frontier performance with respect to the GO 133-C/D Customer Trouble Report and Out-of-Service standards over the 2010-2019 study period for AT&T, and over the April 2016 through December 31, 2019 study period for Frontier.

On April 1, 2016, Verizon transferred ownership and control of its California ILEC operations, then known as Verizon California, to Frontier Communications Corporation. In

our Phase 1 Report, we covered the full 2010-2017 study period by merging the service quality data for both the pre- and post-transfer periods. In this Phase 2 Report, we are limiting our analysis of Frontier to the 45 months from April 2016 through and including December 2019 under Frontier ownership.

For Phase 2, we have appended the trouble report data submitted by the two ILECs pursuant to GO 133-D to the corresponding Phase 1 datasets. Using these expanded datasets, we then extended the long-term trend calculations to cover, in the case of AT&T California, the full 2010-2019 period and, for Frontier California, the 45-month period under Frontier ownership. We have also calculated trend lines for both companies covering the 2-year Phase 2 period from January 2018 through December 2019. The various graphs that are provided each present three separate trend lines:

(1) the Phase 1 2010-2017 trend (for AT&T) and the 4/2016 through 12/2017 trend for Frontier;

(2) the Phase 2 2018-2019 trend for both companies; and

(3) the combined Phases ½ trend, covering the full 2010-2019 period for AT&T, and the 45-month 4/2016 through 12/2019 period for Frontier.

An example of this graphic format is shown below for the Average Duration of AT&T service outages::

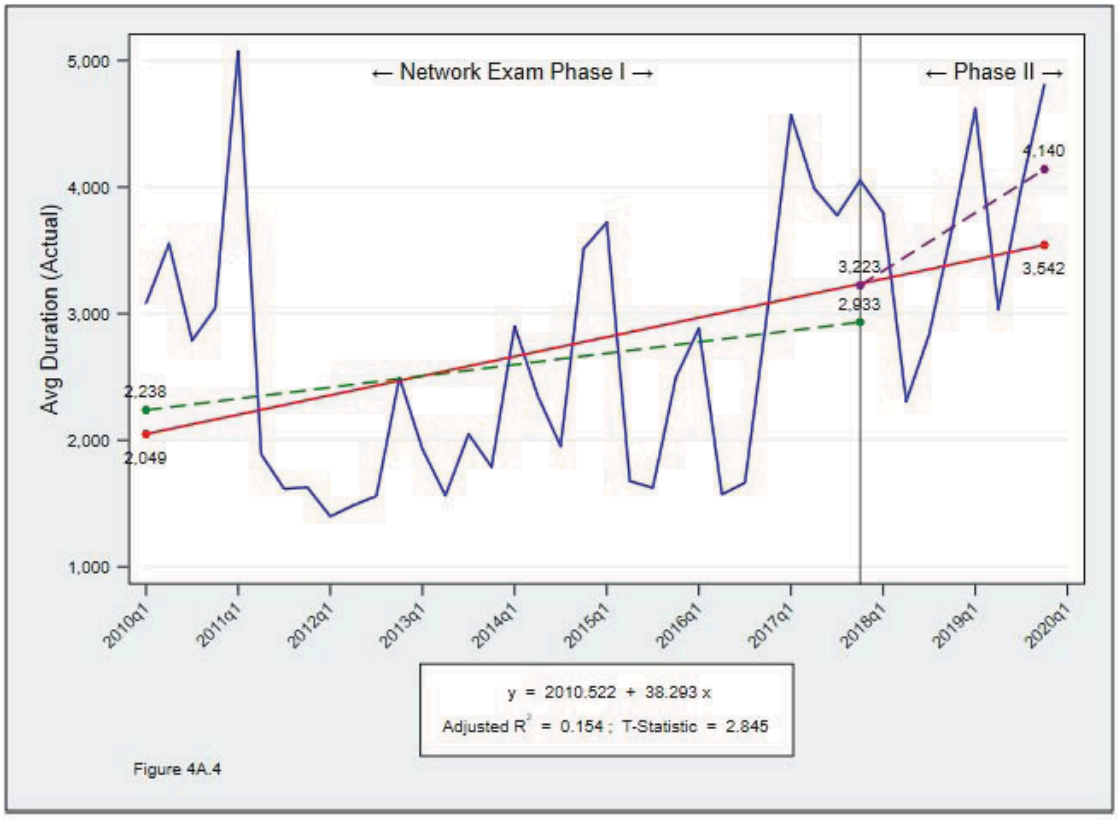


Figure 1.1. The average duration (shown here in days) of all AT&T California out-of-service incidents (actual) saw a significant jump during the 2018-2019 Phase 2 study period.

Overview of the results of the Phase 2 service quality analysis

Our analysis for 2018-2019 shows a fairly consistent and pervasive degradation in *both companies'* service quality performance across virtually every service quality metric that we have examined. The quantity of service outages per 100 access lines – the basic CPUC service quality metric embodied in GO 133-C/D – has been steadily increasing over the two-year Phase 2 study period, indicating a persistent, and disturbing, increase in the rate of service outages overall. The average durations of service outages has also been getting longer; both companies are taking more time, on average, to clear such outages, and the percentage of outages that are cleared within 24 hours – the target for which is specified in GO 133-C/D at 90% – has been dropping.

The massive POTS access line customer losses that both companies had been experiencing over the Phase 1 study period have persisted into Phase 2. Publicly available FCC Form 477 data show that total California ILEC legacy switched access lines in service have dropped by 72.6%, from 14.58 -million as of the beginning of 2010 to 3.99-million as of the

end of 2018, the most recent period for which such data has been made publicly available. The drop-off rate among residential customers is even greater at 81.66%, from 8.21 -million as of the beginning of 2010 to 1.51-million as of the end of 2018. Proprietary data provided by both ILECs, discussed in Chapters 4A and 4F below, show generally similar conditions. Switched access line customer defections are the result of many factors – most notably competition from other voice service providers, particularly from cable television MSOs, competition from mobile wireless carriers (which include affiliates of AT&T California and of pre-transfer Verizon California), as well as from "over-the-top" Internet applications (e.g., Skype, Vonage, Ooma and, more recently from video conferencing services like Zoom, Google Hangouts, Apple Facetime) that do not involve any type ov voice service common carrier at all, other than the underlying provider of the customer's broadband access.

There is, to be sure, something of a chicken-and-egg situation here: Are customers abandoning legacy circuit-switched services because of the service quality degradations, or are the service quality degradations the result of the revenue losses arising from customer defections? Probably both, which points to something of a "death spiral" that, if not addressed, will ultimately lead to the demise of these services within a relatively short period of time.

But the general decline in switched access line demand is not uniform across the state. For many lower-density areas, customer defection rates are considerably smaller than when viewed on a statewide basis. Notably, business customers have retained their legacy POTS services at a higher rate than residential – this despite rising prices and deteriorating service quality. Even with the large numbers of customers who have sought alternatives to legacy circuit-switched services, there are still many who continue to take this service. POTS-type services are the only category of telecommunications that retains at least some vestige of regulatory protections for consumers, generally assuring some level of service availability even in low-density and hard-to-serve areas. The principal competing voice services are being offered by providers operating in highly concentrated markets. Before allowing the death spiral to run its course, we believe it is essential that policy decisions be made as to the merit of retaining these legacy services and their underlying infrastructures as a baseline for those customers that do not perceive or that do not actually have alternatives. If these services are to be retained, the ILECs must be made to bring their level of service quality up to the full GO 133-C/D standards, because it is painfully apparent that the competitive market cannot be counted upon to produce this outcome.

Data collection and reporting pursuant to General Order 133-C and subsequent 133-D

General Order ("GO") 133-C required, in relevant part, that all "facilities-based URF [Uniform Regulatory Framework] Carriers with 5,000 or more customers" report various service quality performance metrics on a monthly basis to be submitted quarterly to the Commission. GO-133-C §§ 3.3(c) and 3.4(c) obligate both AT&T and Frontier to provide reports as well as the underlying ("raw") trouble ticket data on all customer Trouble Reports and Out-of-Service records occurring on and after January 1, 2010. In August 2016, the

CPUC, by D.16-08-021 in R.11-12-001, adopted GO 133-D as a revision to the prior version of the same General Order. GO 133-D added a new §9 that imposes specific financial penalties (fines) upon the ILECs for persistent failure to achieve the required service quality performance levels.

A Trouble Report (sometimes referred to as a Trouble Ticket) is generally created when a customer contacts the telephone company to report a service problem. GO 133-C/D established minimum standards and reporting levels for service on the network side of the customer/network demarcation. Using these Trouble Report records, we are able to create a range of metrics regarding the duration of the out-of-service condition. For Phase 2 of this study, we have appended the two companies' Trouble Report records for 2018-2019 to the 2010-2017 Phase 1 data. However, as noted above, for Frontier, we have limited the Phase 2 analysis to the post-acquisition period, from April 2016 through December 2019. In all, we examined a total of 6.96-million AT&T Trouble Report records for the 2010-2019 period, and a total of just over 300,000 Frontier Trouble Report records for the 2016-2019 Frontier ownership period.

4A: SERVICE QUALITY ANALYSIS UPDATE: AT&T CALIFORNIA

This chapter updates Chapter 4A in our Phase 1 Report to include AT&T California trouble report records for 2018-2019 that have been submitted by the company as required pursuant to GO 133-D. Our analysis shows that the company's performance with respect to nearly every one of the service quality metrics that we had examined in Phase 1 has deviated further from the Commission's GO 133-D service quality objectives and standards. AT&T California continued to account for a successively smaller portion of its parent company's operations, a fact that appears to be fully reflected in the low priority that AT&T California has been receiving both with respect to capital investment and senior management attention over the past several years.

AT&T's legacy circuit-switched POTS access line demand drop-off rate is similar to the industry-wide results for California. This downward trend persisted into 2018 and 2019. In the two years from December 2017 to December 2019, the company lost 565,537 POTS access lines, going from 2,245,171 in December 2017 to 1,679,638 in December 2019. For the entire 10-year period from January 2010 through December 2019, total AT&T California POTS access lines in service plummeted by 79.1%, dropping from 8,035,134 in January 2010 to 1,679,638 in December 2019. Every AT&T California wire center continued to experience further erosion in POTS demand, but the drop-off rate for individual wire centers was highly variable, the highest at 96.56% in the Paradise Main wire center (which had 12,039 lines in service as of January 2010 but only 414 by the end of 2019). The greatest demand drop-offs generally occurred in the largest wire centers.

Viewed at the individual wire center level, the ratio of out-of-service conditions to total POTS lines has varied both from month-to-month and as a long-term trend over time. For

out-of-service conditions not cleared within 24 hours, some wire centers have experienced significant increases in the incidence of this condition, while others have seen improvements.

AT&T Service Quality Performance

In our Phase 1 Report, we described a series of detailed analyses of AT&T service quality and performance in resolving out-of-service conditions both statewide and, more importantly, on a wire center-by-wire center basis. Each of these analyses are updated here to include results for 2018 and 2019. Because GO 133-C/D does not hold ILECs responsible for the entire outage duration if a Sunday or federal holiday intervenes, outage durations are thus adjusted *for GO 133-C/D compliance purposes* by subtracting Sunday or federal holiday hours that fall within an outage situation. Certain additional situations have also been treated as "excluded" even though, from the customer's perspective, the service is not functioning. ETI does not believe that it is appropriate to entirely exclude all instances where, upon encountering an out-of-service condition, the customer has requested an appointment date/time at the customer's convenience *because the requirement to accommodate the customer's personal needs in order to effect a restoration of service is a direct result of the service outage itself*. Instead, the delay in the ultimate restoration of service attributable to the additional time needed to satisfy the customer's request for an appointment should be adjusted out of the total out-of-service duration. ETI was advised that such an adjustment is already reflected in the "CPUC Duration" calculation provided on the individual Trouble Report data records.

Inclusion of the additional 2018-2019 trouble tickets has enabled us to develop service quality trends over a 10-year period (2010-2019); but we also wanted to examine each of the two datasets separately in order to evaluate whether conditions in these last two years had improved or deteriorated relative to the Phase 1 study period. Accordingly each of the service quality charts presented in this chapter (Figures 4A.2 through 4A.33) provides three separate trend lines – the full 10-year trend (the solid red line); the 8-year Phase 1 trend (the dashed green line, which is approximately the same as the 8-year trend line presented in our Phase 1 Report); and the 2-year Phase 2 trend line for 2018-2019 (the dashed purple line). This format provides a convenient visual comparison of the Phase 1 and Phase 2 results for each of the individual service quality metrics we examined.

Service quality metrics for 2018-2019

- *Number of out-of-service trouble reports per 100 access lines* – a slight upward trend over the 10-year study period. The rate of increase has accelerated slightly relative to where it had been for 2010-2017.

- *Duration of out-of-service conditions* –we observe a particularly sharp increase in 2018-2019. The 2010-2017 trend in average OOS duration increased by 31.0% from 2010 through 2017, but in just the last two years, that metric jumped by another

28.4% (Figure 4A.4). For outages that remained uncleared after 24 hours, their trend line average durations was lengthened by 47% over the 2010-2017 period, but for 2018 and 2019, average duration rose further, although the trend held steady over those last two years (Figure 4A.5). The results were somewhat better for all OOS when Sunday/holiday hours and "excluded" situations were eliminated, but the trend was still in the upward direction, and increased for 2018-2019 (Figures 4A.6 and 4A.7).

- *Out-of-service conditions cleared within 24 hours* – GO 133-C/D §3.4(c) establishes a "Minimum Standard Reporting Level" requiring that "90% of all out of service trouble reports [be cleared] within 24 hours [as] the set minimum standard." Only 50.4% of the roughly 5-million out-of-service conditions had been cleared within 24 hours (Figure 4A.9); even on an adjusted basis, where Sunday and federal holiday hours were subtracted out of the outage duration, only 63.3% of out-of-service conditions had been restored within 24 hours (Figure 4A.10). The shortfall relative to the GO 133-D 90% standard increased further in 2018-2019, where service had been restored to only 44.1% of the 573,581 out-of-service conditions (61.8% for "adjusted") within 24 hours.

- *Days required to clear 90%* – another approach to examining this "90% cleared within 24 hours" requirement is to look at the length of time it takes AT&T to reach the 90% cleared threshold. On an adjusted basis, the number of days required for 90% OOS cleared ranges from a low of 1.67 days in the first quarter of 2012 to a high of 11.15 days in the first quarter of 2011. For the most recent year (2019), the adjusted number of days to achieve 90% OOS cleared falls in the 3.8 to 5.2 range (Figure 4A.12).

Effects of geographic and other wire center attributes upon performance results

While examinations of individual wire centers is essential to isolating specific problem areas and sources of concern, it is also instructive to create groups of individual wire centers having similar geographic or other attributes (see Tables 4A.11, 4A.12). ETI constructed five "attribute dimensions" – (1) the presence of fiber upgrades; (2) wire center size (number of access lines); (3) the percentage decrease (loss) in the number of access lines in service to competing providers and/or to competing services over the study period; (4) the AT&T Field Operations (AFO) organization to which the wire center has been assigned; and (5) the population density of the area served by the wire center (households per square mile). For each of these five attribute dimensions, ETI defined a set of categories whose potential effect upon service quality was then individually examined.

These have now been updated to include data for 2018-2019. As in Phase 1, we determined that pPerformance across most service quality metrics was better in wire centers that had been upgraded with fiber optic distribution facilities, in wire centers serving relatively high-density urban and suburban communities, in larger wire centers, and in wire centers that have experienced the largest losses of customers to competitors. However, in almost every instance and category of wire center serving area, performance across most

service quality metrics has significantly deteriorated over the 2018-2019 period relative to where it had been during the Phase 1 2010-2017 time frame.

Summary

Overall, ETI's analysis of the 5.6-million AT&T out-of-service Trouble Report records and other pertinent AT&T service quality data over the full 10-year 2010-2019 period indicates that the company's service quality and its response to protracted out-of-service conditions has declined, in some cases significantly, over this time frame. Of particular concern, the degradation in AT&T service quality overall appears to have accelerated in 2018-2019. There were few exceptions within the overall AT&T California network.

Wire Centers that have received broadband upgrades – and hence benefitted from an infusion of new investment – have fared a lot better than those locations where little or no such upgrades had taken place. Service quality and responses to outages in the very largest wire centers – particularly those in the Los Angeles area (the Los Angeles and San Gabriel AFO Districts) actually showed some improvements, whereas other AFO Districts exhibited deteriorating service quality conditions. In terms of absolute numbers, AT&T out-of-service incidents declined, but the decline was less than in proportion to the large decrease in the number of POTS lines in service that AT&T has experienced over the 10-year study period. The various inter-category relationships were largely maintained in the last two years, but most metrics saw significant losses in all categories in 2018-2019.

4F: SERVICE QUALITY ANALYSIS UPDATE: FRONTIER CALIFORNIA

As of the end of December 2019, the company will have been under Frontier management for 45 months. During this period, Frontier has put its own stamp on the company's operations and, accordingly, there seems little point in retaining the Verizon ownership period in our analysis. More importantly, the company's parent has been in the throws of a massive financial crisis that began shortly after its April 2016 takeover of the three former Verizon ILECs – in California, Texas and Florida (the "CTF acquisition") – that ultimately Frontier to seek Chapter 11 bankruptcy protection in April 2020.

A NOTE ABOUT FRONTIER WIRE CENTER DATA

In total, Frontier California, and Verizon California before it, operate approximately 270 wire centers. Under Verizon ownership, the company had been reporting trouble ticket and out-of-service data separately for each of these 270 wire centers. However, for some unexplained reason, following its takeover, Frontier has administratively – *but not physically* – implemented a succession of consolidations of a number of these individual wire centers *for reporting purposes*, ultimately into approximately 198 combined "reporting units." ETI believes that Frontier's unexplained restructuring of its wire center data undermines the Commission's clear intent, in adopting the variouis GO 133 reporting requirements, to obtain *and track* service quality *at the individual wire center level*. By merging two or more separate wire centers into a single unit for reporting purposes, Frontier effectively conceals its service quality metrics for each of the individual wire centers within the consolidated group. As a consequence, the Commission can no longer track GO 133-C/D service quality performance at the wire center level for roughly half of all Frontier wire centers. Additionally, because some data continues to be reported at the individual wire center level and some wire center names and CLLI codes seem to have been changed or eliminated altogether, these consolidations have made it difficult to accurately integrate multiple datasets for analysis purposes. Henceforth in this Report, we shall refer to Frontier "reporting units" rather than as wire centers.

Frontier has been hemorrhaging customers almost from the date of the acquisition

Like ILECs nationwide, Verizon California had been losing customers for its legacy services long before it announced its deal in February 2015 to sell the three CTF companies to Frontier for $10.54-billion. On the date of that announcement, Verizon California was still serving approximately 1.45-million POTS access lines; by the time the deal closed on April 1, 2016, that number had dwindled by 16.6%, to 1,201,218. As of the end of the Phase 1 study period (December 31, 2017), Frontier California was serving only 879,489 POTS access lines, representing a drop of 26.8%, relative to the April 1, 2016 acquisition date, and as of the closing date of the Phase 2 study period (December 31, 2019), only 572,975 legacy service access lines remained on the Frontier California network, a decrease of 52.3% relative to the April 1, 2016 closing date of the CTF acquisition. Moreover, these losses were hardly confined to POTS-type services. As of February 2015 when the deal was announced, *FiOS* – Verizon's brand name for its Fiber-to-the-Premises ("FTTP") broadband service – was available to approximately 2.65-million homes within the Verizon California operating area. Indeed, the broad availability of *FiOS* across all three of the CTF companies was seen as a major justification for Frontier's acquisition. But by the closing date on April 1, 2016, only 388,881 Frontier California customers were still taking *FiOS* from the company, and as of the end of 2019, that number had dwindled to only 194,008.

Notably, the calculated long-term trend in total out-of-service incidents decreased from 17,824 in the second quarter of 2016 to 12,752 in the fourth quarter of 2019. Thus, while POTS lines in service saw a 52.3% decrease over the period, out-of-service incidents decreased by about 28.5%. Over the period of Frontier ownership, the relative drop-off in legacy POTS access lines greatly exceeded the relative decrease in total out-of-service

incidents. Out-of-service incidents per 100 access lines in service thus *increased* over the period under Frontier management. Moreover, a principal focus of the Commission's concerns regarding ILEC service quality – the number of out-of-service incidents extending for more than 24 hours per 100 access lines – which had been falling over the first seven quarters of Frontier ownership, has reversed course and is rising over the 2018-2019 Phase 2 period. Gains that had been achieved by Frontier in reducing the actual durations of reported OOS conditions occurring in the immediate post-acquisition period were thus reversed, with outages becoming progressively longer in overall duration after 2017.

As with AT&T, ETI's other approach to examining this "90% cleared within 24 hours" requirement is to calculate the average length of time it took for Frontier to reach the 90% cleared threshold. Following improvement over the April 2016 to December 2017 period, as with the other out-of-service metric we examined, these gains did not persist into 2018-2019.

FRONTIER CALIFORNIA

PERCENTAGES OF ACTUAL AND ADJUSTED ("CPUC") OUT-OF-SERVICE CONDITIONS CLEARED WITHIN 24 HOURS AND DAYS REQUIRED TO CLEAR 90%

	Actual		Adjusted	
	Percent Cleared within 24 hours	Days Required to Clear 90%	Percent Cleared within 24 hours	Days Required to Clear 90%
2Q2016	22.0%	5.70	28.0%	4.72
3Q2016	38.8%	3.95	44.5%	3.01
4Q2016	53.7%	3.75	60.6%	2.77
1Q2017	31.1%	6.23	36.8%	5.08
2Q2017	63.1%	3.04	70.0%	2.14
3Q2017	63.6%	3.06	72.2%	2.15
4Q2017	69.0%	2.69	78.6%	1.77
1Q2018	56.3%	3.27	66.3%	2.30
2Q2018	65.6%	2.85	79.3%	1.78
3Q2018	66.8%	2.80	79.3%	1.74
4Q2018	52.4%	3.44	75.1%	2.06
1Q2019	16.1%	10.70	48.6%	8.17
2Q2019	29.8%	7.65	59.3%	5.39
3Q2019	28.4%	6.07	61.5%	4.68
4Q2019	35.3%	4.99	63.3%	3.11

Effects of geographic and other wire center attributes upon performance results

As with our analysis of AT&T California service quality, ETI has constructed and applied the same five "attribute dimensions" to our analysis of Frontier – (1) the presence of *FiOS* broadband availability; (2) wire center size (number of access lines); (3) the percentage decrease (loss) in the number of access lines in service to competing providers and/or to competing services over the study period; (4) the population density of the area served by the wire center (households per square mile); and (5) the Frontier Operating Area to which the wire center has been assigned. For each of these five attribute dimensions, ETI defined a set of categories whose potential effect upon service quality was then individually examined.

These have now been updated to include data for 2018-2019. As in Phase 1, we determined that performance across most service quality metrics was better in wire centers that had been upgraded with fiber-to-the-premises (FTTP) *FiOS*-capable distribution facilities, in wire centers serving relatively high-density urban and suburban communities, in larger wire centers, and in wire centers that have experienced the largest losses of customers to competitors. However, in almost every instance and category of wire center serving area, performance across most service quality metrics has significantly deteriorated over the 2018-2019 period relative to where it had been in the 21 months following Frontier's acquisition of the company.

Summary

Overall, ETI's analysis of the 306,151 Frontier Trouble Report records and other pertinent Frontier service quality data indicates that the company's service quality and its response to protracted out-of-service conditions had improved following its April 1, 2016 takeover, but those gains were short-lived. Those Frontier wire centers that have received broadband upgrades in the form of *FiOS*-capable fiber-to-the-premises ("FTTP") distribution facilities – and hence have benefitted from an infusion of new investment – fared a lot better than those locations where little or no such upgrades had taken place. Service quality and responses to outages in the very largest wire centers – particularly those in the Los Angeles area (the "Beach Cities Operating Areas) actually showed improvements both with respect to the frequency of out-of-service incidents as well as the duration of those outages that did occur, but even here the gains were reversed after 2017.

7: AT&T CORPORATE AND CALIFORNIA FINANCIALS AND ILEC INVESTMENT POLICIES: PHASE 2 UPDATE

This chapter provides updated financial data both for Pacific Bell d/b/a AT&T California and for its corporate parent, AT&T Inc. In Chapter 7 of our Phase 1 Report, we offered the following assessment of AT&T California's financial condition and its investment policies:

- AT&T California's potential revenue from raising prices and curtailing investments in its legacy POTS services far exceed any financial penalties imposed for its failure to meet the GO 133-C/D service quality standards.

- To support its "harvesting" strategy and maintain revenues despite a massive drop-off in demand, AT&T California has raised its rates for legacy flat-rate residential service by 152.6% since the service was de-tariffed by the CPUC in 2009.

- AT&T Inc. senior management's interest in and attention to its legacy wireline ILEC operations has been largely supplanted by its wireless operations and the recent satellite TV and video content acquisitions.

- AT&T California financial statements show an incomplete assessment of the ILEC's financial condition due to the large volume of inter-affiliate transactions made at transfer prices that are not set on the basis of arm's length negotiations.

- Cumulatively, over the full 8-year Phase 1 study period, AT&T California had total net after-tax income of $3.4-billion, but paid out $7.6-billion to its parent company, AT&T Inc, thereby eroding the California company's capital base by roughly $4.2-billion and impairing its ability to maintain and upgrade its aging infrastructure. (See Phase I Report, p. 380, Table 7.5.)

- AT&T, Inc. has also been eroding its California ILEC's capital base by investing less in its infrastructure than its annual depreciation accruals and retirements.

- AT&T's "harvesting" philosophy explains why AT&T has failed to improve service quality for its POTS services at least to the point where the GO 133-C/D standards can be achieved, because the gains it can realize by raising prices and curtailing investment and maintenance far exceed any financial penalties it might suffer from persistently poor service quality.

Our examination of the two additional years of financial results indicates that, for the most part, the various conditions and practices that we had previously identified have persisted and, in some respects, have been further escalated.

The AT&T California component of parent AT&T Inc. revenues has been steadily diminishing, as has the share of the overall AT&T capital budget that is being allocated to the California ILEC. Over the 2010-2017 period, AT&T California's parent AT&T Inc. had experienced significant growth in its overall gross revenues, rising 29.2% from $124.3-billion in 2010 to $160.5-billion in 2017. By 2019, AT&T gross revenues had reached $181.2-billion. AT&T's market capitalization as of December 31, 2019 was approximately $283.5-billion, although as of December 15, 2020, it had declined to about $217.5-billion as a result of the broader COVID-19 economic impacts. The primary sources of AT&T's revenue growth have come from wireless services, where the number of AT&T Mobility

connections nationwide grew by 73.9%, from 95.4-million in 2010 to 165.9-million in 2019, and from several key acquisitions, including DirecTV and Time Warner.

AT&T California revenues, on the other hand, have been moving in the opposite direction. Its gross revenues in 2010 were $9.70-billion, dropping to $8.63-billion in 2017, and by another 23.15% as of the end of 2019, to $6.63-billion. AT&T California's share of total AT&T Inc. revenues has fallen by an even greater amount, from 7.80% in 2010 to 3.66% in in 2019. And in California, despite having experienced a cumulative loss of 76.4% in legacy switched access lines between 2010 and 2019, the company's gross revenues decreased by only 31.6% over the same period. Clearly, a significant portion of AT&T California operating revenues come from the ongoing succession of POTS rate increases and from services other than legacy POTS lines.

But AT&T California's response to the rapidly eroding demand for legacy POTS services has not been to cut prices to retard such "cord-cutting," but instead to implement large rate increases so as to "harvest" as much revenue from the remaining POTS customers as long as they continue to retain their service.

AT&T California has continued its practice of *disinvesting* in its California local network infrastructure.

Because AT&T California is a wholly-owned subsidiary of AT&T Inc., it is the parent AT&T Inc. that determines the amount of its ILECs' net income that will be paid over to the parent in the form of dividends and the amount of capital investment funds that will be made available for local infrastructure investment by its individual operating companies. Cumulatively, over the full 10-year period, AT&T California had total net after-tax income of $6.1-billion, but paid out $11.0-billion in dividends to its parent company, AT&T Inc, thereby eroding the California company's capital base by roughly $4.4-billion and impairing its ability to maintain and upgrade its aging infrastructure. Thus, rather than reinvesting a portion of its net income back into its network, AT&T California has been consistently *disinvesting* in its network. Gross Telecommunications Plant in Service ("TPIS") carried on AT&T California's USOA books decreased by roughly $3.9-billion from the beginning of 2016 through the end of 2019, but *net plant* – i.e., Gross TPIS less accumulated depreciation and amortization – over that same period appears to have *increased* by $5.5-billion, from $4.9-billion to $10.4-billion. AT&T has ascribed this anomaly to a change in accounting method that it suggests had been authorized by the FCC. And these adjusted USOA-type Net TPIS values for 2018 and 2019 likely overstate the amounts that would exist under strict USOA accounting. AT&T California did make Gross Plant Additions for 2018 and 2019 totaling some $2.13-billion net of adjustments, but only a small fraction of that spending appears to have been directed to legacy POTS services.

Inter-affiliate transactions at non-arm's length transfer prices also contribute to the parent company's pattern of disinvestment in AT&T California oerations.

But even AT&T California's nominally reported revenues, expenses and net income cannot by themselves provide a complete or accurate picture of the ILEC entity's financial performance. This is because of the extensive nature and amount of inter-affiliate transactions that involve both *purchases* made by the ILEC from other AT&T affiliates as well as *sales* made by the ILEC to other AT&T affiliates on an ongoing basis. In 2018 and 2019 alone, total AT&T California operating expenses (excluding depreciation and amortization) were $7.16-billion, 58% of which, some $4.15-billion, were spent on services purchased from other AT&T affiliates. In those same two years, AT&T California's total operating revenues were $12.43-billion, 16.17% of which, some $2.01-billion were realized from sales to various other AT&T affiliates.

With the exception of tariffed switched and special access services that are being purchased from AT&T California by various other AT&T affiliates, the specific *transfer prices* at which these transactions are recorded can hardly be viewed as being set on the basis of arm's length negotiations. Since both the seller and buyer in each instance are wholly-owned by the same parent company, the nominal transfer price has little or no effect upon the parent company's bottom line. However, if it is the parent company's goal to extract cash from the ILEC entity, setting an inflated transfer price for services the ILEC purchases from other AT&T affiliates, or heavily discounting the prices that the ILEC charges for whatever (non-tariffed) services it sells to other AT&T affiliates, can accomplish this as effectively as making a dividend payment to the parent, but with far less exposure as to the precise purpose of the policy.

GO 133-D §9.7 Alternative Investments

In August 2016, the Commission issued a revised GO 133-D that imposes financial penalties upon ILECs that persistently fail to meet minimal POTS service quality standards. GO-133-D §§9.3, 9.4 and 9.5 provide for escalating daily fines where a carrier's failure to meet the required service standards persists for an extended period of time. A total of $9.1-million in fines was assessed against AT&T California since this provision became effective. §9.7 allows offending carriers to submit an "Alternative Proposal for Mandatory Corrective Action" whereby carriers can avoid the fine by agreeing to invest an amount of at least double the fine if such an investment will be effective in remedying the service problem for which the fine had been imposed. AT&T California has sought approval of alternative proposals for mandatory corrective action under § 9.7 in lieu of paying the assessed fines in 2017, 2018 and 2019, and the Commission has approved all of these requests. CD has been tracking the effectiveness of such "alternative investments" in improving service quality, but most of these projects have been completed so recently (or are still ongoing) that no conclusion as to their effectiveness in improving service quality can be drawn at this time.

AT&T California's total Gross Plant Additions for 2018-19 amounted to approximately $2.3-billion. Over that same period, AT&T's expenditures on GO 133-D §9.7 "Alternative Investments" in lieu of fines projects amounted to roughly $2.7-*million*, representing a *de minimis* fraction – slightly over one-tenth of one percent – of the Company's total gross infrastructure investments. Of perhaps greater importance, the minuscule extent of such "alternative" investment outlays when compared with even the identified plant rehabilitation costs begs the question as to whether these expenditures would have been made anyway, irrespective of the GO 133-D §9.7 opportunity to make investments is legacy service infrastructure *that would ostensibly not have been made in the absence of the GO 133-D §9.7 offer*.

Summary and conclusions

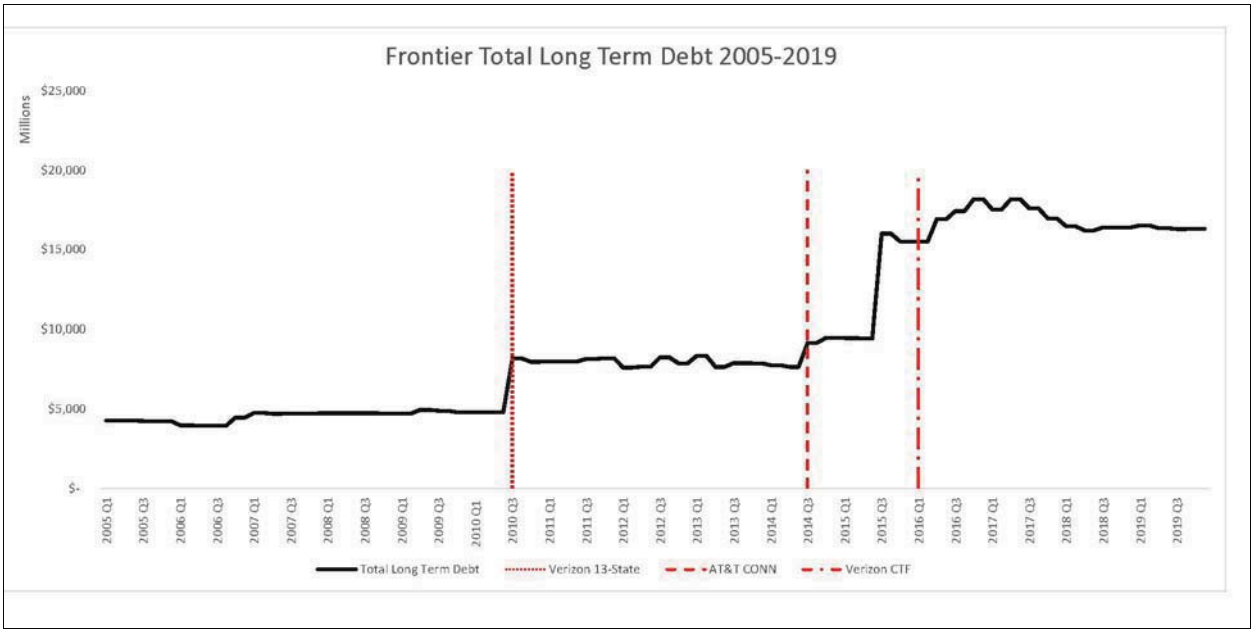
AT&T California has continued its policy of *disinvesting* in its California local network infrastructure, and where it is investing, a large portion of its Gross Plant Additions continue to be directed toward expanding its ability to offer services other than core legacy circuit-switched POTS services. Moreover, there appears to be wide variation across all of AT&T California's 615 wire centers as to the amount of new investment that has been directed at each of them, and ETI has not observed any specific pattern to explain this prioritization. There is no indication, for example, that investment dollars are being directed toward those wire centers that have been underperforming with respect to service quality or in their ability to meet the Commision's GO 133-C/D service quality standards.

8: FRONTIER CORPORATE AND CALIFORNIA FINANCIALS AND ILEC INVESTMENT POLICIES: PHASE 2 UPDATE

A lot has happened to Frontier since our Phase 1 Report

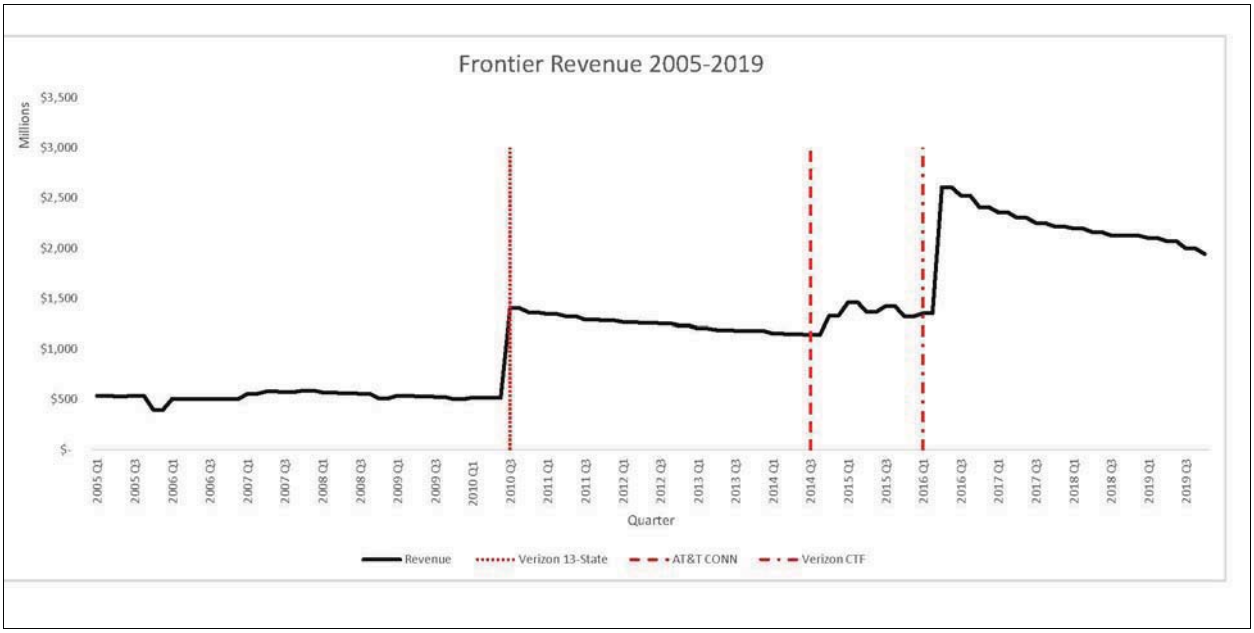
On April 1, 2016, Frontier Communications Corp. completed its acquisition of what is now Frontier California under a three-state ILEC purchase from Verizon that also included Verizon ILEC operations in Florida and Texas (the "CTF acquisition"). Frontier paid Verizon $10.54-billion in cash for the three ILECs, and financed the purchase primarily through the issuance of new debt. Even before Frontier took over control of these three Verizon ILECs, its stock had fallen by around 33% from the (equivalent of) $125.70, where it had been February 9, 2015, shortly after the deal with Verizon had been announced. On July 10, 2017, Frontier implemented a 1-for-15 share reverse split so as to avoid de-listing of its stock. On December 16, 2020. Frontier stock was trading at 10.8¢ per share, down 99.91% from its February 2015 high. In our April 2019 Report on Phase 1 of this Network Examination, we expressed serious concerns as to Frontier's near-term and ongoing ability to maintain and modernize its California wireline ILEC network so as to provide reliable service to California consumers. We noted that Frontier has been hemorrhaging customers in all major service categories across all of its 29-state footprint since the CTF acquisition.

Following the 2016 CTF purchases, Frontier became the nation's fourth largest ILEC with roughly 5.77-million residential and business customers (roughly corresponding to about 8.77-million switched access lines) across 28 states, but in making these various acquisitions, the company had assumed $11.9-billion in new debt, bringing its total debt as of the end of 2017 to around $17-billion. By the end of 2019, Frontier's ILEC access lines had eroded by 28.6% to approximately 6.33-million. Its total long-term debt was only slightly lower than in 2017, at $18.3-billion.



Frontier has financed its succession of ILEC acquisitions primarily through the issuance of debt. (Source: Frontier Communications Corp. Forms 10-K, 10-Q)

Frontier's growth strategy has, in each case, involved the absorption of large, multi-state operations, some of which had been larger in size than the pre-acquisition Frontier. However, each of these acquisitions produced a large, one-time revenue spike followed in each instance by revenue erosion from the new immediate post-acquisition level – producing a sort of "sawtooth" effect. In the first quarter of 2016 – the last 3-month period immediately preceding the Verizon acquisition – Frontier companywide revenue was running at an annual rate of roughly $5.4-billion. In the second quarter of 2016 – immediately following the Verizon acquisition – Frontier revenue had nearly doubled, jumping to an annual rate of around $10.4-billion. But by the final quarter of 2019, Frontier's total revenue was running at an annual rate of less than $7.8-billion – in less than four years, Frontier had given up more than half of the $5-billion revenue gain that had resulted from its 2016 CTF purchase. But the company had acquired that additional $5-billion in operating revenues by incurring more than $11-billion in new debt, and while its revenue gain had been cut in half, its total debt remained only slightly below its 2016 post-acquisition level.



Frontier Communications Corp. Revenues, 2005-2019.
(Source: Frontier Communications Corp. Forms 10-K, 10-Q).

Out of the $10.54-billion that Frontier paid Verizon when the deal closed in April 2016, it allocated some $2.5-billion to "Goodwill" and another $2.16-billion to "Other Intangibles," which it attributed primarily to the value of Verizon's 3-state "Customer Base" that was included in the acquisition. In the case of the Frontier California ILEC entity, Frontier recorded $517.1-million of Goodwill at the time of acquisition. In 2017, Frontier California Goodwill was increased by $93.97-million to $611.1-million. In 2019, the entire $611.1-million in Goodwill was written-off Frontier California's regulatory accounting books. Thus, only $6.24-billion out of the total CTF purchase price was associated with "Property, Plant and Equipment." At year-end 2016, some $12-34-billion out of Frontier Communications Corp.'s $29-billion of Total Assets was associated with Goodwill and Other Intangibles; at year-end 2019, all of Frontier's Goodwill had been written off, and its "Other Intangibles" had eroded to just over $1-billion.

These write-downs of intangibles resulted in a net 2019 Operating Loss of $4.87-billion. However, since the write-downs do not affect cash, when the write-downs are ignored, Frontier's 2019 Operating Income (before the intangible write-downs) was a *positive* $852-million. But total 2019 debt service payments (principal repayments plus interest) were $3.54-billion, well in excess of the company's cash income for that year. Frontier filed for Chapter 11 bankruptcy protection in April 2020.

Verizon California had been consistently disinvesting in its California local network infrastructure, and Frontier has been pursuing a similar strategy.

As we noted in our Phase 1 Report, Verizon California would typically pay dividends to its parent company that exceeded its net operating income. We view such practices as constituting *disinvestment*, in that by paying dividends in excess of earnings, the subsidiary (Verizon California) is effectively transferring a portion of its capital base to its parent. Since taking over the company in April 2016, Frontier California has issued no dividends to its parent, Frontier Communications Corporation. However, Frontier's total net income was actually a loss of $476-million. Frontier California did have positive net income in 2017, but paid no dividend to its parent.

Disinvestment also arises when retirements and depreciation accruals exceed the gross plant additions in any given year or cumulatively over time. This has the effect of reducing Net Plant in Service, a condition that has prevailed under Frontier ownership of the company. Since taking over the company, Frontier has invested $914.7-million (net of adjustments) in gross plant additions, but has recorded $188.3-million in retirements and has taken $1.74-billion in depreciation accruals – a net *disinvestment* of just over $1-billion. Since acquiring the California ILEC from Verizon in 2016, Frontier continued to invest less in Gross Plant Additions than it took in retirements and depreciation accruals, resulting in a net disinvestment of 469.5-million.

GO 133-D §9.7 Alternative Investments

As we discussed in our Phase 1 Report, in August 2016, the Commission issued a revised GO 133-D that imposes financial penalties upon ILECs that persistently fail to meet minimal POTS service quality standards. GO-133-D §§9.3, 9.4 and 9.5 provide for escalating daily fines where a carrier's failure to meet the required service standards persists for an extended period of time. A total of $3.35-million in fines was assessed or is currently pending against Frontier California since this provision became effective. §9.7 allows offending carriers the opportunity to submit an "Alternative Proposal for Mandatory Corrective Action" whereby carriers can avoid the fine by agreeing to invest an amount of at least double the fine if such an investment will be effective in remedying the service problem for which the fine had been imposed. Frontier California has sought approval of alternative proposals for mandatory corrective action under § 9.7 in lieu of paying the assessed fines in 2017, 2018 and 2019. The company's "alternative investment" proposals for 2017 and 2018 amounted to $4.14-million, in liew of paying $2.07-million in fines for the two years. The Commission approved these requests for 2017 and 2018. For 2019, Frontier has calculated its fine at $1.28-million and sought CPUC approval for its "alternative investment" proposal to invest $2.56-million in its network. CD staff recommend against acceptance of Frontier's "alternative investment" proposal, noting that Frontier's "past corrective action plans have thus far not resulted in sustained improvement in its service quality performance, as demonstrated by Frontier CA's need to file this advice letter, which is its third consecutive Section 9.7 corrective action plan. As a result, it is

unclear to Staff whether the project Frontier CA describes in its AL 12828 proposed corrective action plan would result in the necessary sustained performance results that are consistent with the Commission's long-term goals for service quality." On March 4, 2021, the Commission issued Resolution T-17731 accepting Staff's recommendation and denying Frontier's request.

In 2018-2019, Frontier California invested $562.8-million in Gross Plant Additions, primarily in central office equipment ($301.4-million) and outside plant ($261.4-million). Had it simply paid the fine, Frontier would have been out $2.07-million. That extra $2.07-million that Frontier had offered to invest (over and above the $2.07-million it would have paid anyway) amounts to less that 0.37% of Frontier's total 2018-2019 plant additions – a truly *de minimis* sum, little more than a rounding error. There is no indication that, absent its acceptance of the §9.7 Alternative Investments option, the same total amount would not have been invested anyway. In our Phase 1 Report, we had concluded that the GO 133-D fines were insufficient to offer a financial inducement for ILEC compliance with the Commission's service quality minimum performance standards because the cost of the fine represented a minuscule fraction of the cost that the ILEC would need to incur to improve its service quality. We reiterate that observation here, as well as our recommendation that the level of these fines be significantly increased. We certainly concur with the Staff's recommndation and the subsequent Commission decision that Frontier's alternative investments proposal for 2019 be denied.

Summary and conclusions

Frontier California represents a major component of its new parent, Frontier Communications Corp. But with the parent company's financial condition at a crisis stage, Frontier California's financial condition and investment policies will be dictated by conditions that are largely beyond the CPUC's control. The California ILEC entity has virtually no ability to raise equity or debt capital on its own. If the parent company successfully emerges from bankruptcy, its ability to raise capital may improve, and at this point that is speculative at best Frontier California has seen deterioration in almost all of the GO 133-D service quality metrics in most of the company's wire centers over the 2018-2019 period. With Frontier having invested nearly a billion dollars in California since acquiring the company, this is not the outcome that one would expect to see.

11: ILEC SERVICE QUALITY AND COMMUNITY DEMOGRAPHICS

There is considerable variation in service quality performance across each ILEC's wire centers. In our Phase 1 study, we undertook to preliminarily examine whether there was any observable relationship between a community's median household income and the treatment that its ILEC was providing customers with respect to service quality. That examination was limited to AT&T California wire centers, and its results were discussed in Chapter 11 of our Phase 1 report, at pp. 518-522. For Phase 2, we have been tasked with extending this

examination to include Frontier California as well as AT&T California, and also to examine whether there was any evidence of service quality differences in communities with varying racial characteristics.

We have determined that the incidence of service outages for both AT&T and Frontier appears to be somewhat lower in higher income areas, although the companies' responses to those service outages that do occur do not appears to have a similar relationship with median household income levels. For AT&T, there is some indication that communities with proportionately higher black and Hispanic populations do experience higher incidences of service outages, but this pattern does not seem to be present for Frontier (see Figures 11.17 through 11.40). For both ILECs, there is no discernable pattern that responses to those service outages that do occur is linked to racial demographics.

Median household income, ILEC investment, and service quality

We categorized AT&T and Frontier wire centers into income quintiles based upon population and household count data from the 2010 Decennial Census as well as Median Household Income ("MHI") data from the 2018 US Census Bureau *American Community Survey* ("ACS") database. The 2010 Census reports demographic data at the Census Block level (15-digit geographic identifier), the most granular geographic area available, while the ACS reports MHI at the Census Tract level (11-digit geographic identifier). To best approximate the average MHI of households located within each AT&T or Frontier wire center footprint, we weight 2018 Census Tract level MHI by 2010 Census Block level household counts. There are roughly 500,000 Census Blocks in AT&T California's operating areas. Since all of the service quality metrics were developed at the individual *wire center* level, we needed to associate each Census Block with its serving wire center. This was accomplished for AT&T California utilizing a mapping analysis that was prepared for us by the Communications Division's GIS staff. Frontier provided us with a similar mapping, except that this was done at a Census Tract level. Census Tracts are larger, and include many individual Census Blocks.

Investment

We calculated the weighted (by POTS access lines in service as of December 31, 2018, the midpoint of the Phase 2 study period) average Median Household Income of the areas served by these wire centers in each of the specified quintiles, together with the average Gross Plant Addition investment per access line, average monthly out-of-service incidents per 100 access lines, and the percentage of wire centers equipped for broadband services, as summarized in the following Tables for AT&T and Frontier, respectively. As the data indicate, although average gross plant additions per access line are similar in all five quintiles, wire centers serving higher income areas tend to have fewer out-of-service incidents and greater broadband availability than their counterparts in lower income communities.

AT&T CALIFORNIA
MEDIAN HOUSEHOLD INCOME AND 2018-19 GROSS PLANT ADDITIONS

Quintile	House-holds	Median Household Income	Access Lines Jan 2019	2018-2019 Gross Plant Additions per Access Line	Out-of-Service per 100 ALs per month	Pct Wire Centers with Broadband
0%-20%	1,142,727	$36,673	205,299	$1,099	2.29	83.6%
20%-40%	1,654,443	$48,591	305,857	$1,131	1.77	84.3%
40%-60%	2,611,078	$59,866	434,625	$1,018	1.59	95.0%
60%_80%	2,610,669	$75,927	485,362	$900	1.36	97.5%
80%-100%	2,565,025	$105,167	473,132	$1,268	0.96	98.3%
Total AT&T-CA	10,583,942	$70,540	1,904,275	$1,077	1.59	91.7%

NOTE: Individual Census Blocks may include parts of more than one wire center and more than one ILEC serving area. The total number of households passed by AT&T shown here may well exceed those actually present in AT&T California's service area. However, for our purposes, the relevant calculation is the Median Household Income, which would apply for the entire Census Block irrespective of which ILEC serves a particular household.

FRONTIER CALIFORNIA
MEDIAN HOUSEHOLD INCOME AND 2018-19 GROSS PLANT ADDITIONS

Quintile	House-holds	Median Household Income	Access Lines Jan 2019	2018-2019 Gross Plant Additions per Access Line	Out-of-Service per 100 ALs per month	Pct Wire Centers with Broadband
0%-20%	294,942	40,438	71,907	$ 1,249	1.85	51.2%
20%-40%	759,127	53,421	136,170	$ 2,261	1.21	84.1%
40%-60%	734,943	65,579	109,751	$ 694	1.24	88.1%
60%_80%	989,671	77,088	260,326	$ 599	0.93	95.1%
80%-100%	1,284,373	97,266	319,981	$ 1,170	0.61	100.0%
Total Frontier-CA	4,063,056	74,302	898,135	5,973	1.17	83.6%

NOTE: Individual Census Tracts may include parts of more than one wire center and more than one ILEC serving area. The total number of households passed by Frontier shown here may thus exceed those actually present in Frontier California's service area. However, for our purposes, the relevant calculation is the Median Household Income, which would apply for the entire Census Tract irrespective of which ILEC serves a particular household.

A substantial focus of AT&T and Frontier plant investment in recent years has been directed at upgrading its feeder and distribution outside plant to fiber optics aimed at upgrading the companies' ability to offer high-speed broadband Internet access and video services to customers. It appears that, to some extent, both companies have directed these upgrades toward higher income communities, as shown in Table 11.4.

AT&T CALIFORNIA AND FRONTIER CALIFORNIA
WEIGHTED AVERAGE MEDIAN HOUSEHOLD INCOME
IN WIRE CENTER SERVING AREAS
WITH AND WITHOUT BROADBAND SERVICE UPGRADES
BASED ON 2018 AMERICAN COMMUNITY SURVEY DATA

	AT&T California		Frontier California	
Category	Wtd Avg MHI	No. of Wire Centers	Wtd Avg MHI	No. of Wire Centers
No broadband	$ 50,322	50	51,385	35
FTTP / FiOS				66
Other broadband	$ 70,616	555	75,252	178

NOTE: AT&T California has deployed FTTP in certain areas, but we do not have the breakdown of such deployment at the individual wire center level. Hence, for AT&T, "Other broadband" should be interpreted as "All broadband," including both FTTN and FTTP locations.

Racial characteristics of the population being served and service quality

ETI was also tasked with examining whether there is any discernable pattern or relationship between ILEC service quality and the racial characteristics of individual ILEC service areas. To undertake this analysis, we utilized data from the US Census Bureau's 2010 *American Community Survey* ("ACS"), the most current source of this type of information. ACS compiles racial and nationality data at the individual Census Block level, which we aggregated to AT&T and Frontier wire center serving areas as described above. This was necessary because the most granular level of ILEC service quality data that is available is at the wire center level. While we have attempted to compile this information, we caution the Commission as to both its precision and usefulness. Individual wire centers typically serve populations ranging from a few thousand in rural areas to 100,000 or more in urban areas. These serving areas typically embrace a large variety of diverse populations, both residential and nonresidential. Our aggregations necessarily obscure the details of individual communities within a given wire center serving area. In addition, there is likely some correlation between racial and income attributes, which we have not expressly examined or controlled for. Thus, it is possible that the variation in service quality metrics that appear to be linked to race may well be attributable to income differentials.

For both ILECs, there is no indication that wire centers that serve relatively higher percentages of Black, Hispanic or Non-White populations exhibit more frequent incidents of service outages; moreover, as with our income analysis, there does not appear to be any observable pattern associated with any of the service restoration metrics for either company.

Conclusion

While there is some evidence that both AT&T California and Frontier California may be devoting more attention toward the condition of their central office and distribution plant in higher income and non-minority areas, there is no evidence of any inherent racial bias or redlining, nor is there any indication that higher income or non-minority communities are receiving more favorable treatment with respect to service restorations.

As we have noted, these results are at best an indication that more detailed examination of ILEC service quality performance below the individual wire center level may be warranted. A more granular analysis of this sort is well outside the scope of this Study. We do not consider the results presented here to be conclusive, but at best suggestive of a potential concern that could require more detailed investigation.

13: PHYSICAL AND ENVIRONMENTAL FACTORS AFFECTING ILEC SERVICE QUALITY

In Chapter 4, we observed that 16.8% of the roughly 5-million AT&T out-of-service conditions over the 2010-2017 Phase 1 study period had been attributed to "Heavy Rain," "Weather," "Moisture," or "Wet Plant." Over the Phase 2 2018-2019 period, that number almost doubled, to 29.6%. In our Phase 1 Report, we provided details of our preliminary examination of the potential interaction of adverse weather – principally precipitation – upon the incidence of Out of Service (OOS) Trouble Reports. That analysis was, however, limited, and covered only the greater Los Angeles area. We had observed a seemingly erratic pattern of out-of-service incidents that appeared to be highly variable from one period to the next. We hypothesized that one such exogenous source might well be weather or other environmental factors. To test this and focusing specifically on the greater Los Angeles area, ETI compared the incidence of out-of-service trouble reports with weather conditions extant at the time, specifically, with the amount of precipitation that occurred in the area being served by a given wire center. We identified a substantial correlation between precipitation and service outages.

For Phase 2, we have been asked to extend this analysis to cover the full 2010-2019 time frame, and to study a broader geographic area covering all of California. To accomplish this, we compiled precipitation statistics from the National Oceanic and Atmospheric Administration's ("NOAA") Global Summary of the Month ("GSOM") dataset for each of the ten "Census Regions" in the state. ETI identified NOAA weather station locations first by county, then aggregated these by averaging total monthly precipitation for all of the counties included within each of the ten Census regions. We then aggregated individual wire center Trouble Report statistics by county and then by Census Region. We calculated Coefficients of Determination (R^2) and *t*-statistics for each of the ten Census Regions and for each of AT&T California and Frontier California, respectively, as summarized on the following Tables for AT&T and Frontier, respectively:

AT&T CALIFORNIA
RELATIONSHIP BETWEEN PRECIPITATION
AND OUT-OF-SERVICE INCIDENTS
2010-2019

Census Region	No. of Wire Centers	Coefficient of Determination R^2	*t*-statistic
1 Superior California	107	.676	15.696
2 North Coast	58	.490	10.655
3 San Francisco Bay Area	99	.756	19.138
4 Northern San Joaquin Valley	53	.564	12.365
5 Central Coast	54	.592	13.077
6 Southern San Joaquin Valley	65	.403	8.922
7 Inland Empire	13	.378	8.477
8 Los Angeles County	69	.520	11.308
9 Orange County	32	.507	11.008
10 San Diego – Imperial	60	.466	10.154

Source: NOAA GSOM dataset; ETI analysis of AT&T California Out-of-Service incidents 2010-2019

TFRONTIER CALIFORNIA
RELATIONSHIP BETWEEN PRECIPITATION
AND OUT-OF-SERVICE INCIDENTS
2016-2019

Census Region	No. of Wire Centers	Coefficient of Determination R^2	*t*-statistic
1 Superior California	4	.471	3.187
2 North Coast	17	.500	6.553
3 San Francisco Bay Area	4	.652	8.969
4 Northern San Joaquin Valley	13	.206	3.343
5 Central Coast	20	.457	6.014
6 Southern San Joaquin Valley	38	.545	7.171
7 Inland Empire	53	.618	8.336
8 Los Angeles County	37	.746	11.238
9 Orange County	4	.587	7.812
10 San Diego – Imperial	2	.099	2.178

Source: NOAA GSOM dataset; ETI analysis of Frontier California Out-of-Service incidents 2016-2019

The results for both ILECs and across all ten Census Regions are both striking and consistent. For AT&T California, the Coefficients of Determination R^2 varied between a low of .378 for the Inland Empire Region to a high of .756 for the San Francisco Bay Area

Region. The high *t*-statistics for all ten Census Regions confirm that these correlations are statistically significant at the 99.9% confidence level. As noted, the Coefficient of Determination is interpreted as the percentage of variation in the Dependent Variable (OOS Incidents in this case) that is explained by variations in the Independent Variable (Inches of Precipitation). Thus, for the Bay Area, 75.6% of all AT&T California Out-of-Service incidents can be attributed to the effects of precipitation. Even in the largely desert Inland Empire Region, 37.8% of AT&T California OOS incidents are attributable to precipitation.

For Frontier California, the Coefficients of Determination R^2 varied between a low of .099 for the San Diego / Imperial Region to a high of .746 for the Los Angeles County Region. The high *t*-statistics for seven of the Census Regions are statistically significant at the 99.9% confidence level; two others are statistically significant at the 99% level, and one at the 97.5% level. Note, however, that four of the ten Frontier Census Regions each have 4 or fewer wire centers, thus reducing the statistical significant of the calculated results. The Region with the lowest R^2 – San Diego – has only two Frontier wire centers, such that no statistical significance can legitimately be ascribed to this result.

The strong relationship between rainfall and the rate of service outages provides compelling evidence that both ILECs' California distribution networks are not as robust as they need to be to account for local weather conditions over time. Weather or any other environmental factors that "caused" a particular out-of-service incident may (arguably) make that event "beyond management's *immediate* control," but the design and construction of the distribution network should certainly account for these types of weather conditions. And that is certainly well within the scope of "management's control" and responsibilities.

Effects of major wildfires on out-of-service incidents

The massive wildfires that have plagued California in recent years have prompted the Communications Division to include, within the scope of Phase 2 of the Network Examination, the following areas of additional inquiry:

(a) Was service quality worse overall in areas that are prone to wildfires and in areas that had major wildfires during the time period of 2010- 2019?

(b) Has service quality improved or deteriorated in areas that suffered severe wildfire damage?

(c) Analysis of Investment and infrastructure technology in high risk fire areas (both rebuild and existing).

We collected and analyzed wildfire statistics maintained by the California Department of Forestry and Fire Protection (CALFIRE). The CALFIRE data includes dates and locations of major wildfire incidents from 2013 to 2020, as well as the number of acres burned in each incident. Initially, we directed our examination to the same ten Census Regions that we had

utilized in examining the effects of precipitation on service outages. To calculate the monthly number of wildfire incidents by Census Region, we identified the county (or counties) in which each major fire occurred, then aggregated the number of incidents in each county within each of the ten California Census Regions. We performed a similar aggregation for the monthly number of acres burned for each Census Region. However, unlike the strong relationship identified in our precipitation analysis, the correlation between wildfire incidents or wildfire acres burned and OOS per 100 Access Lines proved to be extremely weak.

Wildfires occur mainly during hot summer and fall months when rainfall is minimal, whereas OOS incidents arise during the periods of heaviest precipitation, which occurs during late fall and winter months. On the possibility that the geographic extent of entire Census Regions might overshadow the more localized impact of individual wildfire incidents, we prepared a similar set of regression analyses at the individual county level. We did this for each of the 51 counties in which AT&T California provides service, and for each of the 26 counties where Frontier California operates. We surmised that, by studying the interactions between wildfires and service outages across smaller geographic units, it might be possible to identify correlations that would be masked at the full Census Region level. However, we did not observe any greater correlation at the individual county level than at the full Census Region level.

Investment and infrastructure in high risk fire areas

We examined relationships between total acres burned over the 2013-2020 period and infrastructure investments made by each of the two ILECs. By hypothesis, if ILECs were responding to areas of high wildfire risk with large scale infrastructure investment, we would expect to see some relationship between the extent of wildfire activity and the level of investment being made in a given area. Using county-level wildfire and Gross Plant Additions investment data, we compared Total Acres Burned with two ILEC investment indicia – Total Gross Plant additions and Gross Plant Additions per Access Line. Because infrastructure reliability and investment would be expected to lag behind the actual wildfire damage, we utilized 2018-2019 Gross Plant Additions data for this analysis.

Because we utilized county-level data for this analysis, we would not expect a perfect match between the wildfire and investment data for each ILEC because, with very few exceptions, wildfires do not affect an entire county and ILECs do not generally serve an entire county. Additionally, because California counties vary in population by a factor of around 1000-to-1 and population has, if anything, an inverse relationship with the total number of acres burned, we utilized two alternate indicia of investment activity:

- Total 2018-2019 Gross Plant Additions for each county
- County-level Gross Plant Additions per Switched Access Line (as of January 2019) for each county

All else equal, ILEC investment in any given area is driven largely by the number of customers in that area, so we would expect larger investments to be made in the more populous counties. To control for this, we also examined *unit gross plant investment* per access line in service, using the January 2019 midpoint of the 2018-2019 Phase 2 study period. We also calculated the percentage of total wildfire acres burned for each of the counties served by each ILEC, as well as the percentage of that ILEC's total Gross Plant Additions for each of the counties it serves. We observed very little correlation between Total Acres Burned and either Total Gross Plant Additions or Gross Plant Additions per Access Line.

In order to examine the extent of any such correlation quantitatively, we calculated a statistic known as the Spearman Rank Correlation both as between Total Acres Burned and Total Gross Plant Additions, as well as between Total Acres Burned and Gross Plant Additions per Access Line. Both Acres and Burned and Gross Plant Additions vary by orders-of-magnitude on a county-by county basis, diminishing the usefulness of traditional linear correlation analysis. Rank correlation avoids this problem. Out Rank Correlation calculations for each of the two ILECs are summarized here:

RANK CORRELATIONS BETWEEN TOTAL WILDFIRE ACRES BURNED (2013-2020) AND ILEC GROSS PLANT INVESTMENTS (2018-2019)

Rank Correlation between	AT&T California	Frontier California
Total Acres Burned and Gross Plant Additions	–0.113846154	0.551724138
Total Acres Burned and Gross Plant Additions per Access Line	0.045248869	0.241926656

Notably, the results of these calculations are decidedly different for AT&T and Frontier. In the case of AT&T, the Rank Correlation between Total Acres Burned and Total Gross Plant Additions is *negative* 0.1138, suggesting an inverse relationship between these two variables. When we look at investment on a per-access line basis, the correlation is slightly positive, but quite low at only 0.0452. The clear conclusion here is that, for AT&T, there is no obvious relationship between its investment priorities and areas of high fire risk.

For Frontier, the rank correlation between Total Acres Burned and Total Gross Plant Additions is a *positive* 0.5517, suggesting a relatively strong positive correlation. Even when viewed on a per access line basis, we still see a rank correlation of 0.2419. Of course, these calculations do not reveal any *causal* link between Frontier's investment activities and the incidence of wildfires, although the particularly high rank correlatiion between Acres Burned and Total Gross Plant Additons, which does *not* control for the volume of customers, could be interpreted as inferring at least some causal link in this case.

Conclusion

Our analysis of the effect of exogenous environmental conditions upon service quality of legacy circuit-switched telephone service has identified a strong correlation between precipitation and out-of-service incidents, but no discernable relationship between wildfires and service quality. The massive wildfires that have become all too common in California certainly destroy infrastructure as well as homes and other buildings on a grand scale, and undoubtedly have an impact upon the ability of the ILEC to furnish service in the affected area. However, if a home is destroyed along with the owner's telephone service, dealing with that type of service outage is likely a fairly low priority for the property owner, and as such does not result in a simply out-of-service trouble ticket on an individual customer basis. Frontier's plant investments, which in recent years have focused heavily upon outside plant, do appear to have some positive relationship with the extent of wildfires in a given county, but our analysis does not firmly establish a direct causal link between fires and investment overall.

14: ILEC RESPONSES TO SERVICE OUTAGES: VoIP SERVICES

For more than a decade, traditional circuit-switched voice telephone services have been in the process of being replaced by Voice over Internet Protocol ("VoIP") technology. VoIP requires the deployment of digital services to the customer's premises with sufficient bandwidth to accommodate both voice telephony as well as the various other digital (typically Internet-based) services that are used by the customer. Twisted-pair copper "loops" that have traditionally been provided to almost all residential premises and to most business locations can support digital end-to-end services, but generally cannot support the bandwidth requirements of typical residential and business customers for the full suite of voice and broadband Internet applications, particularly streaming video.

When an ILEC legacy circuit-switched POTS customer orders some form of broadband access from the ILEC, the carrier will generally migrate the customer's voice telephone service to a VoIP offering that is delivered, together with the customer's broadband Internet access, via the digital service. AT&T California *does not* offer VoIP services to customers who do not also take broadband Internet access and/or video from the ILEC; Frontier had a similar policy until July 2019, when it began offering VoIP service on a stand-alone basis.

Regulatory status of VoIP in California

In 2012, the California legislature adopted a new §710 of the California Public Utilities Code whose effect was to remove most aspects of any VoIP service from the CPUC's regulatory jurisdiction. §710 had included a "sunset" provision that became operative as of January 1, 2020; CD has advised us that §710 is no longer in effect and that the CPUC currently has resumed its jurisdiction over VoIP services. That notwithstanding, the ILECs continue to maintain that VoIP remains deregulated and that the Commission does not have

jurisdiction with respect to this service. Whether or not the sunset of §710 has the effect of reinstating the CPUC's ratemaking authority with respect to VoIP services, as a practical matter the Commission no longer regulates most basic service rates in any event.

VoIP service quality metrics: AT&T California

AT&T California began offering VoIP services in 2012. Demand for AT&T VoIP service peaked in 2015 and has been on the decline since then. AT&T has provided us with approximately 3.3-million VoIP-related Trouble Report records for the 2012-2019 period. The following table compares the total number of annual Trouble Reports with the "average" number of VoIP subscriptions during each year.

AT&T CALIFORNIA
VoIP SUBSCRIPTIONS AND TROUBLE REPORTS
2012-2019

Year	EOY Subs	Average Subs for Year	Total Trouble Reports	Monthly TRs as Pct of Subs	Out-of-Service Trouble Reports	Monthly OOS TRs as Pct of Subs	OOS TRs as Pct of all TRs
2011	[redacted]	[redacted]					
2012	[redacted]	[redacted]	170,387	5.58%	109,189	3.57%	64.08%
2013	[redacted]	[redacted]	423,661	5.85%	282,685	3.90%	66.72%
2014	[redacted]	[redacted]	561,227	5.58%	346,958	3.45%	61.82%
2015	[redacted]	[redacted]	586,742	4.68%	316,543	2.52%	53.95%
2016	[redacted]	[redacted]	516,908	3.88%	310,023	2.33%	59.98%
2017	[redacted]	[redacted]	451,563	3.40%	296,370	2.23%	65.63%
2018	[redacted]	[redacted]	323,580	2.57%	215,073	1.71%	66.47%
2019	[redacted]	[redacted]	270,798	2.45%	185,504	1.68%	65.80%

Source: AT&T FCC Form 477 filings, AT&T California Response to CD Data Request 11-A-01.

Expressed in relative terms, there appears to have been a steady improvement in the percentage of VoIP subscriptions that experience trouble conditions in any given month, both in total as well as in the incidence of out-of-service conditions. However, the relative incidence of out-of-service reports as a percentage of all trouble reports has remained within the same 50%-69% range over the full 8-year Phase 1 study period.

Unlike legacy POTS services where customer premises equipment ("CPE") consists mainly of technologically simple analog telephone handsets, VoIP services require, among other things, a local source of electrical power including some form of battery back-up, either a VoIP (digital) handset or an "analog telephone adapter" ("ATA") to enable conventional telephone handsets to be used with VoIP services. 58.4% of all VoIP trouble reports were associated with distribution plant issues. 22% of all VoIP trouble reports were

associated with some other network facility issue. Less than one percent were caused by weather, with another 2.5% the result of various environmental conditions, including fires, animals and floods.

The following table compares service outage rates for legacy circuit-switched and VoIP services, and provides several important findings. In the direct comparison of the 503 wire centers where both VoIP and POTS are offered and where trouble report data is available for both types of service (calculations (4) and (5) in the table), VoIP out-of-service Trouble Reports per Hundred access lines (TRPH) is actually 38.7% *greater* than for POTS. And when we compare calculations (2) and (3), we find that the incidence of POTS out-of-service conditions is 63.5% greater in the 76 wire centers where VoIP is *not* offered than in the 530 wire centers where it is. This result is, of course, consistent with our finding that most POTS service quality metrics are better in wire centers that have been equipped for broadband services than in those where no broadband upgrade investments have been made.

AT&T CALIFORNIA
COMPARISON OF AVERAGE MONTHLY OUT-OF-SERVICE TROUBLE REPORTS PER HUNDRED ACCESS LINES (TRPH)
LEGACY POTS vs. VoIP SERVICES
2018-2019

	Calculation method	Number of Wire Centers	Out-of-Service Reports per Hundred Access Lines
1	Legacy POTS access lines – all wire centers for which data is available	606	1.2366
2	Legacy POTS access lines – wire centers where VoIP is offered	530	1.2213
3	Legacy POTS access lines – wire centers where VoIP is NOT offered	76	1.9964
4	Legacy POTS access lines – wire centers where VoIP Trouble Report data is available	503	1.2138
5	VoIP access lines	503	1.6842

Individual wire center VoIP service quality performance

AT&T VoIP TRPH metrics appear to fall well short of the GO 133-C/D threshold. Certain wire centers appear to exhibit particularly high TRPH numbers, but these seem to be due primarily to the nature of the underlying data upon which this analysis was based rather than to systemic issues in those locations. That said, the spike in overall trouble reports and in service outages that appears to have occurred starting in 2017 does raise some concerns, and it may be worthwhile for the Commission to pursue this further as the importance of VoIP as the preferred method of providing basic service grows in future years.

VoIP service quality metrics: Frontier California

On the day it took over control of the California ILEC from Verizon, Frontier California had [redacted] VoIP lines in service. By the end of December 2019, that number had decreased to [redacted], a roughly 50% erosion in the number of VoIP subscribers between the April 1, 2016 acquisition date and December 31, 2019. Frontier has not provided a technology breakdown with respect to its VoIP services, but we know that not all of Frontier's VoIP customers were being served out of *FiOS*-equipped locations. Frontier's VoIP services were being targeted primarily at residential subscribers; as of the end of December 2019, only about [redacted] business customers were taking VoIP services from Frontier. Notably, Frontier experienced a far greater drop-off in legacy circuit-switched access lines over that same period. By the end of 2019, Frontier California's average monthly VoIP lines in service had decreased by 59.26%. Total trouble reports experienced a much greater decrease, to 40.69% of the August 2016 number, indicating improvement overall. However, as far as out-of-service trouble conditions, those actually *increased* by 54.79% despite a 41.74% *decrease* in the number of VoIP lines in service.

Conclusion

VoIP service is dependent upon locally-provided power, battery backup, and complex customer premises equipment that is not generally required for legacy circuit-switched services. The seemingly higher incidence of VoIP service outages *vis-à-vis* POTS could well be the result of customer premises conditions that are unique to VoIP. These conditions arise both for ILEC- and cable-provided VoIP services. Finally, the so-called "digital divide" – an issue whose importance has increased as a result of the COVID-19 crisis – raises the potential for the loss of high quality wireline voice services in rural and low-income populations. Although the Commission has created LifeLine programs that involve some (but not all) wireless providers, for wireline services the focus has traditionally been on ILEC circuit-switched offerings. As these services are phased out, new LifeLine initiatives that include all major VoIP providers (ILECs and cable MSOs) will need to be formulated. With the sunset of §710 that went into effect as of the beginning of 2020, a comprehensive regulatory approach that embraces all providers of VoIP type services should clearly be a top priority.

15: CPUC CONSUMER AFFAIRS BRANCH COMPLAINTS

The mission of the CPUC's Consumer Affairs Branch ("CAB") is to assist consumers of public utility services address problems that may arise from time to time in connection with their service, billing issues, and/or other relationships with the utility. The CAB describes its role as follows:

> The California Public Utilities Commission (CPUC) regulates privately owned California utilities that provide energy, water, and telecommunications services. If you have a question or complaint concerning one of these utility providers, help is available through the Consumer Affairs Branch (CAB).

> CAB's team of representatives is ready to assist consumers with billing and service matters with regulated utilities. Through dedicated specialists, CAB assists consumers in resolving application denials (appeals) for the California LifeLine program participation. ...

For Phase 2, ETI has been tasked with examining two issues related to the CAB's activities: (1) whether wire centers with a high number of consumer complaints have worse service quality metrics than the statewide average; and (2) the breakdown of complaints of VoIP versus traditional telephone service.

CAB handles both informal complaints as well as formal complaints that are ultimately adjudicated by the CPUC. Our examination was, however, limited to informal complaints. CAB collects geo-coded customer location information, but this is not consistent with the customer of record/account data that is contained in the ILECs' trouble report records, such as the customer's account or billing telephone number, serving wire center, or other location-specific information. Because CAB complaint records do not typically include the complainant's billing telephone number (BTN), it is usually not possible to link individual consumer complaints as submitted to CAB with Trouble Ticket records maintained by the carriers and furnished to us for purposes of this Study. As a result, we are able to address only limited aspects of issue (1). However, we have reviewed records of all complaints received by CAB pertaining to AT&T California (U-1001) and Frontier California (U-1002) over the 24 month period from January 2018 through December 2019, and are able to provide an overall assessment of the relationship between service outages as reported to the carriers vs. service-related complaints submitted to CAB.

Types and quantities of consumer complaints received by CAB

Over the Phase 2 2018-2019 study period, CAB received a total of 5,729 Complaints pertaining to AT&T California and 2,925 Complaints pertaining to Frontier California. In its complaint data records, CAB identifies approximately 75 principal types of complaints by their subject. To support our analysis, we have associated each of the CAB complaint types with one of six (6) principal complaint categories, as follows:

Service Quality issue
Billing / Commercial Dispute
Customer service issue
VoIP
    Service quality issues
    Other issues (e.g., billing, customer service)
Non-phone issue (Cable, Internet)
Unknown

The "Service Quality issue" category, which relates most directly with Trouble Reports submitted to the carriers for service outages and other service-related problems, represents less than a quarter of the total complaints received by CAB. For AT&T California, only 1,213, or 21.17%, of the 5,729 complaints received by CAB pertained to service outages and other telephone service related service quality issues. By comparison, over the 2018-2019 period, AT&T California customers reported some 573,585 service outages to the carrier. For Frontier California, only 718, or 24.55%, of the 2,925 complaints received by CAB during 2018-2019 pertained to telephone service related service quality issues, whereas Frontier California customers reported some 81,021 service outages to the carrier during 2018 and 2019.

CPUC CONSUMER AFFAIRS BRANCH
PRINCIPAL CATEGORIES OF CONSUMER COMPLAINTS
2018-2019

	CAB Complaint Counts			
Complaint category	**AT&T**	**Pct of Total**	**Frontier**	**Pct of Total**
Service Quality issue	1,213	21.17%	718	24.55%
Billing / Commercial Dispute	2,655	46.34%	1,266	43.28%
Customer service issue	755	13.18%	346	11.83%
VoIP Service issue	106	1.85%	245	8.38%
VoIP Billing issue	213	3.72%	37	1.26%
Non-phone issue (Cable, Internet)	755	13.18%	208	7.11%
Unknown	32	0.56%	20	0.68%
TOTALS	**5,729**	**100.00%**	**2,925**	**100.00%**

Nearly half of the complaints submitted to CAB were associated with billing or other commercial interactions between the customer and the carrier. Customer Service complaints represented 13.18% and 11.83% of all complaints received relating to AT&T California and Frontier California, respectively. Thus, more than half of all complaints received by CAB have no direct counterpart with respect to service outages or other trouble tickets as reported to the carriers. CAB also received many complaints that addressed services over which the CPUC has limited or no direct regulatory authority, such as cable TV, Internet access, and even inside wire issues.

VoIP Services

Also included in the CAB records were complaints dealing with VoIP services; however, the vast majority of these dealt with issues other than service-related problems, such as billing and related commercial matters, delayed service installations, and other customer service issues. Nevertheless, it may still be instructive to compare VoIP service quality-related complaints with those addressing service quality issues associated with legacy services, and to present these in the context of Trouble Reports both for VoIP and for legacy services as well as the number of lines in service for each of the two carriers. Table 15.4 below compares CAB VoIP Complaints, VoIP Trouble Tickets, and VoIP subscriptions for each of the two carriers over the Phase 2 2018-2019 study period, and provides similar data for legacy services as well. Subscription counts are averaged over the two years so as to correspond with the Complaint and Trouble Ticket totals over that same period.

VOiP AND LEGACY SERVICE COMPLAINTS, TROUBLE REPORTS AND SUBSCRIPTION COUNTS 2018-2018

	VoIP		Logacy telephone service	
Complaint category	AT&T	Frontier	AT&T	Frontier
Service-related Complaints received by CAB	106	37	1,213	718
Service outage Trouble Reports received by carriers	400,577	63,726	573,585	81,021
Average subscriber counts 2018-2019	[redacted]	[redacted]	[redacted]	[redacted]
Service-related CAB Complaints per 100 lines in service (2018-19 average)	0.0115	0.0165	0.0628	0.1054
Total Out-of-Service Reports per 100 VoIP lines in service, 2018-2019	43.53	28.45	29.68	11.89
Average Out-of-Service Reports per month, per100 lines in service	1.8138	1.1854	1.2367	0.4954

Both carriers appear to be experiencing higher rates of service-related trouble conditions (i.e., out-of-service reports per month per 100 lines in service) for VoIP services than for their legacy telephone services. Notably, the CAB service-related complaints per 100 lines in service are actually *lower* for VoIP services than for legacy services. However, these numbers are so small, and represent little more than a minuscule fraction of all trouble reports for both categories of service, that no meaningful conclusions as to the reasons for this seemingly inverse relationship are possible.

CAB complaints vs. carrier trouble reports for legacy services

In that regard, while the total quantity of service-related complaints submitted to CAB is an extremely small fraction of the total number of trouble reports received by both carriers, the relative number of CAB complaints has been consistently and significantly greater for Frontier California than for AT&T California. Over the 2018-2019 period, CAB received 1,213 service-related complaints from AT&T customers, representing 0.2115% of the 573,585 service outage trouble tickets processed by AT&T over that same period. For Frontier, CAB received 718 service-related complaints, representing 0.862% of the 81,021 service outage trouble tickets processed by Frontier. While the absolute number of complaints received by CAB are still extremely small relative to the number of service problems being reported directly to the carriers, the stark difference in the instance of such complaints as between customers of the two carriers is striking.

CAB complaint data would be enormously more useful, going forward, if customer-specific service details, such as serving wire center, service and billing telephone number(s), and street address could be routinely and consistently recorded along with the description of the problem being experienced by the customer. While these details may be of lesser importance for complaints that do not directly involve service outages and other service-related issues, at the very least this additional account-specific data should be collected where the complaint does involve service quality problems.

16: RELATIONSHIP OF CAF II FUNDING TO POTS SERVICE QUALITY

The Connect America Fund was created by the FCC "to be spent annually to make broadband-capable infrastructure available to as many unserved locations as possible within these areas served by price cap carriers, while sustaining voice and broadband-capable infrastructure in high-cost areas that would not be served absent support." As noted, the focus of the Connect America Fund was to assure increased availability of *broadband* services to otherwise unserved areas. However, the focus of this study has been and remains service quality of *legacy circuit-switched basic voice telephone service,* which we have been referring to as "Plain Old Telephone Service" ("POTS").

For Phase 2, we have been asked to examine whether it is possible to determine if areas that have been recipients of Connect America Fund II ("CAF II") funding exhibit identifiably better service quality for *legacy* circuit-switched basic voice telephone services than is evident for otherwise similar areas that have not benefitted from CAF II-funded broadband infrastructure upgrades. We have determined that the data that would be necessary to support such an analysis is not available and, as such, we are unable to offer an assessment as to whether areas receiving CAF II support exhibit improved POTS service quality.

Limitations of POTS service quality data

The trouble report and other service quality data that has been provided by the two ILECs pursuant to GO 133-C/D and made available to ETI in both Phases 1 and 2 of this study is in all instances organized *at the wire center level*; indeed, GO 133-C/D reporting requirements and service quality metrics are also stated at the individual wire center level. Eligibility for CAF II funding is based upon certain attributes that are determined at the individual *Census Block* level. As such, customer-specific location data sufficient to identify individual customers within a wire center serving area and, in particular, to identify those customers that are served by broadband infrastructure that has been constructed with CAF II funding, is not available.

There are 710,145 census blocks in California, 500,454 of which are in the areas served by AT&T California. Only 9,210 of these fall within the CAF II eligibility standards. And those 9,210 Census Blocks contain a total of 33,761 individual housing units, or 0.31% of the 11,018,714 total housing units within AT&T California operating areas (see Table 16.2). Frontier has provided data on its operating areas at the Census Tract level. Frontier provides service in 1,991 Census Tracts containing a total of 3,414,452 housing units. However, it is likely that some of these Census Tracts extend into areas not served by Frontier, so the total number of housing units where Frontier service is available is likely somewhat lower. There are 3,928 Census Blocks falling with Frontier operating areas containing a total of 12,812 housing units (see Table 16.3). And it is still not possible to associated any individual customer record with the corresponding Census Tract.

We have also been advised by Communications Division staff that, unlike Frontier California, which has used CAF II funding to support construction of *wireline* broadband infrastructure, AT&T California's approach to broadband deployment in CAF II-funded locations has been almost exclusively through the use of fixed wireless technology. Accordingly, since AT&T California has apparently not been using CAF II support for any *wireline* broadband upgrades, there is no *a priori* basis to expect any residual result of *wireless* upgrades to be an improvement in *wireline* service quality.

Conclusion

For the reasons discussed above, we are not able to provide an assessment as to the impact of CAF II funding for wireline or fixed wireless broadband deployment occurring in only a small portion of individual wire centers upon overall legacy circuit-switched voice telephone service quality as measured at the full wire center level.

Principal Phase 2 Observations and Takeaways

4: ILEC RESPONSES TO SERVICE OUTAGES: PHASE 2 UPDATE

- ETI's analysis of the condition of AT&T and Frontier's networks in California is, among other things, based upon the approximately 7.3-million Customer Trouble Report records submitted by the two companies over the 2010-2019 Study Period.

- Our Phase 2 analysis shows a fairly consistent and pervasive degradation in both companies' service quality performance across virtually every service quality metric that we have examined.

- 16.8% of the roughly 5-million AT&T out-of-service conditions over the Phase 1 study period had been attributed to "Heavy Rain," "Weather," "Moisture," or "Wet Plant." Over the Phase 2 2018-2019 period, that number almost doubled, to 29.6%.

- The source of most service outages continues to be largely confined to weather-driven and other failures in outside plant, rather than to the ILECs' aging central office switches or associated equipment.

- Substitution of wireless for wireline services continues. FCC data indicate that, for California, total wireline voice service access lines in service (ILEC and non-ILEC, circuit-switched and VoIP) decreased by 6.23-million, down 32.72%, from 19.65-million as of the beginning of 2010 to 13.42-million as of the end of 2018. During the same period, the number of wireless subscriptions in California increased by 10.4-million, from 32.94-million connections in 2010 to 43.34-million in 2018. Overall, there were 3.9 million more wireless connections than the total population in California, which was 39.4 million people at the end of 2018.

4A: SERVICE QUALITY ANALYSIS UPDATE: AT&T CALIFORNIA

- AT&T California's performance in 2018-2019 has deteriorated relative to where it had been in the 2010-2017 Phase 1 study period, and its performance with respect to nearly every one of the service quality metrics that we had examined in Phase 1 has deviated further from the Commission's GO 133-D service quality objectives and standards.

- The greatest demand drop-offs for legacy POTS services continues to be experienced in the largest wire centers.

- The trend in average duration of all out-of-service conditions over one hour had been steadily increasing over the Phase 1 study period, and spiked further in 2018-2019. By the end of 2019, it took AT&T 67% longer to restore service than it took in 2010.

- Over the 2010-2019 study period, AT&T's average duration for service outages exceeding 24 hours has increased by roughly 67%.

- During 2018-2019, 55.9% of the 573,591 out-of-service conditions (38.2% on an "adjusted" basis) remained uncleared after 24 hours, up from the corresponding 49.6% / 36.7% levels during the 2010-2017 period. To satisfy the GO 133-C/D §3.4(c) requirement, these percentages would need to drop to less than 10%.

- On an adjusted basis, the number of days required for AT&T to clear 90% of all out-of-service conditions was increasing at a faster rate over the 2018-2019 period than over the longer Phase 1 period. Over the eight years from 2010Q1 through 2017Q4, the number of days required for AT&T to clear 90% of service outages increased at an annual rate of 3.37%, from 4.10 days to 5.30 days. Over the next 24 months, from 2017Q4 to 2019Q4, the days to clear 90% jumped at an annual rate of 13.77%, from 5.30 to 6.86.

- There continues to be little effective competition for POTS services. If the market were sufficiently competitive, the greatest loss of demand would occur in wire centers exhibiting the poorest service quality. In fact, the greatest drop-off in demand has occurred in wire centers with the best service quality records.

- Performance across most service quality metrics is better in wire centers that have been upgraded with fiber optic distribution facilities, in those serving higher-density urban and suburban communities, in larger wire centers, and in those with the largest losses of customers to competitors. But in almost every category, performance has significantly deteriorated over the 2018-2019 period.

- Wire centers upgraded with fiber to support broadband services achieve better service quality performance scores in every category – but in 2018-2019, service quality in both types of wire centers was decidedly inferior to what had been achieved during the Phase 1 2010-2017 period. Based upon Phase 2 trend lines, AT&T needed only 1.15 days to clear 90% of service outages in wire centers with fiber optic facilities as of the end of 2019; for non-upgraded wire centers, it took 2.43 days to clear 90%. The corresponding figures as of the end of Phase 1 (4Q2017) were 1.10 and 1.86.

- The strong relationship between the number of POTS lines in a wire center and the quality of service provided has persisted into the 2018-2019 period, with the number and the rate of increase in OOS per 100 POTS lines continuing to be lowest in the very largest (over 20,000 lines) wire centers. However, service quality has deteriorated in all line-size categories since 2017.

- Wire centers that had experienced the lowest rate of POTS line losses – less than 50% over the study period – saw the largest increase in service outages; for those with successively larger line loss percentages, the incidence of service outages increased more slowly or remained almost constant over the study period. But performance in nearly all of the service quality metrics we studied deteriorated after 2017.

- Except in areas with the highest population density, AT&T's response to out-of-service conditions has generally deteriorated over the study period. That deterioration appears to have accelerated for all population density categories in the 2018-2019 period.

- Of the five AT&T maintenance (AFO) districts, LA/Bakersfield and San Gabriel had shown significant improvements in most OOS metrics during the Phase 1 study period. However, even those improvements appear to have largely reversed in 2018-2019.

- Since the bulk of AT&T's investments in its ILEC network have been aimed at upgrades that support broadband services, the AFO Districts with the smallest percentage of such upgrades have continued to experience substantial degradations in service quality into the 2018-2019 period. This result further underscores the pressing need for infrastructure investment irrespective of AT&T's pursuit of the broadband market.

4F: SERVICE QUALITY ANALYSIS UPDATE: FRONTIER CALIFORNIA

- The greatest demand drop-offs for legacy POTS services generally occurred in the largest of Frontier's reporting units.

- Over the 2016-2019 Frontier ownership period, POTS access lines in service experienced a 52.3% decrease, dropping from 1,201,218 to 572,975. Thus, in less than four years after taking over the ILEC, more than half of Frontier California's POTS customers had discontinued their service.

- Over the period of Frontier ownership, the relative drop-off in legacy POTS access lines greatly exceeded the relative decrease in total out-of-service incidents; thus, under Frontier ownership, out-of-service incidents per 100 access lines in service increased.

- Improvements in service quality that were accomplished during the first seven quarters following Frontier's takeover were reversed in 2018-2019, which saw increases in the numbers of service outages lasting more than 24 hours and in the average duration of all service outages.

- 57.85% of the roughly 112,022 out-of-service conditions (34.84% on an "adjusted" basis) remained uncleared after 24 hours by Frontier during the 2018-2019 Phase 2 period. For the 118,402 out-of-service conditions during the 4/2016-12/2017 Phase 1 period, 53.83% (47.01% on an adjusted basis) remained uncleared after 24 hours. To satisfy the GO 133-C/D §3.4(c) requirement, these percentages would need to drop to less than 10%.

- Wire centers upgraded with Fiber-to-the-Premises ("FTTP") capable of providing FiOS broadband services achieve better service quality performance scores in virtually every category than those without such upgrades. But Frontier lost ground in all of these metrics both in upgraded and non-upgraded wire centers over the 2018-2019 period.

- The strong relationship between the number of POTS lines in a wire center and the quality of service provided that we had identified in Phase 1 has generally persisted into Phase 2.

- The largest increases in service outages occurred in wire centers with the lowest POTS drop-off rates; the incidence of service outages increased more slowly or remained almost constant in wire centers with successively larger drop-off rates.

- Frontier service quality metrics continue to show the best results in higher-density serving areas.

- Except in those areas with the lowest population density, Frontier's response to out-of-service conditions had generally improved over the period immediately following its takeover. However, by 2018, these gains had started to reverse.

- Service quality metrics in all six Frontier Operating Areas generally improved from the April 2016 acquisition date through the end of 2017, but this pattern reversed course starting in 2018.

- The Operating Areas with the largest presence of fiber upgrades continue to exhibit the lowest number of OOS incidents and the shortest outage durations for those that do occur over the full 2016-2019 period.

- The trend in average duration of all out-of-service conditions, excluding those cleared within one hour, has been steadily increasing over the 2016-2019 Frontier ownership period.

- The largest increases in service outages continued to occur in wire centers with the lowest POTS drop-off rates.

- The Operating Areas within which most of the Verizon and Frontier FTTP upgrades have occurred have experienced the lowest number of OOS incidents and the shortest outage durations for those that do occur.

7: AT&T CORPORATE AND CALIFORNIA FINANCIALS AND ILEC INVESTMENT POLICIES: PHASE 2 UPDATE

- AT&T senior management's interest in and attention to its legacy wireline ILEC operations continues to be subordinated to its wireless operations and the more recent satellite TV and video content acquisitions.

- Despite experiencing a 76.4% drop in legacy switched access lines from 2010 through 2019, AT&T California's gross revenues decreased by only 31.64% over the same period.

- Even when confined to only those revenue sources directly attributable to legacy switched access line services, AT&T California legacy access line-related revenues decreased by only about 53.4%, significantly below the 76.4% drop in switched access line demand, because AT&T California has raised its rates for legacy flat-rate residential service by 152.6% since the service was de-tariffed by the CPUC in 2009..

- This succession of rate increases is consistent with and in support of a "harvesting" strategy aimed at maximizing revenues from existing customers until they ultimately discontinue their service, thus allowing A&T to maintain revenues despite a massive drop-off in demand.

- AT&T California's response to the erosion of the market for legacy POTS services has been to raise prices, cut back on investment and maintenance, and instead "harvest" those customers that remain on its network for as long as they continue to take their service.

- The fact that AT&T has been able to profitably implement a succession of large annual legacy services rate increases for more than a decade since the implementation of URF raises serious questions as to the Commission's conclusion in URF that competition had developed to a point where continued regulatory protection of basic residential telephone service prices is no longer required or appropriate.

- Over the past two years (2018-19), AT&T California continued to disinvest from its network. The Company had total net after-tax income of $3.21-billion, but paid out $3.42-million in dividends to its parent company, AT&T Inc -- i.e. it paid AT&T dividends that were some $219.5-million more than the California company had earned from its ongoing operations.

- Between 2010 and 2019, AT&T California paid dividends to AT&T Inc. that exceeded its total net income over the period by roughly $4.43-billion.

- A change in the accounting procedures that AT&T California has utilized for its ARMIS-type reports after 2017 has resulted in a roughly $5-billion overstatement of its net Telecommunications Plant in Service for 2018 and 2019.

- Those capital investments that AT&T has been making in its California ILEC have, for the most part, not been directed at legacy basic voice services.

- AT&T's "harvesting" philosophy explains why AT&T has failed to improve service quality for its POTS services at least to the point where the GO 133-C/D standards can be achieved, because the gains it can realize by raising prices and curtailing investment and maintenance far exceed any financial penalties it might suffer from persistently poor service quality.

8: FRONTIER CORPORATE AND CALIFORNIA FINANCIALS AND ILEC INVESTMENT POLICIES: PHASE 2 UPDATE

- Having grossly overpaid Verizon for the 2016 California-Texas-Florida (“CTF”) acquisition, Frontier assumed a massive debt burden that cannot be sustained.

- Most of that overpayment had been carried as “Goodwill” or “Other Intangibles” on Frontier’s corporate balance sheet; by the end of 2019, all of that Goodwill and most of the Other Intangibles have been written off.

- By the end of 2019, Frontier’s total debt was more than $18.3-billion, and the Company’s total debt service (interest and amortization) payments in 2019 were more than $3.5-billion.

- Frontier's California customer base continued to dwindle, to the point where it has lost foughly 50% of the POTS access line customers it had acquired in the 2016 purchase.

- Frontier's net income declined following each successive acquisition, to the point where it has now been negative for seven consecutive quarters.

- Frontier's melt-down and ultimate Chapter 11 bankruptcy filing confirms the inescapable fact that Frontier had grossly overpaid Verizon for the CTF assets.

- Unlike AT&T, which had raised its legacy flat-rate residential POTS rates by 152% since the onset of URF, Verizon's rates for this service had risen by only 31% as of the date of the sale to Frontier, and Frontier had not effected any rate increase since the acquisition throgh the end of 2019.

- Since acquiring the California ILEC from Verizon in 2016, Frontier continued to invest less in Gross Plant Additions than it took in retirements and depreciation accruals, resulting in a net disinvestment of $469.5-million.

11: ILEC SERVICE QUALITY AND COMMUNITY DEMOGRAPHICS

- While we have attempted to compile the requested data on the relationships between ILEC service quality and communities' income level and racial makeup, we caution the Commission as to both the precision and usefulness of these results, and recommend that their use at this time be limited solely to considering the need for a more detailed and more granular investigation.

- The incidence of service outages for both AT&T and Frontier appears to be somewhat lower in higher income areas, although the companies' responses to those service outages that do occur exhibit no similar income-related pattern.

- Average gross plant additions investment per access line are similar in all five quintiles for both AT&T and Frontier, but wire centers serving higher income areas tend to have a lower rate of out-of-service incidents and greater broadband availability than their counterparts in lower income communities.

- For both AT&T and Frontier, there is no indication that wire centers that serve relatively higher percentages of Black, Hispanic or Non-White populations exhibit more frequent incidents of service outages; moreover, as with our income analysis, there does not appear to be any observable pattern for either company associated with any of the service restoration metrics.

13: PHYSICAL AND ENVIRONMENTAL FACTORS AFFECTING ILEC SERVICE QUALITY

- Telephone service outages appear to be highly dependent upon weather conditions, specifically, the amount of precipitation in the area served.

- The strong relationship between rainfall and the rate of service outages provides a strong indication that the ILEC distribution networks are not as robust as they need to be, and clearly lack the resiliency to withstand significant weather events.

- Overall, we observed little correlation between the incidence of major wild fires and ILEC service quality. Wildfires occur mainly during hot summer and fall months when rainfall is minimal, whereas OOS incidents arise during the periods of heaviest precipitation, which occurs during late fall and winter months.

14: ILEC RESPONSES TO SERVICE OUTAGES: VoIP SERVICES

- When an ILEC legacy circuit-switched POTS customer orders some form of broadband access from the ILEC, the carrier will generally migrate the customer's voice telephone service to a VoIP offering that is delivered, together with the customer's broadband Internet access, via the digital service.

- ILEC VoIP services are provided out of the same serving wire center that had been used for legacy circuit-switched services, but the VoIP switch itself can be located anywhere on the Internet. A service interruption or outage can arise in the local distribution infrastructure or anywhere beyond that point on the ILEC's IP network.

- Most AT&T California VoIP services are provided using DSL technology over a hybrid Fiber-to-the-Node ("FTTN") / copper distribution architecture. However, AT&T's deployment of Fiber-to-the-Premises ("FTTP") has been increasing; by the end of 2019, some 20.7% of all AT&T California VoIP customers were being served via FTTP.

- From 2012 through 2016, the percentage of AT&T California VoIP access lines that had experienced out-of-service conditions in any given month was decreasing steadily, but those gains were reversed after 2016.

- The average duration of all trouble and out-of-service conditions was also shrinking up until 2016, but both metrics saw large upward spikes, with outage durations increase from less than 30 hours prior to 2017 to around 50 hours from 2017 onward.

- Some 58.4% of the 3.3-million AT&T California VoIP trouble reports created during the 2012-2019 period involved distribution plant issues.

- In wire centers where both VoIP and POTS are offered and where trouble report data is available for both services, the relative incidence of VoIP service outages was 38.7% greater than it was for POTS over the full Phase 1/2 study periods.

- Frontier suffered large losses both of POTS and VoIP access lines since assuming control of the company on April 1, 2016 with POTS losses slightly higher, suggesting that the availability of FTTP-based FiOS has done little to help Frontier maintain its customer base overall.

- As of the end of December 2019, Frontier was serving only [redacted] residential VoIP subscribers, just under 50% of the VoIP lines in service as of the takeover date. In comparison, Frontier had experienced a far greater drop-off in legacy circuit-switched access lines over that same period.

- Out of the 44,095 out-of-service reports provided for the period from April 2016 through December 2019, only 25,089, or about 56.9%, appear to be the result of Frontier plant or equipment issues or employee actions.

15: CPUC CONSUMER AFFAIRS BRANCH COMPLAINTS

- CAB collects geo-coded customer location information, but this is not consistent with the customer of record/account data that is contained in the ILECs' trouble report records, such as the customer's account or billing telephone number, serving wire center, or other location-specific information. Consequently, CAB complaint records cannot be directly linked to or correlated with carrier trouble tickets because CAB does not collect detailed customer account or location data.

- Less than a quarter of the total complaints received by CAB involved service outages and other service-related problems.

- The vast majority VoIP-related complaints received by CAB address issues other than VoIP service quality, such as billing disputes and other customer service issues.

- Although the absolute number of service-related complaints received by CAB is extremely small when compared with the number of complaints made directly with carriers, on a relative scale more than four times as many complaints involve legacy services provided by Frontier than those furnished by AT&T.

- CAB should undertake to collect customer account and location data as part of all service-related complaints.

16: RELATIONSHIP OF CAF II FUNDING TO POTS SERVICE QUALITY

- The data that would be necessary to support an analysis of the effects of CAF II funding on legacy circuit-switched voice telephone service is not available and, as such, we are unable to offer an assessment as to whether areas receiving CAF II support exhibit improved POTS service quality.

- Housing Units passed by the two ILECs in areas eligible for CAF II support represent a minuscule fraction of all Housing Units within each company's California operating territories.

- GO 133-C/D service quality standards and metrics are compiled at the individual wire center level, whereas eligibility for CAF II funding is determined at the individual Census Block level. Since only a small fraction of all customers served by any given wire center are located in areas receiving CAF II funding support, there is no practical means for associating CAF II support (which is focused on broadband infrastructure) and service quality for legacy circuit-switched voice services.