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December 21, 2017

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: National Exchange Carrier Association, Inc.
2018 Modification of Average Schedules, WC Docket No. 17-346

Dear Ms. Dortch:

Attached is NECA's *2018 Modification of Average Schedules*. This filing is made in compliance with section 69.606 of the Commission's rules, 47 C.F.R. § 69.606, and contains proposed revisions to formulas used for average schedule interstate settlement disbursements. These average schedule formula revisions are proposed to become effective for a one-year period beginning on July 1, 2018.

In accordance with the Commission's rules, this *2018 Modification of Average Schedules* has been filed electronically in the above-referenced docket.

NECA has also filed electronically in the same docket the appendices to the *2018 Modification of Average Schedules* in Microsoft-Excel format. These files provide all of the data used by NECA to compute the proposed formulas.

If you have questions regarding the content of these files, please contact Tatjana Curovic, Sr. Director, Average Schedules, at 973-884-8483.

Sincerely,

A handwritten signature in black ink, appearing to read "Douglas Slotten", is written over a horizontal line.

Attachment:

2018 Modification of Average Schedules

Cc: Douglas Slotten, WCB
Pamela Arluk, WCB (w/o enclosure)
Best Copy

2018 MODIFICATION OF AVERAGE SCHEDULES

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

In the Matter of)	
)	
)	
National Exchange Carrier Association, Inc.)	WC Docket No. 17-346
)	
2017 Modification of Average Schedules)	

I. INTRODUCTION

The National Exchange Carrier Association, Inc. (NECA) herein proposes modifications to current interstate average schedule formulas, for Federal Communications Commission (FCC or Commission) approval. As required, these formulas are developed in accordance with Commission rules, and are designed to "simulate the disbursements that would be received . . . by a [cost study] company that is representative of average schedule companies."¹ These modifications are scheduled to be effective from July 1, 2018 to June 30, 2019.²

The methods described in this filing represent the same methods employed in prior year's filing. NECA proposes formula changes that would result in a 5.6% overall increase of settlement at constant demand. Actual settlements are expected to be lower due to projected losses of access lines and Non-DSL demand. Impacts of the proposed formula changes on individual average schedule companies will vary, depending on each company's size and demand trends and characteristics.

A. Background

Exchange Carriers (ECs) that participate in NECA's access charge pools receive compensation for providing interstate access services either on the basis of their actual costs or a set of interstate average schedule formulas. Cost separation studies, performed in accordance with Parts 32, 36, 64, 65 and 69 of

¹ See 47 C.F.R. s 69.606(a).

² This *2018 Modification of Average Schedules* may be referred to herein as the "2017 Filing" and the data collection and analyses upon which this filing is based are referred to as the "2017 Study." The settlement formulas proposed herein are referred to as the "2018 Schedules." References made herein with respect to previous years' filings, studies and settlement formulas use similar nomenclature.

the Commission's rules, involve extensive data collection, analysis and reporting. The Commission has recognized that it is inefficient to require cost separation studies for all companies as not all ECs have the resources available to perform these studies. Commission rules accordingly permit certain ECs to receive interstate access compensation (or "settlements") based upon a set of "average schedule" formulas developed by NECA.

Settlements made on the basis of average schedule formulas benefit both ECs and interstate ratepayers. The average schedule settlement method substantially reduces administrative costs for these smaller ECs by eliminating the need to conduct detailed accounting and engineering cost studies required of cost companies. This cost benefit, in turn, benefits ratepayers.

Section 69.606 (b) of the Commission's rules requires NECA either to file revised formulas on or before December 31st of each year, or to certify that no such revisions are necessary.³ Accordingly, each year, NECA conducts a detailed study of cost and demand data to determine if revisions to the average schedule formulas are warranted. NECA's annual study involves selecting a statistical sample of both cost and average schedule companies and collecting accounting and demand data from the selected companies. NECA then develops statistical models ("allocation factor models") that describe how representative cost companies allocate their total costs to the interstate jurisdiction and to individual access charge categories.

The study also projects cost and demand data obtained from sample average schedule companies, to account for growth. NECA then applies the allocation factor models derived from representative cost companies to sample average schedule company projected total company account data. This process enables NECA to determine the interstate access portion of average schedule company total costs following methods prescribed by the Commission for cost companies, thereby simulating the effects of performing interstate cost studies for these companies. Finally, NECA develops formulas that relate sample average schedule company interstate access costs to various commonly-used demand units (such as access lines, DSL lines or special access non-DSL revenues) or combinations of demand units and other factors (such as lines per exchange). In developing these average schedule formulas, NECA carefully

³ 47 C.F.R. § 69.606(b). The current formulas have been in effect since July 1, 2017

analyzes different statistical models and selects the model that has the best fit to actual data. Upon Commission approval, these formulas are used by NECA to compute interstate settlements for average schedule companies that simulate cost study results.

In preparing proposed formula revisions, NECA receives valuable assistance from its Average Schedule Task Group. The Task Group meets periodically throughout the year, reviews the steps taken in developing the proposed formulas, advises NECA regarding the development of procedures for administration of the formulas, and assists the NECA Board of Directors in evaluating final proposed formulas. Task Group participation assures that average schedule companies are able to participate fully in the development of the average schedules, and have an opportunity to provide input to NECA regarding the manner in which changes to their networks can be reflected in the settlement formulas.

B. Overview of This Filing

Each of the steps followed in NECA's study is explained in detail or referenced in this Filing. Section II references the statistical sampling methods that NECA used in its data collection for settlement formula development. Section III describes the sources and types of data NECA collected from cost and average schedule companies. Section IV explains the methods NECA used to develop cost allocation factor models from sample cost company data. Section V describes how NECA projected growth from historical cost and demand data to develop cost and demand data applicable to the period the proposed formulas will be in effect. Section VI explains how NECA calculated Interstate and Access Category costs by account and the derivation of access category revenue requirements for each sample average schedule study area. Section VII explains how NECA developed the "best fitting" statistical formulas for use in determining settlements, and explains how the proposed formulas will affect average schedule companies. Section VIII lists the current and proposed average schedule formulas. Finally, the appendices with all the data used in NECA's study are listed on Page iv and are provided in Microsoft-Excel format.

C. Effects of Proposed Modifications on Average Schedule Companies

In this filing, NECA proposes formula changes that would result in a 5.6% overall increase of settlement at constant demand. Actual settlements, taking into account projected losses of access lines and Non-DSL demand, are expected to be lower. Effects of these formula changes on individual average schedule companies will vary depending on each company's size and demand characteristics. A summary

of company changes by access line size is included in Section VII. Overall, about two thirds of 284 average schedule study areas are expected to experience settlement rate increases while the rest will experience settlement rate decreases, at constant demand.

Most of the settlement increases are attributed to increases in the common line formula due to a positive growth in Cable & Wire investment and an increased allocation of Part 69 accounts to common line. The DSL Voice-Data formula increase is attributed to a higher account growth than last year, while the Non-DSL formula increase is mainly driven by decreased Non-DSL demand growth.

D. Communications with Average Schedule Companies

NECA notifies all average schedule companies of the potential effects of these proposed formula changes. This notification presents proposed formula impacts and explanations for the proposed changes, as well as information allowing each average schedule company to project revised settlement amounts on its own or with the assistance of NECA regional staff. In addition, NECA will update average schedule training and other materials routinely supplied to average schedule companies to reflect the new settlement formulas.

II. SAMPLE SELECTION

The average schedule formulas are developed using data collected annually from sampled average schedule and cost companies. A well-designed sample provides a desired level of precision and reliability and eliminates the need to collect data from the entire population of cost and average schedule companies. By employing statistical sampling methods, NECA and pool members save time, labor, and money without sacrificing accuracy.

In this year's study, NECA uses data from the annual samples of study areas collected in 2015 and 2016. The annual samples were drawn from a five-year sample design developed by NECA in 2014 for the 2015-2019 average schedule studies, as shown in Appendix A1.⁴ This sample design provides for random stratified samples in which study areas are sampled no more than every other year within the five-year period. The design entails stratification based on various attributes, as shown in Appendix A2. A detailed description of the methodology used to develop the sample design can be found in the December 2015 Filing.⁵

⁴ See NECA 2016 *Modification of Average Schedules*, Section II.B-II.1 (filed December 23, 2015), *approved National Exchange Carrier Association, Inc. 2016 Modification of Average Schedules*, WC Docket No. 15-298, Order, 31 FCC Rcd. 4354 (2016).

⁵ Id.

III. DATA COLLECTION

A. Introduction

This section describes the sources and types of data NECA collected to support average schedule formula development. For this study, NECA gathered data from several sources, including NECA's settlement system, NECA's annual average schedule data collection, NECA's Cost Study Database, Tariff Nos. 4 and 5, and the Customer Database.

NECA's annual data collection from sample cost and average schedule study areas is discussed in Section III.B. Cost company accounting data for the sampled cost companies comes from cost companies' annual cost separations studies submitted to NECA, as described in Section III.C. This data, together with demand data reported to settlements by the companies, are used to develop statistical models of separations (Part 36) and access allocations (Part 69), which are applied to average schedule companies' data. Since average schedule companies do not perform cost separations studies, the sampled average schedule companies report financial data to NECA at the total study area accounting level (Part 32 accounts). Collection of this data is described in Section III.D.

Demand data reported to the NECA pools by average schedule companies are used to forecast base period demand to the test period. They are used in the development of separations and allocation factors needed to derive sample companies' revenue requirements, and in the development of settlement formulas. Section III.E details the sources of cost company and average schedule demand data. Section III.F describes NECA's process for validating used in this study.

B. NECA's Annual Data Collection

In 2015 and 2016, NECA collected accounting data and demand data not available in the settlements database from sample average schedule study areas to support development of average schedule settlement formulas and the average schedule USF loop cost formula. The demand data collected consisted of loop counts used in the development of USF formula.

The 2015 sample provided accounting data from calendar years 2013 and 2014, and demand data from 2015. The 2016 sample provided accounting data from calendar years 2014 and 2015 and demand

data from 2016. Sample companies for both years were based on the sample design, as referenced in Section II. The 2015 annual data collection sampled data from 104 average schedule study areas from NECA's traffic sensitive pool. Four study areas were excluded from the sample due to non-TS pool participation, leaving a sample of 100 study areas. The 2016 annual data collection sampled data from 95 average schedule study areas from NECA's traffic sensitive pool. Three study areas were excluded from the sample due to non-TS pool participation, leaving a sample of 92 study areas. As a result, the two years of data collection yielded valid data from 192 average schedule study areas.

C. Cost Company Cost Data

NECA used detailed cost study data from 2015 as the foundation of average schedule separations and allocation models (discussed in Section IV). NECA routinely acquires this data to validate pool settlement distributions and to support tariff rate filings as part of its member company data review activities. All cost companies participating in the NECA pools are required to provide cost studies annually, showing total company (Part 32) amounts, total interstate (Part 36) amounts, and access category (Part 69) amounts. Sample cost data is provided in Appendix B1.

To estimate separation and allocation cost ratios for DSL-related accounts for study areas offering DSL outside of the NECA pool, NECA used cost studies of Group C Cost companies offering DSL outside NECA's Tariff with reported DSL costs. This data is provided in Appendix G1.

D. Average Schedule Company Accounting Data

Average Schedule company accounting data were used to develop Part 69 revenue requirements, described in Section VI. Total company account specific data (Part 32) from calendar years 2014 and 2015 were requested from each average schedule study area in the 2016 sample. These companies were required to exclude from reported account balances any costs associated with non-regulated activities, in accordance with the Commission's Part 64 rules. Each company was also asked to supply copies of 2014 and 2015 financial documents supporting its accounting data, such as summarized General Ledgers, Annual Reports or final Trial Balances. The 2014 and 2015 accounting data from the 2016 sample are displayed in Appendices C1 and C2, respectively.

The same type of accounting data from calendar years 2013 and 2014 were obtained from average

schedule study areas in the 2015 sample. Source documents for these data were also obtained for verification purposes. Average schedule company accounting data obtained from the 2015 sample are displayed in Appendices C3 and C4.

E. Demand Data

Demand data from sample cost study areas were necessary to support the separation factor modeling described in Section IV.D. Demand data for study areas in the average schedule sample, reported to the NECA settlements system, were used to develop demand forecasts, calculate average schedule separations and allocation factors, compute revenue requirements and create new settlement formula models.

Demand data were extracted from the following sources:

1. Data reported to NECA's settlements system or Customer Database.
 - a. For sample average schedule companies, NECA used the average month of the period from July 2016 through June 2017, including all adjustments through September 2017 for the following data elements,⁶ except where noted:
 - Common Line Access Lines
 - Traffic Sensitive Switched Access Minutes of Use
 - Number of Exchanges
 - DSL Voice-Data Line Counts
 - DSL Broadband-Only Line Counts (December 2016 view of December 2014 and December 2015)
 - Non-DSL Special Access Revenues, adjusted to current tariff rates, and to the uniform rate band in the current NECA tariff as detailed in Section V.E.1
 - b. For cost companies, NECA used the average month of the period from January 2015 through December 2015⁷, including all adjustments through June 2017 for the following data elements:

⁶ Throughout the remainder of this Filing, Common Line Access Lines may be referred to as "access lines" and Traffic Sensitive Switched Access Minutes of Use as "access minutes."

⁷ Cost company demand data from 2015 correspond to 2015 cost studies used in this average schedule filing.

- Common Line Access Lines
- Traffic Sensitive Switched Access Minutes of Use
- Number of Exchanges
- DSL Voice-Data Line Counts
- DSL Broadband-Only Line Counts
- Non-DSL Special Access Revenues taken from data reported to NECA settlements, and adjusted to current tariff rates, and to the uniform rate band in the current NECA Tariff, following the same method as used for average schedule companies.

2. Cost company exchange counts from NECA's Customer Database supplemented by Tariff No. 4.

Demand data from sample average schedule and cost study areas are displayed in Appendices D1 and D2, respectively.

F. Data Edits

1. Cost Study Area Part 32, Part 36 and Part 69 Data Edits

Several edits were performed on cost study areas' data to ensure completeness and accuracy. The methods used for these edits included the following steps:

- a. Results from NECA's cost study program were reconciled with results provided by sample companies.
- b. Cost study data entries were reviewed for completeness.
- c. Related accounts were compared for consistency.
- d. Access element amounts were compared to total company and total interstate amounts.
- e. Data review ensured sufficient level of detail to conduct cost study analyses.

2. Average Schedule Study Area Accounting Data Edits

Several edits were performed on average schedule study areas' accounting data to ensure completeness and accuracy. The methods used for these edits included the following steps:

- a. Accounting source documents were compared to data reporting forms to ensure that the data were reported correctly. A review of data ensured that all study areas provided sufficient account detail.
- b. Individual study area investments per line ratios were compared to average sample ratios. Extreme values were investigated to ensure accuracy.
- c. Individual accounts for each study area were compared to their total investments and expenses for reasonability.
- d. Growth ratios for each account for each carrier were evaluated to ensure reasonability.

3. Demand Data Edits

Demand data used in this study were reviewed for consistency with prior reports and with NECA settlement procedures. Month-over-month and year-over-year comparisons were made to identify data anomalies and growth trend changes.

IV. COST COMPANY ALLOCATION MODELS

A. Introduction

This section describes the use of cost study data provided by cost companies for the year ending December 2015.⁸ These cost study data are used to calculate separated costs and to allocate separated costs to access categories, as discussed in Section IV.B, using FCC rules that apply to the test period (July 1, 2018 through June 30, 2019). From each cost study, NECA calculates fractions of unseparated accounts that are allocated to the interstate jurisdiction, and fractions of interstate accounts that are allocated to access categories. NECA then develops statistical models that relate these fractions to relevant demand variables.

Because average schedule companies do not perform studies that produce cost separations and access category allocations, NECA uses these models in average schedule studies to allocate average schedule company accounts to access categories. As discussed in Section VI, the models are used to calculate values for the separation and allocation of accounts of each sample average schedule company. The following is an illustration of a straight line equation model for separating an account.

$$\frac{\text{Interstate Cost in the Account}}{\text{Total Cost in the Account}} = 0.05 + (0.9 \times \text{Related Variable})$$

NECA employed the straight-line equation form in some models and other forms in other models. Part 36 models are explained in Section IV.D.

Next, NECA used cost study accounting data in each access charge category to model the allocation of interstate amounts to access categories (Part 69 models). These Part 69 models are explained in Section IV.E. An illustration follows:

$$\frac{\text{Common Line Cost in the Account}}{\text{Interstate Cost in the Account}} = 0.1 + (0.6 \times \text{Related Variable})$$

⁸ Data from 2016 cost studies do not begin to become available until the second half of 2017, which was too late for inclusion in this Study.

To ensure that all models represent the average schedule population, influential data points were identified and accommodated according to the method referenced in Section IV.C.

B. Jurisdictional Cost Separations and Access Category Allocations

The following sections discuss cost allocation methods underlying data obtained from 2015 cost studies for sample cost companies. The summary of cost separation and allocation methods in Exhibit 4.1 describes factors used to separate and allocate sample cost company accounts for the test period.

1. Separation of Local Switching Investment

Since 2001, as recommended by the Federal-State Joint Board on Separations, the Commission has imposed an interim separations freeze⁹ on all Part 36 category relationships and interstate separations factors for price cap carriers, and all interstate separations factors for rate-of-return carriers. The latest order, released in May 2017, extended the freeze through December 31, 2018.

2. Summary of Cost Separation and Allocation Methods

Using the 2015 cost study separations factors, NECA calculated the interstate costs of each sample cost study. These calculated costs are shown in Appendix B1. Exhibit 4.1 summarizes the basis of this calculation.

In addition to sample cost study areas, NECA used 2015 DSL cost data from all Group C cost companies in the calculation of ratios used to allocate and remove DSL costs for sample average schedule study areas with DSL outside of NECA's tariff.

In the *USF/ICC Transformation Order*¹⁰ the Commission froze switched access revenue

⁹ Jurisdictional Separations and Referral to the Federal-State Joint Board, CC Docket No. 80-286, *Report and Order*, 16 FCC Rcd 11382 (2001).

¹⁰ *Connect America Fund*, WC Docket No. 10-90, *A National Broadband Plan for Our Future*, GN Docket No. 09-51, *Establishing Just and Reasonable Rates for Local Exchange Carriers*, WC Docket No. 07-135, *High Cost Universal Service Support*, WC Docket No. 05-337, *Developing an Unified Intercarrier Compensation Regime*, CC Docket No. 01-92, *Federal-State Joint Board on Universal Service*, CC Docket No. 96-45, *Lifeline and Link-Up*, WC Docket No. 03-109,

requirement at the level of year 2011 and prescribed a 5% phase-out in each subsequent year. Nevertheless, NECA continues to develop separation and allocation models to allocate average schedule sample companies' costs to the Switched Access category. Separation and allocation of switched-related accounts are necessary to ensure accurate allocation of costs to the Special Access and Common Line categories.

3. Cost Study Separations Factors

Using the interstate costs calculated as described above, a set of separations factors was calculated for each sample cost study area. The set includes separations factors (percentages) for each category of Central Office Equipment and Cable & Wire Facilities, and for related expense, reserve, and tax calculation accounts. A separations factor is calculated as follows:

$$\text{Separations Factor} = \frac{\text{Interstate Cost in Category or Account}}{\text{Total Cost in Account}}$$

These separations factors were used as described in Section IV.D to develop separations factor models.

4. Cost Study Access Allocation Factors

Using the access category cost calculated as described in Section IV.B.2 above, a set of access allocation factors was calculated for each sample cost study area. The set includes one group of access allocation factors for each category of Central Office Equipment, Cable & Wire Facilities, and for certain investment accounts, expenses and reserves. These allocation factors were used as described in Section IV.E to develop allocation factor models. Groups of allocation factors include one each for Common Line, Central Office, Transport and Special Access.

Universal Service – Mobility Fund, WT Docket No. 10-208, Report and Order and FNPRM, 26 FCC Rcd. 17663 (2011), *pets. For reviewing pending*, *Direct Commc'ns Cedar Valley, LLC v. FCC*, No. 11-9581 (10th Cir. Filed Dec 18, 2011) (*USF/ICC Transformation Order*).

EXHIBIT 4.1 <u>COST SEPARATION AND ALLOCATION METHODS</u>		
Account or Category	Part 36 Separations Basis	Part 69 Allocation Basis
Central Office Equipment		
Category 1	Cost Study	Cost Study
Category 2	Cost Study	Cost Study
Category 3	Local Switching Separation Factor	Interstate portion is assigned to local switching element.
Category 4.11	Cost Study	Cost Study
Category 4.12	Cost Study	Cost Study
Category 4.13	Prorate into Joint, interstate private line (PL) and intrastate PL based on 4.13 loops. Joint portion is separated 25% to interstate; PL portion is directly assigned to appropriate jurisdictions.	Joint portion is assigned to Base Factor Portion (BFP). PL portion is assigned to special access.
Category 4.2	Cost Study	Cost Study
Category 4.3	Cost Study	Cost Study
Cable & Wire Facilities		
Category 1	Prorate into joint and PL based on Cat. 1 loops. Joint portion is separated 25% to interstate. PL portion is assigned to appropriate jurisdiction.	Joint portion is assigned to BFP. PL portion is assigned to special access.
Category 2	Cost Study	Cost Study
Category 3	Cost Study	Cost Study
Category 4	Cost Study	Cost Study
Information Originating/ Terminating Equipment		
Category 1	25% to Interstate	Prorate into public tel., limited pay and all other IOT based on splitting factors. Public tel. is assigned to pay element. Limited pay is assigned to limited pay element. All other IOT is assigned to Common Line BFP element.
Category 2	Cost Study	Cost Study
General Support Facilities	COE+IOT+C&WF	COE+IOT+C&WF

EXHIBIT 4.1 (Continued) <u>COST SEPARATION AND ALLOCATION METHODS</u>		
Account or Category	Part 36 Separations Basis	Part 69 Allocation Basis
Tangible Assets - Capital Lease		
General Support Facilities	General Support Assets	General Support Assets
Central Office Equipment		
Category 1	COE Cat. 1	COE Cat. 1
Category 2	COE Cat. 2	COE Cat. 2
Category 3	COE Cat. 3	COE Cat. 3
Category 4	COE Cat. 4	COE Cat. 4
Information Originating/ Terminating Equipment		
Category 1	IOT Cat. 1	IOT Cat. 1
Category 2	IOT Cat. 2	IOT Cat. 2
Cable & Wire Facilities		
Category 1	C&WF Cat. 1	C&WF Cat. 1
Category 2	C&WF Cat. 2	C&WF Cat. 2
Category 3	C&WF Cat. 3	C&WF Cat. 3
Category 4	C&WF Cat. 4	C&WF Cat. 4
Tangible Assets - Lease Hold Improvements		
General Support Facilities	General Support Assets	COE+IOT+C&WF+GSF
COE - Switching	COE Cat. 2 & COE Cat. 3	COE+IOT+C&WF+GSF
COE - Operator Equipment	COE Cat. 1	COE+IOT+C&WF+GSF
COE - Transmission	COE Cat. 4	COE+IOT+C&WF+GSF
Information Originating/ Terminating Equipment	IOT	COE+IOT+C&WF+GSF
Cable & Wire Facilities	C&WF	COE+IOT+C&WF+GSF
Intangible Assets	Acct 2001 Excluding Acct 2690	COE+IOT+C&WF+GSF
Telecom. Plant Held for Future Telecom. Use	Acct 2001	Acct 2001

EXHIBIT 4.1 (Continued) <u>COST SEPARATION AND ALLOCATION METHODS</u>		
Account or Category	Part 36 Separations Basis	Part 69 Allocation Basis
Telecom. Plant Under Construction (Includes AFUDC)	Acct 2001	Acct 2001
Telecom. Plant Acquis. Adjustment	Acct 2001	Acct 2001
Materials & Supplies	C&WF	COE+IOT+C&WF+GSF
Cash Working Capital	Total Expenses Excluding Depreciation & Amortization Expense	COE+IOT+C&WF+GSF
Accumulated Depreciation		
General Support Facilities	GSF	GSF
COE - Switching	COE Cat. 2 + COE Cat. 3	COE Cat. 2 + COE Cat. 3
COE - Operator Equipment	COE Cat. 1	COE Cat. 1
COE - Transmission	COE Cat. 4	COE Cat. 4
Information Originating/Terminating Equipment	IOT	IOT
Cable & Wire Facilities	C&WF	C&WF
Property Held for Future Telecom Use	Acct 2002	COE+IOT+C&WF+GSF
Accumulated Amortization - Tangible	Acct 2680	Associated Acct 2680 Investment
Accumulated Amortization - Intangible	Acct 2690	COE+IOT+C&WF+GSF
Accumulated Amortization - Other	Acct 2005	Acct 2005
Net Current Deferred Taxes		
General Support Facilities	GSF	GSF
COE - Switching	COE Cat. 2 + COE Cat. 3	COE Cat. 2 + COE Cat. 3
COE - Operator Equipment	COE Cat. 1	COE Cat. 1
COE - Transmission	COE Cat. 4	COE Cat. 4
Information Originating/Terminating Equipment	IOT	IOT
Cable & Wire Facilities	C&WF	C&WF
Not Classified	Acct 2001 Excluding Land	Acct 2001

EXHIBIT 4.1 (Continued) <u>COST SEPARATION AND ALLOCATION METHODS</u>		
Account or Category	Part 36 Separations Basis	Part 69 Allocation Basis
Net Non-Current Deferred Taxes		
General Support Facilities	GSF	GSF
COE - Switching	COE Cat. 2 + COE Cat. 3	COE Cat. 2 + COE Cat. 3
COE - Operator Equipment	COE Cat. 1	COE Cat. 1
COE - Transmission	COE Cat. 4	COE Cat. 4
Information Originating/ Terminating Equipment	IOT	IOT
Cable & Wire Facilities	C&WF	C&WF
Not Classified	Acct 2001 Excluding Land	Acct 2001
Network Support Expenses	GSF	COE+IOT+C&WF+GSF
General Support Expenses	GSF	GSF
COE Expenses -6210	COE	COE 2210
-6220	COE	COE 2220
-6230	COE	COE 2230
C&WF Expenses	C&WF	C&WF
IOT Expenses	IOT	IOT
Other Property, Plant & Equipment Expenses	Acct 2001	COE+IOT+C&WF
Network Operations Expenses	COE+IOT+C&WF	COE+IOT+C&WF
Access Expenses	Cost Study	Cost Study
Depreciation & Amortization Expense		
General Support Facilities	GSF	GSF
COE - Switching	COE Cat. 2 + COE Cat. 3	COE Cat. 2 + COE Cat. 3
COE - Operator Equipment	COE Cat. 1	COE Cat. 1
COE - Transmission	COE Cat. 4	COE Cat. 4
Information Originating/ Terminating Equipment	IOT	IOT
Cable & Wire Facilities	C&WF	C&WF
Plant Held for Future Telecom. Use	Acct 2001	Acct 2001
Amortization - Tangible Assets	Acct 2680	Acct 2680
Amortization - Intangible Assets	Acct 2690	Acct 2690
Amortization - Other	Acct 2005	Acct 2005

EXHIBIT 4.1 (Continued) <u>COST SEPARATION AND ALLOCATION METHODS</u>		
Account or Category	Part 36 Separations Basis	Part 69 Allocation Basis
Marketing Expenses	Cost Study	COE+IOT+C&WF+GSF
Service Expenses - OB&C	User Study	Limited to 5% to CL
Service Expenses - All Other	Cost Study	Cost Study
Corporate Operation Expense	Big Three Expenses	Big Three Expenses
Other Operating Taxes	Acct 2001	COE+IOT+C&WF+GSF
Investment Tax Credit	Acct 2001	COE+IOT+C&WF+GSF
Funds During Construction	Acct 2003	COE+IOT+C&WF+GSF
Contributions	Corporate Expenses	COE+IOT+C&WF+GSF
Interest on Capital Leases	Acct 2680 - Capital Leases	COE+IOT+C&WF+GSF
Other Interest & Related Items	Net Telecommunication Plant	Acct 2001 or Net Investment
Other Jurisdictional Assets	Cost Study	Cost Study
Other Jurisdictional Liabilities & Deferred Credit - Net	Cost Study	Cost Study
Investment Allowance/Disallowance	Acct 2001	COE+IOT+C&WF+GSF
Capitalized Payroll	Acct 2001	COE+IOT+C&WF+GSF
Depreciation Adjustment	Acct 2001	COE+IOT+C&WF+GSF
Expense Allowance/Disallowance	Acct 2001	COE+IOT+C&WF+GSF
Customer Deposits	Acct 2001 Excluding Land	COE+IOT+C&WF+GSF
Accumulated Depreciation Allowance/Disallowance	Acct 2001 Excluding Land	COE+IOT+C&WF+GSF
FIT Allowance/Disallowance	Acct 2001	COE+IOT+C&WF+GSF

C. Outlier Accommodation Methods

NECA continues to employ the DFFITS outlier accommodation method to moderate the impact of influential data points in model development. This method responds to FCC concerns raised in the *June 1998 Order*¹¹ that recommended NECA use a more accurate and consistent method to address outliers. A detailed description of this method can be found in Section IV.C of last year's filing.¹²

D. Part 36 Separations Factor Modeling

This section describes the use of cost company separations factor data to develop models of separations factors for average schedule companies. Separations models were developed for categories of Central Office Equipment and Cable & Wire Facilities, consisting either of single accounts or groups of accounts, and for each Class B account of investment, expense, reserve and taxes. Accounts were grouped into categories if single account detail was not necessary in the study. For example, COE Cat. 1+2+3+4.3 accounts were combined into a single category because these accounts are directly assigned to switched access and NECA no longer develops switched access settlement formulas as discussed in IV.B.2 above.

The separations models are based on 2015 cost company demand data (defined in Section III.E), and cost study separations factors (defined in Section IV.B.3).

¹¹ NECA Proposed Modifications to the 1998-99 Interstate Average Schedule Formulas, AAD 98-20, *Order*, 13 FCC Rcd 17351 (1998) (*June 1998 Order*).

¹² NECA 2017 *Modification of Average Schedules*, WC Docket No. 16-400, Section IV.C (filed December 22, 2016) (*December 2016 Filing*).

1. Model Forms

NECA deploys regression models if a statistically significant relationship is found between the dependent variable (P) (categorized accounts to unseparated account) and the independent variable(s) X selected for each cost category. Otherwise, a weighted average ratio form is used. Three model forms are listed below.

- *Simple Straight Line Model Form: $P = a + bX$*
- *Proportional Model Form: $P = bX$*
- *Weighted Average Ratio Form: $P = a$*

A detailed description of the model forms and illustrative examples can be found in Section IV.D.1 of last year's filing.¹³

NECA investigated the relationship between DEM weight and access minutes per line and determined access minutes below 180 per line to be "normal volume minutes." This adoption more accurately allocates total COE to interstate for study areas with normal traffic.

NECA determined minimum and maximum values of separation factors from cost company model results as illustrated in Exhibit 4.2. Such values were used to limit average schedule company's separations factors obtained from the corresponding cost models. If the average schedule company interstate portion calculated from a model was outside the cost company limits, the corresponding limit was used as the average schedule company's separations factor. The test was not applied to regression models' dependent upon other accounts' separations factors, which were already constrained within cost company model limits.

2. Separation Factor Models

All separations factor models are displayed in Exhibit 4.2. When a regression model was used, the associated *t-statistic*, *R-Square statistic*, and *F-statistic* values are shown.

¹³ See, *December 2016 Filing*, Section IV.D.1.

EXHIBIT 4.2

PART 36 SEPARATION FACTOR MODELS

COE Categories 1 + 2 + 3 + 4.3 - Operator Systems + Tandem Switching + Local Switching + Host/Remote Circuit

If total combined Cat. 1 + 2 + 3 + 4.3 COE is not zero, then:

$$\begin{aligned} P &= \frac{\text{Interstate Cat. 1 + 2 + 3 + 4.13 COE}}{\text{Total COE}} \\ &= 0.09846 + 0.0001632 \times \text{DEM Weight} \times \text{Normal Volume Minutes per Line} \\ &\quad \text{if Line size} \leq 1,000 \\ &= 0.03916 + 0.0001632 \times \text{DEM Weight} \times \text{Normal Volume Minutes per Line} \\ &\quad \text{if Line size} > 1,000 \end{aligned}$$

$$\begin{aligned} \text{Minimum} &= 0.05493 \\ \text{Maximum} &= 0.1866 \end{aligned}$$

$$R^2 = 0.11 \qquad F = 12.23 \qquad t_1 = 3.14 \qquad t_2 = 3.86$$

COE Category 4.11 Plus 4.12 - Wideband Exchange Line + Exchange Trunk

If interstate Cat. (4.11 + 4.12) COE is not zero, then:

$$\begin{aligned} P &= \frac{\text{Interstate COE Cat. 4.11 + Cat. 4.12}}{\text{Total COE}} \\ &= 0.1544, \text{ if the study area provides DSL service outside NECA tariff;} \\ &\quad \text{Otherwise,} \\ &= 0.04427 + 0.2621 \times \text{DSL Lines per Line,} \\ &\quad \text{if Line size} \leq 1,000; \\ &= 0.08217 + 0.2621 \times \text{DSL Lines per Line,} \\ &\quad \text{if Line size} > 1,000; \end{aligned}$$

$$\begin{aligned} \text{Minimum} &= 0.04802 \\ \text{Maximum} &= 0.2963 \end{aligned}$$

$$R^2 = 0.21 \qquad F = 20.12 \qquad t_1 = 5.39 \qquad t_2 = -2.03$$

COE Category 4.13 - Exchange Line Circuit Excluding Wideband

$$\begin{aligned} P &= \frac{\text{Interstate Cat. 4.13 COE}}{\text{Total COE}} \\ &= 0.1169 \end{aligned}$$

EXHIBIT 4.2 (Continued)

PART 36 SEPARATION FACTOR MODELS

COE Category 4.2 - Interexchange Circuit

If total Cat. 4.2 COE is not zero, then:

$$\begin{aligned} P &= \frac{\text{Interstate Cat. 4.2 COE}}{\text{Total COE}} \\ &= 0.04381 + 0.001097 \times \text{Non-DSL Revenues per Line} \\ &\quad \text{if Line size} \leq 3,700 \\ &= 0.07861 + 0.001097 \times \text{Non-DSL Revenues per Line} \\ &\quad \text{if Line size} > 3,700 \\ \text{Minimum} &= 0.04449 \\ \text{Maximum} &= 0.1749 \\ R^2 &= 0.12 \qquad F = 13.16 \qquad t_1 = 3.34 \qquad t_2 = -4.11 \end{aligned}$$

C&WF Category 1.2 - Interstate Private Line + Interstate WATS

If total Cat. 1.2 C&WF is not zero, then:

$$\begin{aligned} P &= \frac{\text{Interstate Cat. 1.2 C\&WF}}{\text{Total C\&WF}} \\ &= 0.00173 + 0.00008292 \times \text{Non-DSL Revenues per Line} \\ &\quad \text{if Line Size} \leq 1,500 \\ &= 0.0009383 + 0.00008292 \times \text{Non-DSL Revenues per Line} \\ &\quad \text{if Line Size} > 1,500 \\ \text{Minimum} &= 0.001084 \\ \text{Maximum} &= 0.01164 \\ R^2 &= 0.24 \qquad F = 24.78 \qquad t_1 = 6.63 \qquad t_2 = 2.14 \end{aligned}$$

C&WF Category 1.3 - Subscriber Common Line - Joint Interstate/Intrastate Use

$$\begin{aligned} P &= \frac{\text{Interstate Cat. 1.3 C\&WF}}{\text{Total C\&WF}} \\ &= 0.2244 \end{aligned}$$

EXHIBIT 4.2 (Continued)

PART 36 SEPARATION FACTOR MODELS

C&WF Category 2 + 3 - Wideband Exchange Trunk + Interexchange

If interstate Cat. 2 +3 C&WF is not zero, then:

$$\begin{aligned} P &= \frac{\text{Interstate Cat. (2+3) C\&WF}}{\text{Total C\&WF}} \\ &= 0.1028 + 0.001468 \times \text{Non-DSL Revenues per Line} \\ &\quad \text{if Line Size} \leq 700 \\ &= 0.05794 + 0.001468 \times \text{Non-DSL Revenues per Line} \\ &\quad \text{if Line Size} > 700 \\ \text{Minimum} &= 0.05924 \\ \text{Maximum} &= 0.2783 \\ R^2 &= 0.10 \quad F = 11.53 \quad t_1 = 4.29 \quad t_2 = 2.47 \end{aligned}$$

C&WF Category 4 - Host/Remote Message

If interstate Cat. 4 C&WF is not zero, then:

$$\begin{aligned} P &= \frac{\text{Interstate Cat. 4 C\&WF}}{\text{Total C\&WF}} \\ &= 0.00223 \end{aligned}$$

GSF - General Support Facilities Equipment

$$\begin{aligned} P &= \frac{\text{Interstate GSF}}{\text{Total GSF}} \\ &= 1.0000 \times \% \text{ Interstate of Total [COE + C\&WF + IOT]} \\ R^2 &= 1.00 \quad F = 2,752,327,804 \quad t = 52,462 \end{aligned}$$

Tangibles - Account 2680

$$\begin{aligned} P &= \frac{\text{Interstate Tangibles}}{\text{Total Tangibles}} \\ &= 0.9968 \times \% \text{ Interstate of Total [COE + C\&WF + IOT]} \\ R^2 &= 1.00 \quad F = 24,099 \quad t = 155 \end{aligned}$$

EXHIBIT 4.2 (Continued)

PART 36 SEPARATION FACTOR MODELS

Intangibles - Account 2690

$$\begin{aligned} P &= \frac{\text{Interstate Intangibles}}{\text{Total Intangibles}} \\ &= 1.0001 \times \% \text{ Interstate of Total 2001 (Excluding 2690)} \\ R^2 &= 1.00 \quad F = 307,503,659 \quad t = 17,536 \end{aligned}$$

Telecommunications Plant - Other - Accounts 2002 + 2003 + 2005

$$\begin{aligned} P &= \frac{\text{Interstate of Total 2002 + 2003 + 2005}}{\text{Total 2002 + 2003 + 2005}} \\ &= 0.9997 \times \% \text{ Interstate of Total 2001} \\ R^2 &= 1.00 \quad F = 130,709,167 \quad t = 11,433 \end{aligned}$$

Materials & Supplies - Account 1220

$$\begin{aligned} P &= \frac{\text{Interstate Materials & Supplies}}{\text{Total Materials & Supplies}} \\ &= 1.0000 \times \% \text{ Interstate of C\&WF} \\ R^2 &= 1.00 \quad F = \text{Infinity} \quad t = \text{Infinity} \end{aligned}$$

Accumulated Depreciation - Accounts 3100 + 3200

$$\begin{aligned} P &= \frac{\text{Interstate Accumulated Depreciation}}{\text{Total Accumulated Depreciation}} \\ &= 0.007777 + 1.0082 \times \% \text{ Interstate of Total 2001} \\ R^2 &= 0.95 \quad F = 3,879 \quad t = 62 \end{aligned}$$

Accumulated Amortization - Accounts 3400 + 3500 + 3600

$$\begin{aligned} P &= \frac{\text{Interstate Accumulated Amortization}}{\text{Total Accumulated Amortization}} \\ &= 0.9956 \times \% \text{ Interstate of Total 2001} \\ R^2 &= 1.00 \quad F = 26,242 \quad t = 162 \end{aligned}$$

EXHIBIT 4.2 (Continued)

PART 36 SEPARATION FACTOR MODELS

Net Deferred Federal Income Taxes - Accounts 4100 + 4340 + 4370

$$\begin{aligned} P &= \frac{\text{Interstate Net Deferred Federal Income Taxes}}{\text{Total Net Deferred Federal Income Taxes}} \\ &= 0.3829 \end{aligned}$$

Network Support Expense - Account 6110

$$\begin{aligned} P &= \frac{\text{Interstate of Network Support Expense}}{\text{Total Network Support Expense}} \\ &= 1.0000 \times \% \text{ Interstate of Total [COE + C\&WF + IOT]} \\ R^2 &= 1.00 \quad F = 1,426,782,916 \quad t = 37,773 \end{aligned}$$

General Support Expense - Account 6120

$$\begin{aligned} P &= \frac{\text{Interstate of GSF Expense}}{\text{Total GSF Expense}} \\ &= 1.0000 \times \% \text{ Interstate of Total [COE + C\&WF + IOT]} \\ R^2 &= 1.00 \quad F = 2,752,246,193 \quad t = 52,462 \end{aligned}$$

COE Expense - Account 6210

$$\begin{aligned} P &= \frac{\text{Interstate of COE}}{\text{Total COE}} \\ &= 1.0001 \times \% \text{ Interstate of COE} \\ R^2 &= 1.00 \quad F = 451,341,476 \quad t = 21,245 \end{aligned}$$

C\&WF Expense - Account 6410

$$\begin{aligned} P &= \frac{\text{Interstate of C\&WF Expense}}{\text{Total C\&WF Expense}} \\ &= 1.0025 \times \% \text{ Interstate of C\&WF} \\ R^2 &= 1.00 \quad F = \text{Infinity} \quad t = \text{Infinity} \end{aligned}$$

EXHIBIT 4.2 (Continued)

PART 36 SEPARATION FACTOR MODELS

Other Property, Plant & Equipment Expense - Account 6510

$$\begin{aligned} P &= \frac{\text{Interstate of Account 6510}}{\text{Total Account 6510}} \\ &= 1.0000 \times \% \text{ Interstate of Total 2001} \\ R^2 &= 1.00 \quad F = 5,203,769,412 \quad t = 72,137 \end{aligned}$$

Network Operations Expense - Account 6530

$$\begin{aligned} P &= \frac{\text{Interstate of Network Operations Expense}}{\text{Total Network Operations Expense}} \\ &= 1.0000 \times \% \text{ Interstate of Total [COE + C\&WF + IOT]} \\ R^2 &= 1.00 \quad F = 2,753,662,593 \quad t = 52,475 \end{aligned}$$

Depreciation and Amortization Expense - Account 6560

$$\begin{aligned} P &= \frac{\text{Interstate Depreciation and Amortization Expense}}{\text{Total Depreciation and Amortization Expense}} \\ &= 0.01798 + 1.0000 \times \% \text{ Interstate of Total 2001} \\ R^2 &= 0.85 \quad F = 1,139 \quad t = 34 \end{aligned}$$

Marketing Expense - Account 6610

$$\begin{aligned} P &= \frac{\text{Interstate Marketing Expense}}{\text{Total Marketing Expense}} \\ &= 0.3260 \end{aligned}$$

Services Expense - Account 6620

$$\begin{aligned} P &= \frac{\text{Interstate Services Expense}}{\text{Total Services Expense}} \\ &= 0.3437 \end{aligned}$$

EXHIBIT 4.2 (Continued)

PART 36 SEPARATION FACTOR MODELS

Corporate Operations Expense – Accounts 6710 and 6720

$$\begin{aligned} P &= \frac{\text{Interstate Corporate Operations Expense}}{\text{Total Corporate Operations Expense}} \\ &= 0.04175 + 0.9611 \times \% \text{ Interstate of Total Big Three Expenses} \\ R^2 &= 0.78 \quad F = 712 \quad t = 27 \end{aligned}$$

Other Operating Taxes - Account 7200

$$\begin{aligned} P &= \frac{\text{Interstate Account 7200}}{\text{Total Account 7200}} \\ &= 1.0522 \times \% \text{ Interstate of Total 2001} \\ R^2 &= 0.96 \quad F = 4,638 \quad t = 68 \end{aligned}$$

Federal Investment Tax Credit

If study area is subject to Federal Income Tax,

$$\begin{aligned} P &= \frac{\text{Interstate of Investment Tax Credit}}{\text{Total Investment Tax Credit}} \\ &= 0.3243 \end{aligned}$$

Non-Operating Income and Expense

$$\begin{aligned} P &= \frac{\text{Interstate of Non-Operating Income and Expense}}{\text{Total Non-Operating Income and Expense}} \\ &= 0.1318 + 0.8151 \times \% \text{ Interstate of Total 2001} \\ R^2 &= 0.61 \quad F = 222 \quad t = 15 \end{aligned}$$

Interest & Related Items - Account 7500

$$\begin{aligned} P &= \frac{\text{Interstate of Total 2001}}{\text{Total 2001}} \\ &= 0.9444 \times \% \text{ Interstate of Total 2001} \\ R^2 &= 0.99 \quad F = 29,218 \quad t = 171 \end{aligned}$$

E. Part 69 Allocation Factor Modeling

This section describes the development of Part 69 allocation factor models.

1. Methods and Data

Most categories of cost are allocated according to Part 69 rules either by a 100 percent direct assignment rule or by a simple indirect allocation rule. Only a few cost categories have allocations complex enough to require a model to apportion them among access categories.¹⁴ As with the development of Part 36 models, NECA developed models of simplest form with statistically significant independent variables. These models explained the largest percentage of variation of allocation fractions and had statistically significant coefficients with correct signs. Using graphical displays and statistical regression analysis, alternative forms and combinations of variables were tested. Simple weighted average ratios were chosen when the data did not demonstrate any statistically significant relationship between the allocation fractions and the other variables.

NECA selected model variables based on relationships designated in Part 69 rules or correlations with other relevant variables, such as demand variables and other account allocations. The dependent variable in a model for a particular account is the ratio of cost in an individual access category to total interstate cost for that account. For example, the following variables were used to develop the model for Common Line Accumulated Amortization:

Dependent variable:

$$\% \text{ CL of Accumulated Amortization} = \frac{\text{Common Line Accumulated Amortization}}{\text{Interstate Accumulated Amortization}}$$

Independent variable:

$$\% \text{ CL of Interstate Account 2001} = \frac{\text{Common Line Account 2001}}{\text{Interstate Account 2001}}$$

Exhibit 4.3 lists all variables used as independent variables in the allocation factor models.

¹⁴ Exhibit 4.1 shows the methods used in this average schedule study to allocate cost company accounts to access categories.

Some models used independent variables designated by Part 69 rules. The Depreciation Expense models are examples of such models. According to Part 69 rules, Depreciation Expense is apportioned to access categories in proportion to related components of Telecommunications Plant in Service, the total of which is the independent variable in these models.

Other models use variables correlated with variables designated by Part 69 rules. The COE Category 4.13 - Exchange Line Circuit Equipment Excluding Wideband model is an example of such a model. The ratios of Non-DSL special access revenues to lines are correlated with the usage-based assignment prescribed by Part 69.

EXHIBIT 4.3 <u>INDEPENDENT VARIABLES USED IN PART 69 MODEL DEVELOPMENT</u>	
<u>Variable Name</u>	<u>Calculation</u>
% Access of Interstate 2001	$\frac{\text{Access Category Telecommunications Plant in Service}}{\text{Total Interstate Telecommunications Plant in Service}}$
% Access of Interstate Other Plant	$\frac{\text{Access Category Telecommunications Plant} - \text{Other}}{\text{Total Interstate Telecommunications Plant} - \text{Other}}$
% Access of Interstate Big Three Expenses	$\frac{\text{Access Category Big Three Expenses}}{\text{Total Interstate Big Three Expenses}}$
% Access of Interstate Big Three Expenses Less Services Expense	$\frac{\text{Access Category Big Three Expenses Minus Services}}{\text{Total Interstate Big Three Expenses Minus Services}}$
% Access of Plant Specific Expense	$\frac{\text{Access Category Plant Specific Expense}}{\text{Total Interstate Plant Specific Expense}}$
% Access of Plant Non-Specific Expense	$\frac{\text{Access Category Plant Non-Specific Expense}}{\text{Total Interstate Plant Non-Specific Expense}}$
% Access of Customer Operations Expense	$\frac{\text{Access Category Customer Operations Expense}}{\text{Total Interstate Customer Operations Expense}}$
Non-DSL Revenues per Line	$\frac{\text{Non-DSL Revenues}}{\text{Lines}}$
% SA COE (4.11+4.12) over SA TPIS	$\frac{\text{Special Access COE 4.11+4.12}}{\text{Special Access Telecommunications Plant in Service}}$
% Broadband-Only Lines per DSL Line	$\frac{\text{Broadband-Only Lines}}{\text{DSL Lines}}$

2. Part 69 Allocation Models

a. Expense and Reserve Models

Structured according to Part 69 allocation rules, these models relate the percentage of interstate access category expenses or reserves to the respective percentage of interstate Telecommunications Plant in Service. The strength of these Part 69 models, as evidenced by the high *R-Square*, *F-statistic* and *t-statistic* values, is attributed to the very close relationship between the variables used in the model and the factors defined in the rules.

Exhibit 4.4 displays models developed for certain expense and reserve accounts.

EXHIBIT 4.4

PART 69 – EXPENSE AND RESERVE ALLOCATION MODELS

Accumulated Depreciation

%CL	=	-0.005677	+	0.9586	x	% CL of Interstate 2001
%CO	=	1.1323	x			% CO of Interstate 2001
%SA	=	1.0317	x			% SA of Interstate 2001
%TR	=	0.9876	x			% TR of Interstate 2001

	<u>R²</u>	<u>F</u>	<u>t</u>	<u>Minimum</u>	<u>Maximum</u>
%CL Model	0.93	2790	53	0.130535	0.848085
%CO Model	0.98	8376	92	0.000000	0.555356
%SA Model	0.99	24884	158	0.031985	0.777903
%TR Model	0.99	28085	168	0.000000	0.609407

Net Deferred Income Taxes

%CL	=	0.4883
%CO	=	0.08737
%SA	=	0.3624
%TR	=	0.0619

Accumulated Amortization

%CL	=	0.9946	x	% CL of Interstate 2001
%CO	=	0.9152	x	% CO of Interstate 2001
%SA	=	0.9985	x	% SA of Interstate 2001
%TR	=	0.9775	x	% TR of Interstate 2001

	<u>R²</u>	<u>F</u>	<u>t</u>	<u>Minimum</u>	<u>Maximum</u>
%CL Model	1.00	5632	75	0.173940	0.694773
%CO Model	0.89	194	14	0.005771	0.294666
%SA Model	1.00	5585	75	0.125667	0.610686
%TR Model	0.94	364	19	0.001908	0.552814

Depreciation and Amortization Expense

%CL	=	0.01404	+	0.899	x	% CL of Interstate 2001
%CO	=	0.6901	x			% CO of Interstate 2001
%SA	=	1.1279	x			% SA of Interstate 2001
%TR	=	0.001649	+	1.051	x	% TR of Interstate 2001

	<u>R²</u>	<u>F</u>	<u>t</u>	<u>Minimum</u>	<u>Maximum</u>
%CL Model	0.78	730	27	0.141792	0.814768
%CO Model	0.63	343	19	0.000000	0.338471
%SA Model	0.98	8645	93	0.034969	0.850495
%TR Model	0.97	6607	81	0.001649	0.650176

EXHIBIT 4.4 (Continued)

PART 69 – EXPENSE AND RESERVE ALLOCATION MODELS

Services Expenses

%CL	=	0.5394	x	% CL of Interstate 2001
%CO	=	0.02259	+	0.6489 x % CO of Interstate 2001
%SA	=	0.07507	+	0.3371 x % SA of Interstate 2001
%TR	=	0.006671	+	0.5131 x % TR of Interstate 2001

	<u><i>R</i>²</u>	<u><i>F</i></u>	<u><i>t</i></u>	<u>Minimum</u>	<u>Maximum</u>
%CL Model	0.76	650	25	0.076646	0.480408
%CO Model	0.58	278	17	0.022593	0.340839
%SA Model	0.10	22	5	0.085519	0.329266
%TR Model	0.57	268	16	0.006671	0.323286

b. Central Office Equipment Models

Exhibit 4.5 lists those categories of Central Office Equipment that require models to calculate cost allocations. Direct assignment rules used for other categories are summarized in Exhibit 6.5.

To allocate costs to special access category for study areas providing DSL service outside of NECA's tariff, NECA developed average ratios (with outliers accommodated) for the combined COE Categories 4.11 + 4.12 and for COE Category 4.2. The data used for the average ratios came from Group C cost companies outside NECA's DSL tariff but reported DSL costs, as displayed in Appendix G1.

EXHIBIT 4.5

PART 69 – CENTRAL OFFICE EQUIPMENT ALLOCATION MODELS

COE Categories 1 + 2 + 3 + 4.3 - Operator Systems + Tandem Switching + Local Switching + Host/Remote Circuit

$$\begin{aligned}\%CL &= 0.00 \\ \%SA &= 0.00 \\ \%(\text{CO} + \text{TR}) &= 1.00\end{aligned}$$

Categories 4.11 + 4.12 - Exchange Circuit

If Special Access Revenues are not equal to zero:

$$\begin{aligned}\%CL &= 0.00 \\ \%CO &= 0.00 \\ \%SA &= 0.0645, \text{ if the study area provides DSL service outside NECA tariff, or} \\ &= 1.00, \text{ otherwise} \\ \%TR &= 0.00\end{aligned}$$

If Special Access Revenues equal zero:

$$\begin{aligned}\%CL &= 0.00 \\ \%CO &= 0.00 \\ \%SA &= 0.00 \\ \%TR &= 1.00\end{aligned}$$

Category 4.13 - Exchange Line Circuit Equipment Excluding Wideband

R^2 F t

If Special Access Revenues are not equal to zero:

$$\begin{aligned}\%CL &= 0.9945 - 0.000271 \times \text{Non-DSL Revenues per Line} & 0.08 & 16.80 & -4.10 \\ \%CO &= 0.00 \\ \%SA &= 0.005547 + 0.000271 \times \text{Non-DSL Revenues per Line} & 0.08 & 16.80 & 4.10 \\ \%TR &= 0.00\end{aligned}$$

If Special Access Revenues equal zero:

$$\begin{aligned}\%CL &= 1.00 \\ \%CO &= 0.00 \\ \%SA &= 0.00 \\ \%TR &= 0.00\end{aligned}$$

EXHIBIT 4.5 (Continued)

PART 69 – CENTRAL OFFICE EQUIPMENT ALLOCATION MODELS

Category 4.2 - Interexchange Circuit Equipment

If Special Access Revenues are not equal to zero:

$$\begin{aligned}\%CL &= 0.00 \\ \%CO &= 0.00 \\ \%SA &= 0.7069, \text{ if the study area provides DSL service outside NECA tariff, or} \\ &= 0.7287, \text{ otherwise} \\ \%TR &= 0.2713\end{aligned}$$

If Special Access Revenues equal zero:

$$\begin{aligned}\%CL &= 0.00 \\ \%CO &= 0.00 \\ \%SA &= 0.00 \\ \%TR &= 1.00\end{aligned}$$

c. Cable & Wire Facilities Models

Exhibit 4.6 lists all categories of Cable & Wire Facilities that require models. Categories not displayed are directly assigned by Part 69 rules as summarized in Exhibit 6.5.

In order to correctly allocate costs to special access category for study areas providing DSL inside and outside of the NECA's DSL tariff, the combined Category 2 and 3 models for special access were developed in two steps. First, a special access model for all study areas having costs in these accounts was developed by regression methods. Next, NECA created a Non-DSL special access allocation fraction for study areas providing DSL outside NECA's tariff as follows:

$$\begin{aligned}& \text{Non-DSL Allocation Fraction} \\ &= \frac{\text{Total Non-DSL C\&WF Cat 2 + 3}}{\text{Total Interstate C\&WF Cat 2 + 3}} \\ &= 0.4820\end{aligned}$$

This adjustment ratio, 0.4820, was calculated based on data of Group C cost companies outside NECA's DSL tariff but reported DSL costs, as displayed in Appendix G1. The model for study areas with DSL outside NECA's tariff equals the product of the special access model from the first step and this adjustment ratio.

EXHIBIT 4.6
PART 69 – CABLE & WIRE FACILITIES ALLOCATION MODELS

Categories 2 + 3 - Wideband and Exchange Trunk + Interexchange

R^2 F t_1 t_2 t_3

If Special Access Revenues are not equal to zero:

$$\begin{aligned}\%CL &= 0.00 \\ \%CO &= 0.00\end{aligned}$$

If study area provides DSL outside NECA tariff,

$$\begin{aligned}\%SA &= 0.4365 + 0.00114 \times \text{Non-DSL Revenues per Line} \\ &\quad + 0.1713 \times \text{Broadband-Only Lines per DSL Line}\end{aligned}$$

0.09 6.29 3.02 2.60 2.69

$$\begin{aligned}\%TR &= 0.0455 - 0.00114 \times \text{Non-DSL Revenues per Line} \\ &\quad - 0.1713 \times \text{Broadband-Only Lines per DSL Line}\end{aligned}$$

0.09 6.29 -3.02 -2.60 2.69

otherwise,

$$\begin{aligned}\%SA &= 0.8377 + 0.002366 \times \text{Non-DSL Revenues per Line} \\ &\quad + 0.3554 \times \text{Broadband-Only Lines per DSL Line}\end{aligned}$$

0.09 6.29 3.02 2.60 2.69

$$\begin{aligned}\%TR &= 0.1623 - 0.002366 \times \text{Non-DSL Revenues per Line} \\ &\quad - 0.3554 \times \text{Broadband-Only Lines per DSL Line}\end{aligned}$$

0.09 6.29 -3.02 -2.60 2.69

If Special Access Revenues equal zero:

$$\begin{aligned}\%CL &= 0.00 \\ \%CO &= 0.00 \\ \%SA &= 0.00 \\ \%TR &= 1.00\end{aligned}$$

Category 4 - Host/Remote Message

$$\begin{aligned}\%CL &= 0.00 \\ \%CO &= 0.00 \\ \%SA &= 0.00 \\ \%TR &= 1.00\end{aligned}$$

d. DSL/Non-DSL Revenue Requirement Allocation Model

NECA developed an allocation model to split special access revenue requirement into DSL and Non-DSL components based on cost companies' data. Data from the subset of 159 sample study areas in the NECA DSL tariff with non-zero DSL related costs as displayed in Appendix G2, was used to develop the model as follows:

DSL Revenue Requirement Allocation Factor

$$\begin{aligned}
 &= \frac{2015 \text{ DSL Revenue Requirement}}{2015 \text{ SA Revenue Requirement}} \\
 &= 0.2506 + 0.8039 \times \frac{2015 \text{ SA COE } 4.11+4.12}{2015 \text{ SA TPIS}} \\
 &\quad + 1.0576 \times \text{Broadband-Only Lines per DSL Line} \\
 &\quad + 0.0422 \times \text{Line Indicator(LI)}
 \end{aligned}$$

Where

LI = '0' if Line size <=1800 and '1' otherwise

$$R^2 = 0.58 \quad F = 70.08 \quad t_1 = 12.76 \quad t_2 = 6.99 \quad t_3 = 1.85$$

The above allocation factor is used to apportion special access revenue requirement to DSL category. Special access revenue requirements not allocated to DSL using this model were assigned to the Non-DSL category.

This model also served the purpose of deriving the DSL Voice-Data revenue requirement by removing the Broadband-Only costs included in the DSL accounts, as described below in Section IV.E.2.e.

e. DSL Voice-Data Revenue Requirement Development

The DSL/Non-DSL Revenue Requirement Allocation model in Section IV.E.2.d above includes the broadband-only portion of the DSL Allocation factor equal to 1.0576 multiplied by the company's Broadband-Only Lines per DSL Line. This portion was subtracted from the DSL model allocation for sample average schedule companies with broadband-only service, in order to remove the broadband-only costs from DSL revenue requirements. The remaining Voice-Data DSL revenue requirement was used in

the development of the DSL Voice-Data formula described in Section VII.D.2.a.

DSL Voice Data Revenue Requirement

$$= \frac{[DSL Revenue Requirement Allocation Factor - 1.0576 \times Broadband-Only Lines per DSL Line]}{Special Access Revenue Requirement}$$

Broadband-Only costs are recovered through the Consumer Broadband-Only Loop formula and the Broadband-Only Second Mile formula as described in Section VII.C.3 and VII.D.2.c. These formulas were not based on the average schedule sample companies' broadband-only costs but rather were developed based on cost companies' revenue requirements.

The separations and allocation models defined in Section IV.F above were used to develop the Part 36 and Part 69 costs for sample average schedule companies, as described in Section VI.

F. Additional Account Adjustments

NECA used cost study data to determine two account adjustment factors described below. These factors were used to develop average schedule revenue requirements as described in Section V.B.2.

1. Interest on Customer Deposits

Since sample average schedule companies do not provide separate subaccount data for Interest on Customer Deposits, this subaccount was imputed using cost companies' data. A factor of 0.002691 was calculated as the weighted average fraction of Interest on Customer Deposits to Interest and Related Items from sample 2015 cost study data. This factor was multiplied by Total Interest and Related Items of each sample average schedule company to produce its imputed Interest on Customer Deposits amount at Part 32 level.

2. Charitable Contributions

Because not all sample average schedule companies separately record amounts of Charitable Contributions, these amounts were imputed using cost companies' data. A factor was calculated as the sample weighted ratio of unseparated charitable contributions over unseparated Expenses and Other Taxes (EOT) from 2015 Cost Study data. The resulting factor of 0.0022 was multiplied by Part 32 EOT amount

of each sample average schedule company to produce its imputed charitable contribution amount at Part 32 level.

G. Cost Study Factors

Cost study factors were developed to calculate the average effective Federal Income Tax rate for total, interstate and each access category. To calculate these effective tax rates for average schedule companies, the 2015 cost study data of sample cost companies that are subject to federal income tax were used. These average effective tax rates are used to calculate Average Schedule Company Federal Income Tax in Section VI.D. The following method was used to calculate these rates. Results are shown in Exhibit 4.7.

$$\text{Average Effective Tax Rate} = \frac{\Sigma [(Grossed Up Federal Income Tax - (Investment Tax Credit + Deferred Tax Provision)) \times (Sample Weight)]}{\Sigma [(Net Return - Total Income Adjustments) \times (Sample Weight)]}$$

EXHIBIT 4.7
EFFECTIVE TAX RATES

<u>Category</u>	<u>Tax Rate</u>
Unseparated	0.294099
Interstate	0.278751
Common Line	0.273299
Central Office	0.248254
Special Access	0.287324
Transport	0.300075

V. DATA PROJECTIONS

A. Introduction

NECA used historical demand and accounting data from average schedule study areas to project account balances and demand necessary for the development of average schedule settlement formulas for the 2018/2019 test period. The data sources are described in Section III.

This study continues using a stratified method of account growth analysis. The sample companies were assigned to two strata, based on access line size, and a separate set of growth ratios was calculated for each stratum. This stratification improves the overall accuracy of account growth forecasts because account growth tends to vary according to company size.

For additional reliability, NECA computed stratified composite average accounting growth ratios by averaging 2016 Sample growth ratios with 2015 Sample growth ratios. These composite growth ratios were then applied to the accounts of individual sample study areas to calculate test period account values. A description of this method is included in Section V.B.

Test period demand projections used in formula regression models were based on trends measured from a multi-year history of the average schedule population. Historical demand data as reported to the NECA pool were used to develop growth models and calculate multi-year growth ratios. These multi-year growth ratios were applied to the average monthly base period demand value of each sample average schedule study area to calculate test period demand values. Sections V.C through V.E describe the use of these methods to forecast each demand variable. The forecasted data described in this section were used in the calculation of test period access category revenue requirements described in Section VI.E and in settlement formula regression models.

B. Account Forecasting

NECA calculated year over year growth ratios for each account in each access line stratum of the 2016 Sample, accommodated for outliers. To lower the variance found in growth ratios computed from a single sample, NECA used composite growth ratios developed by averaging the 2017 Study growth ratios

with those developed in the 2016 Study.¹⁵

1. Stratification of the 2016 Sample

NECA recognizes different growth trends by company size and continues to apply stratification in account growth analysis. Sample companies are assigned into two groups (Small/Large) based on access line sizes. The access line threshold is 2000 in this study.

2. Account Estimation

In order to include only telephone operating costs, NECA apportioned the Interest and Related Items account between the operating and non-operating categories. Related average schedule accounts and subaccounts were estimated using ratios from sample cost company data, as described below.

- Since sample average schedule companies do not provide separate subaccount data for Interest on Customer Deposits, this subaccount was derived by applying a factor of 0.002691 to Operating Interest and Related Items. This factor was derived for this purpose from sample cost company cost studies, as described in Section IV.F.1.
- The amount of Charitable Contributions included in Account 7370, Non-Operating Income and Expense, was derived based on the average ratio of Charitable Contributions to Expenses and Other Taxes reported by sample cost companies. The development of this ratio, 0.002200, can be found in Section IV.F.2.
- The amounts of State Income Taxes (SIT) for sample Subchapter S companies were derived based on the average ratios of SIT to Total Expense reported by other average schedule companies¹⁶ in the 2015 sample. The resulting factors of 0.016795 for 2015 accounts and 0.016052 for 2014

¹⁵ Accounting data supplied by the 2016 Average Schedule Sample are reported in Appendices C1 and C2. Accounting data supplied by the 2015 Average Schedule Sample are reported in Appendices C3 and C4.

¹⁶ NECA used the same method with 2015 Sample as documented in the 2016 Study. The factors used were 0.016918 for 2014 accounts and 0.016305 for 2013 accounts.

accounts were multiplied by Expense to calculate SIT for each sample Subchapter S study area. These calculated SIT amounts were excluded from calculating the Other Taxes growth rates.

3. Identification and Accommodation of Outliers

Annual growth ratios were calculated for Part 32 accounts using 2014 and 2015 accounting data from the 2016 Sample. To ensure no company's data exerted undue influence on these ratios, NECA applied an Outlier Accommodation Method, which reduced the relative weight of highly influential points while allowing them to be included in account growth ratio development.¹⁷

4. Account Groupings

To calculate growth ratios, NECA grouped some accounts as shown in Exhibit 5.1. A separate annual growth ratio was computed for each of the accounts using the combined ratio estimate technique, described in Section V.B.5. Entries in Exhibit 5.2 for groups of accounts show growth ratios which NECA applied to all accounts in the group.

¹⁷ *December 2016 Filing, Section IV.C.*

EXHIBIT 5.1

ACCOUNT GROUPINGS FOR GROWTH CALCULATION

Account Group	Accounts Included in Group	Part 32 Account Number
Accumulated Depreciation & Amortization	Accumulated Depreciation – Telecommunications Plant in Service Accumulated Depreciation – Held for Future Telecommunications Use Accumulated Amortization – Tangible Accumulated Amortization – Intangible Accumulated Amortization – Other	3100 3200 3400 3500 3600
Plant Specific Expense	Network Support Expense General Support Expense Central Office Equipment Expense Cable & Wire Facilities Expense	6110 6120 6210, 6220, 6230 6410
Plant Non-Specific Expense	Other Property, Plant and Equipment Expense Network Operations Expense	6510 6530
Customer Operations Expense	Marketing Expense Services Expense	6610 6620
Other Operating Taxes	Operating State and Local Income Taxes Operating Other Taxes	7230 7240
Net Deferred Income Taxes	Net Current Deferred Operating Income Taxes Net Non-Current Deferred Operating Income Taxes Other Jurisdictional Liabilities and Deferred Credits	4100 4340 4370
GSF and Tangibles	General Support Facilities Amortizable Tangible Assets	2110 2680
COE and Intangibles	Central Office Equipment Intangibles	2210-2230 2690

5. The 2016 Sample Stratified Annual Growth Ratios

NECA uses the combined ratio estimate technique to determine stratified annual growth ratios. For the 2016 Sample, the Stratified Annual Growth Ratios were calculated for each of the two strata using the following formula:

2016 Sample Stratified Annual Growth Ratio =

$$\frac{\sum_{\text{Stratum}_i} (\text{Sample Weight}_i \times \text{Variance Weight}_i \times 2015 \text{ Account Balance}_i)}{\sum_{\text{Stratum}_i} (\text{Sample Weight}_i \times \text{Variance Weight}_i \times 2014 \text{ Account Balance}_i)}$$

In addition, some accounts were projected using growth ratios of other accounts.

- 1) Total Telecommunications Plant growth rate was applied to Other Telecommunications Plant, Charitable Contributions, and Allowance for Funds Used during Construction. NECA defines Other Telecommunications Plant as the sum of Property Held for Future Telecommunications Use, Telecommunications Plant under Construction, and, Telecommunications Plant Adjustment.
- 2) Interest and Related Items growth rate was applied to Interest on Customer Deposit account.
- 3) Net Telecommunications Plant growth rate was applied to Other Non-Current Assets, and Other Long Term Liabilities.

Columns C and G of Exhibit 5.2 display the resulting 2016 Sample Stratified Annual Growth Ratios for each of the two access line size strata.

EXHIBIT 5.2

AVERAGE SCHEDULE ACCOUNT GROWTH RATIOS

	Small Study Areas (Access Lines ≤ 2,000)			
	(A) 2015 Sample Annual Growth	(B) 2015 Sample Adjusted Growth	(C) 2016 Sample Annual Growth	(D) 2016 Composite Growth
Account				
Telecommunications Plant In Service	1.0314	1.0304	1.0312	1.0308
Land & Support Assets	0.9974	0.9974	1.0207	1.0090
Central Office Equipment	0.9934	0.9934	0.9957	0.9945
Cable & Wire Facilities	1.0662	1.0621	1.0530	1.0575
Tangible Assets	0.9974	0.9974	1.0207	1.0090
Intangibles	0.9934	0.9934	0.9957	0.9945
Materials And Supplies	1.2513	1.2008	1.0968	1.1488
Other Telecommunications Plant	1.0328	1.0318	1.0316	1.0317
Total Telecommunications Plant	1.0328	1.0318	1.0316	1.0317
Other Non-Current Assets	1.0394	1.0379	1.0466	1.0423
Accum. Depreciation & Amortization	1.0325	1.0315	1.0260	1.0287
Net Telecommunications Plant	1.0394	1.0379	1.0466	1.0423
Net Deferred Operating Income Tax	0.9380	0.9339	0.9832	0.9586
Plant Specific Expense	0.9896	0.9895	0.9981	0.9938
Plant Non-specific Expense	0.9794	0.9790	1.0190	0.9990
Customer Service Expense	0.9801	0.9797	1.0260	1.0028
General & Administrative Expense	0.9646	0.9633	1.0227	0.9930
Depreciation & Amortization Expense	1.0467	1.0446	0.9821	1.0134
Charitable Contributions	1.0328	1.0318	1.0316	1.0317
Interest & Related Items	1.0762	1.0708	0.8173	0.9441
Interest On Customer Deposits	1.0762	1.0708	0.8173	0.9441
Other Long Term Liabilities	1.0394	1.0379	1.0466	1.0423
Federal Investment Tax Credits	1.0394	1.0379	1.0466	1.0423
Other Operating Taxes	1.0175	1.0172	1.0984	1.0578
Allow. For Funds Used During Const.	1.0328	1.0318	1.0316	1.0317
Expenses & Other Taxes	0.9946	0.9946	1.0051	0.9998
Revenue Requirement	1.0050	1.0050	1.0169	1.0109

EXHIBIT 5.2

AVERAGE SCHEDULE ACCOUNT GROWTH RATIOS

(Continued)

Account	Large Study Areas (Access Lines > 2,000)			
	(E) 2015 Sample Annual Growth	(F) 2015 Sample Adjusted Growth	(G) 2016 Sample Annual Growth	(H) 2016 Composite Growth
Telecommunications Plant In Service	1.0253	1.0247	1.0366	1.0306
Land & Support Assets	1.0149	1.0147	1.0077	1.0112
Central Office Equipment	1.0061	1.0061	1.0195	1.0128
Cable & Wire Facilities	1.0410	1.0394	1.0519	1.0456
Tangible Assets	1.0149	1.0147	1.0077	1.0112
Intangibles	1.0061	1.0061	1.0195	1.0128
Materials And Supplies	0.9278	0.9222	0.9577	0.9399
Other Telecommunications Plant	1.0245	1.0239	1.0357	1.0298
Total Telecommunications Plant	1.0245	1.0239	1.0357	1.0298
Other Non-Current Assets	1.0040	1.0040	1.0168	1.0104
Accum. Depreciation & Amortization	1.0309	1.0300	1.0457	1.0378
Net Telecommunications Plant	1.0040	1.0040	1.0168	1.0104
Net Deferred Operating Income Tax	1.0496	1.0473	0.8672	0.9572
Plant Specific Expense	0.9725	0.9717	1.0428	1.0073
Plant Non-specific Expense	1.0948	1.0866	1.0314	1.0590
Customer Service Expense	1.0156	1.0154	1.0357	1.0255
General & Administrative Expense	0.9793	0.9789	1.0880	1.0334
Depreciation & Amortization Expense	1.0372	1.0359	1.0468	1.0413
Charitable Contributions	1.0245	1.0239	1.0357	1.0298
Interest & Related Items	0.9211	0.9143	0.8187	0.8665
Interest On Customer Deposits	0.9211	0.9143	0.8187	0.8665
Other Long Term Liabilities	1.0040	1.0040	1.0168	1.0104
Federal Investment Tax Credits	1.0040	1.0040	1.0168	1.0104
Other Operating Taxes	0.9075	0.8981	0.9649	0.9315
Allow. For Funds Used During Const.	1.0245	1.0239	1.0357	1.0298
Expenses & Other Taxes	1.0079	1.0078	1.0506	1.0292
Revenue Requirement	1.0036	1.0036	1.0430	1.0233

6. The 2017 Study Stratified Composite Growth Ratios

NECA uses composite growth ratios from two annual samples to provide more stable account growth estimates and reduce statistical variance. Derivation of composite growth rates entails adjusting 2015 Sample annual straight line growth ratios to the next year, and averaging these adjusted growth ratios with the 2016 Sample Stratified Growth Ratios.

A composite growth ratio is the arithmetic average of the Adjusted 2015 Sample Stratified Annual Growth Ratio and the related 2016 Sample Stratified Annual Growth Ratio.

An example of the composite growth ratio calculation using the growth in COE investment reported by study areas with less than or equal to 2,000 access lines is shown below.

2017 Study Stratified Composite Growth Ratio for Stratum 1

$$\begin{aligned} &= [(Adjusted\ 2015\ Stratified\ Stratum_1\ Growth\ Ratio \\ &\quad +\ 2016\ Stratified\ Stratum_1\ Annual\ Growth\ Ratio) / 2] \\ &= [(0.9934 + 0.9957) / 2] \\ &= 0.9945 \end{aligned}$$

The 2017 Study Stratified Composite Growth Ratios are displayed in Columns D and H of Exhibit 5.2.

7. Stratified Multi-Year Growth Ratios

NECA derived stratified multi-year growth ratios to estimate test period costs from the historical accounting data submitted by study areas. For the 2014 accounts submitted by the 2015 Sample, the multi-year growth rates reflect the fact that the test period extends four and one-half years beyond the end of 2014. For accounts submitted by the 2016 Sample multi-year growth ratios reflect three and one-half years between the end of 2015 and the test period. The calculation for multi-year growth ratios is as follows:

For 2015 Accounts:

$$\begin{aligned} &2015 \text{ Stratified Multi-Year Growth Ratio}_i = \\ &1 + [(2017 \text{ Study Stratified Composite Growth Ratio}_i - 1) \times 3.5] \end{aligned}$$

For 2014 Accounts:

$$\begin{aligned} &2014 \text{ Stratified Multi-Year Growth Ratio}_i = \\ &1 + [(2016 \text{ Study Stratified Composite Growth Ratio}_i - 1) \times 4.5] \end{aligned}$$

8. Account Forecasting

NECA prepared a forecast of each account for each sample study area. The forecasted data represents the average month of the test period. Study areas supplying 2014 data were separated into access line size groups based on the number of lines reported for December 2014. The forecasted amounts in each group were computed by multiplying the 2014 account balance by the 2014 Stratified Multi-Year Growth Ratio by group. Similarly, study areas supplying 2015 data from the 2016 Sample were separated into access line groups using December 2015 access line count, projected to the test period by multiplying the 2015 account balance by the corresponding multi-year growth ratio.

Study Area Forecast of 2015 Account =

$$(Study \text{ Area } 2015 \text{ Account Value}) \times (2015 \text{ Stratified Multi-Year Growth Ratio}_i)$$

Study Area Forecast of 2014 Account =

$$(Study \text{ Area } 2014 \text{ Account Value}) \times (2014 \text{ Stratified Multi-Year Growth Ratio}_i)$$

Section VI.E describes the computation of revenue requirements using forecasted accounts.

C. Stratified Access Line Forecasting

NECA forecasted access lines of sample study areas using Stratified Access Line Growth Ratios, which measure the relative growth of access lines from the average month of the base period to the average month of the test period within each stratum of average schedule companies. NECA used 1,000 and 7,500 access lines as thresholds to group sample study areas, same as in last year's study. Stratified models of

access line trends were developed by fitting a regression time series model to historical monthly access line values of the average schedule study areas in each stratum. A historical time period of 36 months from July 2014 through June 2017 was used to develop the models. Then NECA derived the following models and access line growth ratios, using the regression data displayed in Exhibit 5.3, to estimate base period to test period growth for the average schedule population:

If Access Lines are less than or equal to 1,000

$$\text{Monthly Access Lines} = 80,466 - 199.24 \times \text{Month Sequence}$$

$$R^2 = 0.9777 \quad t\text{-statistic for Intercept} = 735.26 \quad F\text{-statistic} = 1,492.03$$

$$t\text{-statistic for Month Sequence} = -38.63$$

If Access Lines are greater than 1,000 but less than or equal to 7,500

$$\text{Monthly Access Lines} = 290,439 - 739.93 \times \text{Month Sequence}$$

$$R^2 = 0.9875 \quad t\text{-statistic for Intercept} = 957.71 \quad F\text{-statistic} = 2,679.89$$

$$t\text{-statistic for Month Sequence} = -51.77$$

If Access Lines are greater than 7,500

$$\text{Monthly Access Lines} = 277,968 - 1,055.32 \times \text{Month Sequence}$$

$$R^2 = 0.9910 \quad t\text{-statistic for Intercept} = 761.45 \quad F\text{-statistic} = 3,762.17$$

$$t\text{-statistic for Month Sequence} = -61.34$$

Using these access line regression models, each of the Stratified Access Line Growth Ratios were computed by calculating the average month sequence number for the Base Period and Test Period and evaluating the models at these points:

$$\text{Average of Month Sequence Numbers in Test Period (July 2018 to June 2019)} = 54.5$$

$$\text{Average of Month Sequence Numbers in Base Period (July 2016 to June 2017)} = 30.5$$

2 Year Access Line Growth Ratio for Study Areas with Access Lines less than or equal to 1,000

$$\begin{aligned} &= \frac{\text{Access Line Modeled Avg. Month of 7/18 – 6/19}}{\text{Access Line Modeled Avg. Month of 7/16 – 6/17}} \\ &= \frac{69,607.8 \text{ Access Lines}}{74,389.5 \text{ Access Lines}} \\ &= 0.93572 \end{aligned}$$

2 Year Access Line Growth Ratio for Study Areas with Access Lines greater than 1,000 but less than or equal to 7,500

$$\begin{aligned} &= \frac{\text{Access Line Modeled Avg. Month of 7/18 – 6/19}}{\text{Access Line Modeled Avg. Month of 7/16 – 6/17}} \\ &= \frac{250,112.7 \text{ Access Lines}}{267,871.1 \text{ Access Lines}} \\ &= 0.93371 \end{aligned}$$

2 Year Access Line Growth Ratio for Study Areas with Access Lines greater than 7,500

$$\begin{aligned} &= \frac{\text{Access Line Modeled Avg. Month of 7/18 – 6/19}}{\text{Access Line Modeled Avg. Month of 7/16 – 6/17}} \\ &= \frac{220,453.1 \text{ Access Lines}}{245,780.8 \text{ Access Lines}} \\ &= 0.89695 \end{aligned}$$

Next, average monthly base period access lines were computed for each sample study area, using the September 2017 view of data from July 2016 through June 2017. Each sample company was then assigned to a stratum based on its access line size. Access lines for each sample study area were projected by multiplying its base period access lines by its Stratified Access Line Growth Ratio, displayed in Appendix D1.

EXHIBIT 5.3

DEMAND DATA USED IN ACCESS LINES TIME SERIES MODELS

DATE	Month Sequence	Access Lines By Line Size Group		
		Small (Access Lines < 1,000)	Medium (7,500 ≥ Access Lines ≥ 1,000)	Large (Access Lines > 7,500)
201407	1	81,162	291,370	276,687
201408	2	80,881	290,619	275,209
201409	3	80,240	289,462	274,329
201410	4	79,878	288,568	273,605
201411	5	79,610	287,152	272,542
201412	6	79,180	285,705	271,437
201501	7	78,842	284,496	270,074
201502	8	78,574	283,810	269,491
201503	9	78,527	283,243	269,315
201504	10	78,337	282,321	268,914
201505	11	78,282	282,003	268,890
201506	12	77,966	281,482	267,806
201507	13	77,546	280,781	266,847
201508	14	77,361	280,065	262,530
201509	15	77,084	279,235	261,813
201510	16	76,874	278,405	260,923
201511	17	76,648	277,074	258,710
201512	18	76,550	275,490	257,549
201601	19	76,311	274,425	256,130
201602	20	76,278	274,093	255,445
201603	21	76,169	274,151	254,788
201604	22	75,990	273,061	253,583
201605	23	75,842	272,870	253,352
201606	24	75,761	272,525	252,565
201607	25	75,502	272,334	251,570
201608	26	75,292	271,765	250,137
201609	27	75,028	271,058	249,152
201610	28	74,997	271,265	248,843
201611	29	74,682	269,074	247,426
201612	30	74,469	268,615	245,469
201701	31	74,309	267,842	245,517
201702	32	74,198	266,825	244,446
201703	33	73,962	266,343	243,558
201704	34	74,179	265,660	242,284
201705	35	74,018	265,290	242,153
201706	36	73,565	264,533	240,919

D. DSL Lines and DSL Voice-Data Lines Models

DSL lines and DSL Voice-Data lines were forecasted to the July 2018 – June 2019 test period. The forecasts were based on time series regression models using 36-month data series of the average schedule study areas from July 2014 through June 2017. These data are shown in Exhibit 5.4. In each model the Month Sequence variable with values of 1 through 36 was used to represent time. The regression models and the corresponding two-year growth ratios are shown below.

$$\text{Monthly DSL Lines} = 140,128 + 384.56 \times \text{Month Sequence}$$

$$R^2 = 0.9875 \quad t\text{-statistic for Intercept} = 889.96 \quad F\text{-statistic} = 2,685.35 \\ t\text{-statistic for Month Sequence} = 51.82$$

$$\text{Monthly DSL Voice-Data Lines} = 135,085 + 267.16 \times \text{Month Sequence}$$

$$R^2 = 0.9719 \quad t\text{-statistic for Intercept} = 817.54 \quad F\text{-statistic} = 1,176.88 \\ t\text{-statistic for Month Sequence} = 34.31$$

The DSL lines and DSL Voice-Data Lines Growth Ratios were computed by calculating the average month sequence number for the Base Period and Test Period and evaluating the models at these points.

$$\text{Average of Month Sequence Numbers from July 2018 to June 2019 Test Period} = 54.5$$

$$\text{Average of Month Sequence Numbers from July 2016 to June 2017 Base Period} = 30.5$$

2 Year DSL Lines Growth Ratio

$$= \frac{\text{DSL Lines Modeled Avg. Month of 7/18 - 6/19}}{\text{DSL Lines Modeled Avg. Month of 7/16 - 6/17}} \\ = \frac{161,086.3 \text{ DSL Lines}}{151,856.8 \text{ DSL Lines}} \\ = 1.06078$$

2 Year DSL Voice-Data Lines Growth Ratio

$$\begin{aligned} &= \frac{\text{DSL Voice-Data Lines Modeled Avg. Month of 7/18 - 6/19}}{\text{DSL Voice-Data Lines Modeled Avg. Month of 7/16 - 6/17}} \\ &= \frac{149,645.2 \text{ DSL Voice-Data Lines}}{143,233.3 \text{ DSL Voice-Data Lines}} \\ &= 1.04477 \end{aligned}$$

Average monthly base period DSL lines and DSL Voice-Data lines were then computed for each sample study area, using the September 2017 view of data from July 2016 through June 2017. DSL lines and DSL Voice-Data lines for each sample study area were projected by multiplying its base period DSL Voice-Data lines by the above two-year growth ratios, displayed in Appendix D1.

NECA did not develop a growth model separately for DSL Broadband-Only lines because there are insufficient data points for a meaningful time series model and the Consumer Broadband-Only Loops (CBOL) settlement formula is derived from the Common Line formula as described in Section VII.C.3.

EXHIBIT 5.4**DEMAND DATA USED IN SPECIAL ACCESS DSL LINES AND DSL VOICE-DATA LINES**
TIME SERIES MODELS

Month	Month Sequence	DSL Lines	Voice-Data DSL Lines
201407	1	140,690	135,510
201408	2	141,338	136,163
201409	3	141,661	136,385
201410	4	140,746	135,348
201411	5	141,467	135,975
201412	6	141,740	136,148
201501	7	142,070	136,404
201502	8	142,797	137,088
201503	9	143,635	137,825
201504	10	144,106	138,261
201505	11	144,660	138,593
201506	12	144,903	138,846
201507	13	145,206	139,056
201508	14	145,604	139,381
201509	15	146,233	139,884
201510	16	146,394	139,229
201511	17	146,388	138,911
201512	18	147,164	139,527
201601	19	147,319	139,362
201602	20	148,090	140,011
201603	21	148,899	140,483
201604	22	149,328	140,727
201605	23	149,642	140,846
201606	24	150,161	141,199
201607	25	150,445	141,853
201608	26	150,359	141,514
201609	27	150,638	141,650
201610	28	150,720	143,241
201611	29	150,948	143,285
201612	30	151,517	143,651
201701	31	151,452	143,437
201702	32	151,851	143,583
201703	33	152,469	143,911
201704	34	153,190	144,559
201705	35	153,526	144,723
201706	36	153,358	144,416

E. Special Access Non-DSL Revenue Forecasting

1. Non-DSL Revenue Data Adjustments

In this study, NECA used historical Special Access Non-DSL revenue data reported to settlements from July 2014 to June 2017 to build a times series growth model. NECA applied two types of adjustments to the reported data. First, NECA expressed the historical revenues in terms of rates in effect in December 2017. Non-DSL special access reported revenues were further adjusted by rate band adjustment factors. According to NECA's Tariff, study areas charge different special access rates according to their Non-DSL band assignments. Non-DSL revenues reported to NECA, thus, reflect a discount or premium relative to the uniform rate. For the purposes of the average schedule study, the band rate effect was removed from the reported revenues in order to express the revenues at the uniform rate level.

Both Non-DSL uniform rate and rate band adjustment factors reflect special access rates and band assignments which became effective on July 1, 2017,¹⁸ and in effect at the time of this filing.

2. Non-DSL Revenue Growth Model

NECA developed stratified time series growth models for Non-DSL revenues by three Non-DSL revenues per exchange groups at break points 550 and 1,000. The time series regression models were fit to the 36-month data series of adjusted Non-DSL revenues of the average schedule study areas, using data from July 2014 through June 2017. This data is shown in Exhibit 5.5. In each model, the Month Sequence variable with values of 1 through 36 was used to represent time. The three regression models and the corresponding two-year growth ratios are given below.

¹⁸ NECA Tariff FCC No. 5, Transmittal No. 1519 (filed June 16, 2017).

If Non-DSL Revenues Per Exchange are less than or equal to 550

$$\text{Monthly Non-DSL Revenues} = 45,608 - 1,407.58 \times \text{Month Sequence} \\ + 1,333.52 \times \text{Trend Change Indicator}$$

Trend Change Indicator = 0, from Jul. 2014 to Jun. 2015
Trend Change Indicator = 1 for Jul. 2015, 2 for Aug. 2015, etc.

$$R^2 = 0.8112 \quad t\text{-statistic for Intercept} = 32.17 \quad F\text{-statistic} = 70.88 \\ t\text{-statistic for Month Sequence} = -9.04 \\ t\text{-statistic for Trend Change Indicator} = 6.73$$

If Non-DSL Revenues Per Exchange are greater than 550 but less than or equal to 1,000

$$\text{Monthly Non-DSL Revenues} = 36,688 - 400.34 \times \text{Month Sequence} \\ + 250.01 \times \text{Trend Change Indicator}$$

Trend Change Indicator = 0, from Jul. 2014 to Aug. 2015
Trend Change Indicator = 1 for Sept. 2015, 2 for Oct. 2015, etc.

$$R^2 = 0.7424 \quad t\text{-statistic for Intercept} = 46.45 \quad F\text{-statistic} = 47.56 \\ t\text{-statistic for Month Sequence} = -5.21 \\ t\text{-statistic for Trend Change Indicator} = 2.34$$

If Non-DSL Revenues Per Exchange are greater than 1,000

$$\text{Monthly Non-DSL Revenues} = 5,717,019 - 59,383 \times \text{Month Sequence} \\ + 16,706 \times \text{Trend Change Indicator}$$

Trend Change Indicator = 0, from Jul. 2014 to Feb. 2015
Trend Change Indicator = 1 for Mar. 2015, 2 for Apr. 2015, etc.

$$R^2 = 0.9510 \quad t\text{-statistic for Intercept} = 73.83 \quad F\text{-statistic} = 320.24 \\ t\text{-statistic for Month Sequence} = -5.03 \\ t\text{-statistic for Trend Change Indicator} = 1.27$$

The Non-DSL Revenue Growth Ratios were computed by calculating the average month sequence number for the Base Period and Test Period and evaluating the models at these points.

Average of Month Sequence Numbers from July 2018 to June 2019 Test Period = 54.5

Average of Month Sequence Numbers from July 2016 to June 2017 Base Period = 30.5

2 Year Non-DSL Revenue Growth Ratio with Non-DSL Revenues Per Exchange less than or equal to 550

$$\begin{aligned} &= \frac{\text{Non-DSL Revenue Modeled Avg. Month of 7/18 - 6/19}}{\text{Non-DSL Revenue Modeled Avg. Month of 7/16 - 6/17}} \\ &= \frac{25,569.5 \text{ Non-DSL Revenues}}{27,347.1 \text{ Non-DSL Revenues}} \\ &= 0.93500 \end{aligned}$$

2 Year Non-DSL Revenue Growth Ratios for Study Areas with Non-DSL Revenues Per Exchange greater than 550 but less than or equal to 1,000

$$\begin{aligned} &= \frac{\text{Non-DSL Revenue Modeled Avg. Month of 7/18 - 6/19}}{\text{Non-DSL Revenue Modeled Avg. Month of 7/16 - 6/17}} \\ &= \frac{24,995.2 \text{ Non-DSL Revenues}}{28,603.1 \text{ Non-DSL Revenues}} \\ &= 0.87387 \end{aligned}$$

2 Year Non-DSL Revenue Growth Ratio for Study Areas with Non-DSL Revenues Per Exchange greater than 1,000

$$\begin{aligned} &= \frac{\text{Non-DSL Revenue Modeled Avg. Month of 7/18 - 6/19}}{\text{Non-DSL Revenue Modeled Avg. Month of 7/16 - 6/17}} \\ &= \frac{3,257,485.5 \text{ Non-DSL Revenues}}{4,281,729.6 \text{ Non-DSL Revenues}} \\ &= 0.76079 \end{aligned}$$

Average monthly base period adjusted Non-DSL revenues were then computed for each sample study area using the September 2017 view of data from July 2016 through June 2017. The adjusted Non-DSL revenues for each sample study area were projected by multiplying the base period values by the above two-year growth ratio, displayed in Appendix D1.

EXHIBIT 5.5

DEMAND DATA USED IN SPECIAL ACCESS NON-DSL REVENUE TIME SERIES MODEL

Month	Month Sequence	Non-DSL Revenue By Non-DSL Revenue Per Exchange Group		
		Non-DSL Revenue Per Exchange <= 550	550 < Non-DSL Revenue Per Exchange <= 1,000	Non-DSL Revenue Per Exchange > 1,000
201407	1	51,468	35,757	5,564,947
201408	2	38,117	35,842	5,635,812
201409	3	40,201	37,597	5,809,922
201410	4	39,120	34,495	5,433,831
201411	5	38,177	32,593	5,348,396
201412	6	35,890	29,665	5,160,693
201501	7	35,663	34,993	5,167,381
201502	8	35,066	35,548	5,199,113
201503	9	28,468	36,443	5,093,143
201504	10	32,929	33,237	4,995,359
201505	11	33,071	34,685	4,986,892
201506	12	34,768	32,401	5,079,985
201507	13	26,015	30,095	5,081,061
201508	14	29,286	29,659	5,012,490
201509	15	25,830	27,749	5,010,124
201510	16	25,706	31,587	5,067,864
201511	17	25,320	31,197	4,975,091
201512	18	27,683	30,987	4,903,053
201601	19	29,609	31,414	4,847,803
201602	20	29,859	30,641	4,767,689
201603	21	29,581	29,644	4,731,639
201604	22	29,217	29,628	4,767,257
201605	23	28,805	29,386	4,678,189
201606	24	27,622	29,608	4,711,222
201607	25	26,094	29,484	4,617,845
201608	26	25,083	29,955	4,539,787
201609	27	29,155	28,583	4,495,020
201610	28	28,321	28,183	4,334,838
201611	29	27,674	27,385	4,306,611
201612	30	28,733	28,309	4,251,252
201701	31	27,903	28,925	4,235,058
201702	32	28,626	28,440	4,137,168
201703	33	27,074	28,524	4,166,069
201704	34	26,677	28,462	3,961,130
201705	35	25,420	27,966	3,944,933
201706	36	26,272	28,336	4,027,752

VI. AVERAGE SCHEDULE COMPANY PART 36 AND PART 69 COSTS

A. Introduction

Section VI describes the calculation of separated (Part 36) and allocated (Part 69) accounts for each sample average schedule study area. Allocated accounts were used to develop the Part 69 access category revenue requirements on which test period settlement formulas are based, as explained in Section VII. In order to complete these calculations, NECA used the separations and allocation factor models developed in Section IV, and the test period unseparated accounts and demand forecasts, described in Section V.

B. Separation of Part 32 Accounts

NECA first computed the interstate portion of each test period Part 32 account for each sample average schedule company, using the separations models developed from sample cost company data, displayed in Exhibit 4.2.

Because the portion of an account belonging to a category changes as new facilities are deployed in response to demand changes, NECA used projected test period access lines and projected special access demand of sample average schedule companies to evaluate the models which were based on these demand elements. Like in prior studies, NECA used historical switched access minutes per access line instead of projected demand to evaluate the combined switched category separation model (COE Categories 1 + 2 + 3 + 4.3).

Each separations model was used to calculate a fraction for each sample average schedule study area, which is the ratio of the interstate cost in an account, category or sub-account to the corresponding total unseparated, uncategorized cost. The fraction was multiplied by the sample study area's test period corresponding account value to calculate the interstate value of the account or category during the test period. One of the three methods¹⁹ described in the following subsections was used to compute the interstate percentage of each account or category.

¹⁹ *December 2016 Filing, Section VI.B.*

1. Direct Separations Calculations - Average Separations Fractions
2. Direct Separations Calculations - Regression Model Separations Fractions
3. Indirect Separations Calculations

Exhibit 6.1 summarizes the separated and unseparated accounts of sample average schedule study areas. All amounts are weighted sums of costs in accounts and categories using sample weights. Individual study area accounts separated by these methods were next allocated to access categories as described in Section VI.C.

EXHIBIT 6.1

WEIGHTED CATEGORIZATION AND INTERSTATE SEPARATIONS RESULTS

<u>Account</u>	<u>Weighted Total Cost</u>	<u>Average Interstate Proportion</u>	<u>Weighted Separated Cost</u>
Telecommunications Plant in Service	\$3,801,700,009	35.39%	\$1,345,484,912
General Support Facilities	\$461,688,271	35.51%	\$163,924,213
Central Office Equipment	\$1,094,991,913	47.30%	\$517,941,869
COE Cat 1 + 2 + 3 + 4.3		9.87%	\$108,037,625
COE Cat 4.11 + 4.12		18.76%	\$205,434,802
COE Cat 4.13		11.69%	\$128,004,555
COE Cat 4.2		6.98%	\$76,464,887
Cable & Wire Facilities	\$2,233,481,179	29.53%	\$659,511,386
C&WF Cat 1.2		0.14%	\$3,018,123
C&WF Cat 1.3		22.44%	\$501,193,177
C&WF Cat 2 + 3		6.80%	\$151,928,762
C&WF Cat 4		0.15%	\$3,371,324
Tangibles	\$1,575,037	41.99%	\$661,322
Intangibles	\$9,963,609	34.59%	\$3,446,122
Materials and Supplies	\$31,274,523	29.59%	\$9,254,876
Other Telecommunications Plant	\$75,178,717	35.48%	\$26,672,544
Other Non-Current Assets	\$1,771,298	36.72%	\$650,334
Cash Working Capital	\$16,582,445	36.53%	\$6,058,038
Accumulated Depreciation	\$2,743,827,184	36.64%	\$1,005,384,919
Accumulated Amortization	\$1,404,101	42.97%	\$603,338
Net Deferred Operating FIT	\$82,905,874	38.29%	\$31,744,659
Network Support Expense	\$3,808,899	34.72%	\$1,322,552
General Support Expense	\$25,622,407	35.54%	\$9,104,963
COE Expense	\$46,653,460	47.80%	\$22,301,717
C&WF Expense	\$53,748,424	29.61%	\$15,916,891
Other Property & Plant Expense	\$4,195,767	34.97%	\$1,467,149
Network Operations Expense	\$41,016,519	35.35%	\$14,500,652
Depreciation & Amortization Expense	\$155,789,172	37.10%	\$57,796,271
Marketing Expense	\$11,100,384	32.60%	\$3,618,725
Services Expense	\$59,836,069	34.37%	\$20,565,657
General & Administration Expense	\$114,021,693	39.02%	\$44,496,819
Charitable Contributions	\$514,689	41.77%	\$214,990
Interest & Related Items	\$3,500,130	33.14%	\$1,159,827
Interest on Customer Deposits	\$9,412	35.09%	\$3,302
Other Long-Term Liabilities	\$37,716,752	36.33%	\$13,703,626
Federal Income Taxes	\$23,862,819	29.22%	\$6,972,003
Investment Tax Credits	\$0	0.00%	\$0
Other Operating Taxes	\$14,611,897	37.27%	\$5,446,335
Allowance for Funds Used During Construction	\$1,002,519	31.95%	\$320,286
Expenses & Other Taxes	\$530,928,790	37.06%	\$196,756,023
Average Net Investment	\$1,066,186,779	31.92%	\$340,346,402
Revenue Requirement	\$665,738,703	35.92%	\$239,144,112

C. Allocation of Interstate Costs to Access Categories

In order to determine each sample study area's revenue requirements, NECA allocated its interstate costs to the access categories defined in Part 69 of the Commission's rules. The computation of access category allocation factors relied on:

- Cost company allocation factor models described in Exhibits 4.4, 4.5 and 4.6
- Study area access lines and special access demand forecasted to the test period
- Study area historical switched access minutes
- Direct and indirect allocation methods, as per Part 69 of the Commission's rules

Selected categories of interstate investment were directly assigned to access categories. These assignments are summarized in Exhibit 6.2.

EXHIBIT 6.2

INTERSTATE INVESTMENT DIRECTLY ASSIGNED TO ACCESS CATEGORIES

<u>Investment Category</u>	<u>Access Category</u>
COE Category 4.11 + 4.12	Special Access
C&WF Category 1.2	Special Access
C&WF Category 1.3	Common Line

Access category assignments for certain categories of expense and investment were calculated using allocation factor models that do not depend on assignment of other accounts. This computation was performed on Net Deferred Income Taxes, combined COE Categories 1, 2, 3 & 4.3, COE Categories 4.11 & 4.12, COE Category 4.13 and COE Category 4.2 and for C&WF Categories 2, 3 and 4. Models used in these calculations are displayed in Exhibits 4.4, 4.5 and 4.6.

Proportionate assignments of some accounts were made depending on the assignment of other accounts, as displayed in Exhibit 6.3. The access allocation results and factors are displayed in Exhibit 6.4 and Exhibit 6.5.

EXHIBIT 6.3

PROPORTIONATE ALLOCATION OF ACCOUNTS TO ACCESS CATEGORIES

<u>Account</u>	<u>Allocation Basis</u>
General Support Facilities	Combined COE and C&WF Investment ²⁰
Tangibles	Combined COE and C&WF Investment
Intangibles	Combined COE and C&WF Investment
Materials and Supplies	Telecommunications Plant in Service
Other Telecommunications Plant	Telecommunications Plant in Service
Other Non-Current Assets	Big Three Expenses
Accumulated Depreciation	Telecommunications Plant in Service
Accumulated Amortization	Telecommunications Plant in Service
Network Support Expense	Telecommunications Plant in Service
General Support Expense	General Support Facilities
Central Office Expense	Combined Central Office Investment
C&WF Expense	Cable & Wire Facilities
Other Property, Plant & Equipment Expense	General Support Facilities
Network Operations Expense	General Support Facilities
Depreciation and Amortization Expense	Telecommunications Plant in Service
Marketing Expense	General Support Facilities
Services Expense	Telecommunications Plant in Service
Executive & Planning Expense	Big Three Expenses
General & Administrative Expense	Big Three Expenses
Contributions	Big Three Expenses
Interest & Related Items	General Support Facilities
Interest on Customer Deposits	Net Telecommunications Plant
Other Long Term Liabilities	Big Three Expenses
Other Operating Taxes ²¹	General Support Facilities
Allow. for Funds Used During Construction	Telecommunications Plant in Service

²⁰ See Section IV.B.2 for a description of the allocation of some General Support Facilities costs to the Billing and Collection Category.

²¹ Includes Operating Other Taxes plus Operating State and Local Income Taxes.

EXHIBIT 6.4

WEIGHTED ACCESS CATEGORY ALLOCATION RESULTS

<u>Account</u>	<u>Interstate</u>	<u>Common Line</u>	<u>Special Access</u>
Telecommunications Plant in Service	\$1,345,484,912	\$717,693,926	\$298,058,580
General Support Facilities	\$163,924,213	\$87,288,167	\$37,563,830
Central Office Equipment	\$517,941,869	\$127,114,602	\$161,421,624
COE Cat 1 + 2 + 3 + 4.3	\$108,037,625	\$0	\$0
COE Cat 4.11 + 4.12	\$205,434,802	\$0	\$105,855,395
COE Cat 4.13	\$128,004,555	\$127,114,602	\$895,587
COE Cat 4.2	\$76,464,887	\$0	\$54,670,642
Cable & Wire Facilities	\$659,511,386	\$501,193,177	\$98,298,291
C&WF Cat 1.2	\$3,018,123	\$0	\$3,018,123
C&WF Cat 1.3	\$501,193,177	\$501,193,177	\$0
C&WF Cat 2 + 3	\$151,928,762	\$0	\$95,280,167
C&WF Cat 4	\$3,371,324	\$0	\$0
Tangibles	\$661,322	\$285,867	\$266,912
Intangibles	\$3,446,122	\$1,812,113	\$507,924
Materials and Supplies	\$9,254,876	\$5,166,492	\$2,066,782
Other Telecommunications Plant	\$26,672,544	\$14,332,109	\$7,803,036
Other Non-Current Assets	\$650,334	\$315,983	\$117,966
Cash Working Capital	\$6,058,038	\$2,893,268	\$1,266,998
Accumulated Depreciation	\$1,005,384,919	\$502,807,764	\$230,934,745
Accumulated Amortization	\$603,338	\$253,079	\$256,624
Net Deferred Operating FIT	\$31,744,659	\$15,500,917	\$11,386,746
Network Support Expense	\$1,322,552	\$723,557	\$297,090
General Support Expense	\$9,104,963	\$4,807,905	\$1,983,358
COE Expense	\$22,301,717	\$5,416,541	\$7,359,062
C&WF Expense	\$15,916,891	\$12,091,299	\$2,452,094
Other Property & Plant Expense	\$1,467,149	\$811,821	\$449,978
Network Operations Expense	\$14,500,652	\$7,749,486	\$3,241,348
Depreciation & Amortization Expense	\$57,796,271	\$28,674,659	\$14,471,580
Marketing Expense	\$3,618,725	\$1,925,735	\$737,599
Services Expense	\$20,565,657	\$5,973,099	\$3,048,216
General & Administration Expense	\$44,496,819	\$22,719,046	\$8,424,403
Charitable Contributions	\$214,990	\$109,513	\$37,780
Interest & Related Items	\$1,159,827	\$624,222	\$246,652
Interest on Customer Deposits	\$3,302	\$2,238	\$536
Other Long-Term Liabilities	\$13,703,626	\$7,023,438	\$2,231,218
Federal Income Taxes	\$6,972,003	\$4,365,915	\$1,223,317
Investment Tax Credits	\$0	\$0	\$0
Other Operating Taxes	\$5,446,335	\$2,901,369	\$1,228,475
Allowance for Funds Used Dur-Const.	\$320,286	\$180,932	\$100,282
Expenses & Other Taxes	\$196,756,023	\$93,906,268	\$43,731,520
Average Net Investment	\$340,346,402	\$215,368,150	\$67,165,534
Revenue Requirement	\$239,144,112	\$120,704,907	\$51,906,936

EXHIBIT 6.5

WEIGHTED ACCESS CATEGORY ALLOCATION FACTORS

<u>Account</u>	<u>Common Line</u>	<u>Special Access</u>
Telecommunications Plant in Service	53.34%	22.15%
General Support Facilities	53.25%	22.92%
Central Office Equipment	24.54%	31.17%
COE Cat 1 + 2 + 3 + 4.3	0.00%	0.00%
COE Cat 4.11 + 4.12	0.00%	51.53%
COE Cat 4.13	99.30%	0.70%
COE Cat 4.2	0.00%	71.50%
Cable & Wire Facilities	75.99%	14.90%
C&WF Cat 1.2	0.00%	100.00%
C&WF Cat 1.3	100.00%	0.00%
C&WF Cat 2 + 3	0.00%	62.71%
C&WF Cat 4	0.00%	0.00%
Tangibles	43.23%	40.36%
Intangibles	52.58%	14.74%
Materials and Supplies	55.82%	22.33%
Other Telecommunications Plant	53.73%	29.25%
Other Non-Current Assets	48.59%	18.14%
Cash Working Capital	47.76%	20.91%
Accumulated Depreciation	50.01%	22.97%
Accumulated Amortization	41.95%	42.53%
Net Deferred Operating FIT	48.83%	35.87%
Network Support Expense	54.71%	22.46%
General Support Expense	52.81%	21.78%
COE Expense	24.29%	33.00%
C&WF Expense	75.97%	15.41%
Other Property & Plant Expense	55.33%	30.67%
Network Operations Expense	53.44%	22.35%
Depreciation & Amortization Expense	49.61%	25.04%
Marketing Expense	53.22%	20.38%
Services Expense	29.04%	14.82%
General & Administration Expense	51.06%	18.93%
Charitable Contributions	50.94%	17.57%
Interest & Related Items	53.82%	21.27%
Interest on Customer Deposits	67.77%	16.23%
Other Long-Term Liabilities	51.25%	16.28%
Federal Income Taxes	62.62%	17.55%
Investment Tax Credits	0.00%	0.00%
Other Operating Taxes	53.27%	22.56%
Allowance for Funds Used During-Construct.	56.49%	31.31%
Expenses & Other Taxes	47.73%	22.23%
Average Net Investment	63.28%	19.73%
Revenue Requirement	50.47%	21.71%

D. Calculation of Cash Working Capital

Total company, interstate and access category amounts of Cash Working Capital were calculated according to the simplified formula prescribed in a *Commission Order*.²² This formula is displayed below. Amounts calculated by these methods are displayed in Exhibits 6.1 and 6.4.

$$\text{Cash Working Capital} = 0.041096 \times \text{Total Amount for Allowances}$$

Where, *Total Amount for Allowances*

$$\begin{aligned} &= \text{Total Operating Expenses} + \text{Operating Taxes} + \text{Interest \& Related Items} \\ &+ \text{Charitable Contributions} + \text{Interest on Customer Deposits} \\ &- \text{Depreciation \& Amortization Expense} \end{aligned}$$

E. Calculation of Interstate Access Category Revenue Requirements

1. Common Line and Special Access Revenue Requirements

Revenue requirements were computed for Common Line and Special Access categories for sample study areas in accordance with the Commission's Part 69 rules, as follows:

$$\begin{aligned} \text{Total Investment} &= \text{Central Office Equipment} + \text{Cable and Wire Facilities} \\ &+ \text{General Support Facilities} + \text{Other Telecommunication Plant} + \text{Tangibles} \\ &+ \text{Intangibles} + \text{Materials and Supplies} + \text{Other Non-Current Assets} \end{aligned}$$

$$\begin{aligned} \text{Average Net Investment} &= \text{Total Investment} + \text{Cash Working Capital} \\ &- \text{Accumulated Depreciation \& Amortization} \\ &- \text{Net Deferred Income Taxes} - \text{Other Long-Term Liabilities} \end{aligned}$$

$$\text{Return}^{23} = \text{Average Net Investment} \times 0.1050^{24}$$

²² See Amendment of Part 65 of the Commission's Rules to Prescribe Components of the Rate Base and Net Income of Dominant Carriers, CC Docket No. 86-497, *Report and Order*, 3 FCC Rcd 269 (1987), *Order on Reconsideration*, 4 FCC Rcd 1697 (1989).

²³ This method assures that average schedule settlements are calibrated to the rate of return authorized by the Commission.

²⁴ *Connect America Fund*, WC Docket No. 10-90, *ETC Annual Reports and Certifications*, WC Docket No. 14-58, *Developing a Unified Intercarrier Compensation Regime*, CC Docket No. 01-92, *Report and Order*, *Order and Order on Reconsideration*, and *Further Notice of Proposed Rulemaking*, 31 FCC Rcd. 3087 (2016). (*Report and Order or Further Notice*).

$$\begin{aligned} \text{Net Plant}^{25} = & \text{Telecommunication Plant in Service} + \text{Other Telecommunication Plant} \\ & + \text{Material and Supplies} - \text{Accumulated Depreciation \& Amortization} \\ & - \text{Net Deferred Income Taxes} + \text{Other Non-Current Assets} \\ & - \text{Other Long-Term Liabilities} \end{aligned}$$

$$\text{Net Federal Income Tax}^{26} = \text{Average Effective Tax Rate} \times (\text{Net Plant} \times 0.1050)$$

$$\begin{aligned} \text{Total Expenses and Other Taxes} = & \text{Network Support Expense} \\ & + \text{Central Office Equipment Expense} + \text{Cable \& Wire Facilities Expense} \\ & + \text{General Support Facilities Expense} + \text{Other Property Plant \& Equipment Expense} \\ & + \text{Network Operations Expense} + \text{Depreciation \& Amortization Expense} \\ & + \text{Marketing Expense} + \text{Services Expense} \\ & + \text{General \& Administrative Expense} + \text{Charitable Contributions} \\ & + \text{Other Operating Taxes} + \text{Interest on Customer Deposits} \end{aligned}$$

$$\begin{aligned} \text{Revenue Requirement} = & \text{Total Expenses and Other Taxes} + \text{Return} \\ & + \text{Federal Income Tax - Allowance for Funds Used During Construction} \end{aligned}$$

$$\text{Monthly Revenue Requirement} = \text{Revenue Requirement} / 12$$

2. Allocation of Special Access Revenue Requirements to Non-DSL and DSL Voice-Data Categories

To support the development of separate formulas for DSL and Non-DSL special access costs, NECA allocated total interstate special access costs of sample study areas between these categories.

For study areas providing DSL outside NECA's tariff, special access costs were allocated between DSL and Non-DSL using the allocation factors described in Section IV.E.2.d & e. DSL amounts were excluded from development of the proposed formulas. Amounts excluded were calculated using allocation models listed in Exhibits 4.5 and 4.6 shown as follows:

For COE Category 4.11 + 4.12, 93.55% of Interstate COE 4.11 + 4.12

For COE Category 4.2, 3.00% of Interstate COE 4.2

²⁵ Net Telephone Plant in each access category was limited to be greater than or equal to zero.

²⁶ Federal Income Taxes are calculated only for non-tax exempt average schedule study areas, using the tax status reported to NECA. If the Federal Income Tax calculation for any study area resulted in a negative value, a zero value was used. Federal Income Tax is calculated using the Average Effective Tax Rate developed using sample cost study data, as described in Section IV.G.

For C&WF Category 2 + 3, 51.80% of Interstate C&WF 2 + 3

The remaining special access costs in these categories represent Non-DSL costs. Special access costs in other accounts of these study areas were allocated to the Non-DSL subcategory by proportions based on these investment amounts, using the methods explained in Section VI.C. By these methods, NECA excluded costs associated with DSL from the development of the proposed special access formula, as these study areas will not be eligible for DSL settlements from NECA.

For each study area providing DSL in NECA's tariff, NECA first allocated special access revenue requirement to the DSL and Non-DSL categories using the DSL revenue requirement model described in Section IV.E.2.d shown as follows.

The DSL revenue requirement allocation factor is calculated using DSL/Non-DSL revenue separation models.

DSL Revenue Requirement

$$= \text{DSL Revenue Requirement Allocation Factor} \times \text{Special Access Revenue Requirement}$$

Non-DSL Revenue Requirement

$$= \text{Special Access Revenue Requirement} - \text{DSL Revenue Requirement}$$

As explained in Section IV.E.2.e, from the above-calculated DSL revenue requirement NECA derived the DSL Voice-Data revenue requirement by removing the embedded DSL Broadband-Only related costs from the DSL revenue requirement of sample study areas with DSL Broadband-Only lines. The DSL Voice-Data revenue requirement was used in the development of the DSL Voice-Data formula described in Section VII.D.2.a.

DSL Voice-Data Revenue Requirement

$$= (\text{DSL Revenue Requirement Allocation Factor} - 1.0576 \times \text{DSL Broadband-Only Lines per DSL Line}^{27}) \times \text{Special Access Revenue Requirement}$$

if study area provides DSL Broadband-Only service in the year matching its account data

²⁷ See Section IV.E.2.e.

or

= DSL Revenue Requirement otherwise

The resulting allocation of special access revenue requirement for sample study areas is shown in Exhibit 6.6.

EXHIBIT 6.6
SPECIAL ACCESS REVENUE REQUIREMENT ALLOCATION
FOR SAMPLE STUDY AREAS

Revenue Requirement	Sample Study Areas by DSL Tariff Participation			
	Inside NECA Tariff		Outside NECA Tariff	
	(\$)	% of Special Access	(\$)	% of Special Access
Non-DSL	\$11,503,365	30.8%	\$14,550,572	100.0%
DSL	\$25,910,837	69.4%	\$0	0.0%
Total Special Access	\$37,356,364		\$14,550,572	
Voice-Data DSL	(\$)	% of DSL	N/A	N/A
	\$24,667,796	95.2%		
Study Area Counts	106		86	

DSL Broadband-Only costs are recovered through the Consumer Broadband-Only Loop formula and the DSL Broadband-Only Second Mile formula as described in Section VII.C.3 and VII.D.2.c of this filing. These formulas were developed based on cost companies' revenue requirements.

3. Switched Access Revenue Requirements

Switched access revenue requirements are no longer used in the formula development process as a result of actions taken in the *USF/ICC Transformation Order*. Switched access settlements are instead determined based on the transition of frozen baseline revenue requirements, as defined in the *USF/ICC Transformation Order* and shown in Section VIII.

VII. SETTLEMENT FORMULA DEVELOPMENT

A. Introduction

This section describes 2017 Study development methods for the following average schedule settlement formulas and factors:

- Common Line Access Line
- Operating Expenses Limit Factor
- Consumer Broadband-Only Loop
- Universal Service Support Contribution Reimbursement
- Special Access – DSL Voice-Data
- Special Access – Broadband-Only Second Mile Transport
- Special Access – Non-DSL
- Rate of Return Factors

Development of these settlement formulas is described in Sections VII.B through VII.E. Impacts of the proposed settlement formulas are described in Section VII.F. The proposed formulas are displayed in Section VIII, where they are compared with current formulas.

The *USF/ICC Transformation Order* froze the amounts of switched access category at the 2011 Tariff filing levels and prescribed a 5 percent annual phase-down. This filing accordingly provides switched access formulas as a table of frozen amounts, subject to phase-down outlined in Appendix H.²⁸

The *USF/ICC Transformation Order* also required NECA pool members to begin billing NECA's access recovery charge (ARC) tariff rates. Some revenues collected based on ARC rates, along with revenues collected by the carriers based on transitional intrastate terminating rates, are the means of recovery of intrastate terminating revenue requirement. Carriers report these revenues to NECA each month, which are netted through NECA's pooling process. Like cost companies, an average schedule

²⁸

This method was initially proposed by NECA in its *National Exchange Carrier Association, Inc. 2011 Modification of Average Schedules*, WC Docket No. 10-251, *National Exchange Carrier Association, Inc. 2012 Second Further Modification of Average Schedules*, WC Docket No. 11-204, Order, 27 FCC Rcd 6209 (2012).

company reports revenues and keeps an amount equal to its transitional revenue requirement defined in Commission rule 51.917. Accordingly, no intrastate average schedule formula is needed for this purpose.

Each year NECA analyzes and estimates relationships between access cost and access demand and proposes formula revisions, where necessary, to reflect changes in these relationships. Settlement formulas can be revised for several reasons, such as:

- FCC rule changes
- Cost and demand growth
- Technology changes
- Network structure changes
- Tariff changes

B. Outlier Analysis

Settlement formulas were developed either by linear regression or ratio estimates and in each case an outlier accommodation method was applied as explained in detail in the last study.²⁹

C. Common Line Formulas

Common Line formulas include the Common Line Access Line formula (described in Section VII.C.1), the Common Line Line Port and Common Line Transport frozen amounts (Section VII.C.2), the Consumer Broadband-Only Loop Formula (Section VII.C.3), Operating Expenses Limit factor (Section VII.C.4), the Common Line Universal Service Contribution Reimbursement formula (Section VII.C.5), and the Common Line Rate of Return Factor formula (Section VII.E).

1. Common Line Access Line Formula

The Common Line Access Line formula has the same structure as in the last study. The common line formula is designed to compensate average schedule companies for interstate costs associated with subscriber access lines (*e.g.*, cable, drop, protector and circuit equipment). Relative costs of much of this equipment and associated expenses are usually higher in lower density exchange areas. To reflect this relationship, the formula relates the Common Line revenue requirement per access line (CPL) to lines per

²⁹ December 2016 Filing, Section IV.C.

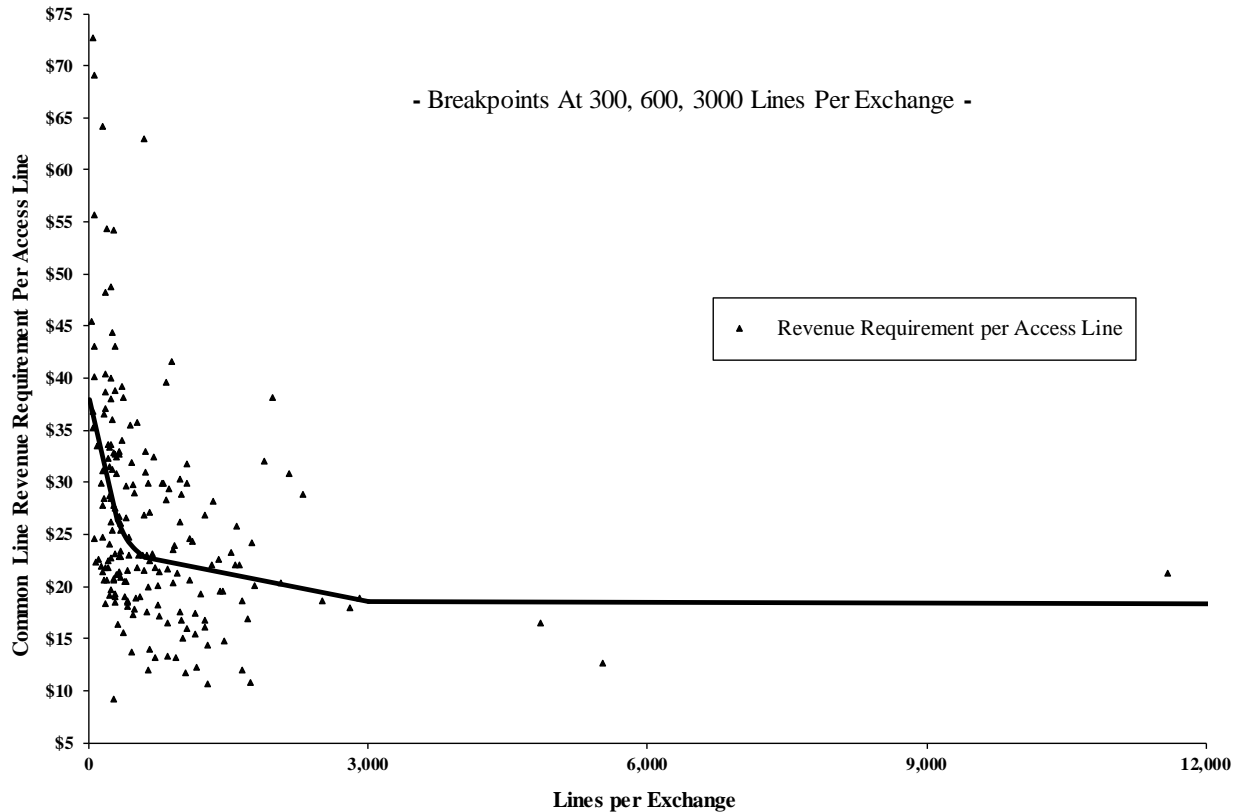
exchange (LPE), where lines is the sum of access lines and broadband-only lines. The formula results in a set of connected lines and curves, each corresponding to a designated range of average access lines per exchange. The breakpoints (K_1 , K_2 and K_3) defining these ranges are 300, 600 and 3,000 lines per exchange. Access lines used in the development of this formula were projected to the test period as described in Section V.D. Derivation of the Common Line revenue requirement is explained in Section VI.E.

The common line model has the following parameters:

- Three lines per exchange breakpoints which delimit the groups of study areas with lower range of lines per exchange from those below (K_1), a midrange of values of lines per exchange between (K_1) and (K_2), a second midrange with lines per exchange between (K_2) and (K_3), and the upper range of lines per exchange with lines per exchange values above (K_3).
- For the lower lines-per-exchange group, a slope (b_1) and intercept (a_1) of the formula are estimated by regression methods.
- For the first midrange lines-per-exchange group, the slope (b_2) is estimated by regression methods, while the intercept (a_2) is resolved by a constraint that requires that the small company line meet the midrange curve at K_1 .
- The second midrange formula component, which transitions between the first mid-range line and upper range curve, the intercept and slope are resolved by constraints that the transitional line meet the midrange and large company curves at K_2 and K_3 respectively.
- A High Lines per Exchange Multiplier (M) for the upper lines-per-exchange group, which is estimated by regression methods.

Exhibit 7.1 shows how the proposed formula fits the study data.

EXHIBIT 7.1
COMMON LINE FORMULA FIT TO COST PER LINE DATA



Study areas with lines per exchange below 600 had relatively higher revenue requirements per line. Study areas with lines per exchange greater than 3,000 had relatively lower revenue requirements per line. There was no conclusive trend of revenue requirement per line for study areas between 600 and 3,000 lines per exchange.

The formula component for the upper range of lines-per-exchange group is parallel to the midrange curve, adjusted by the High Lines-Per-Exchange Multiplier M . This multiplier accounts for the lower cost per line of the upper group, producing a better model fit.

The best-fitting combination of parameters a_1 , b_1 , b_2 , and M was estimated using a weighted non-linear regression model, derived as follows:

For companies with $LPE < 300$,

$$CPL_i = a_1 + b_1 \times LPE_i$$

For companies with $300 \leq LPE < 600$,

$$CPL_i = a_2 + b_2 / LPE_i$$

For companies with $600 \leq LPE < 3,000$,

$$CPL_i = P_i \times (a_2 + b_2 / 600) + (1 - P_i) \times M \times (a_2 + b_2 / 3,000)$$

$$P_i = \frac{3,000 - LPE_i}{3,000 - 600}$$

For companies with $3,000 \leq LPE$,

$$CPL_i = M \times (a_2 + b_2 / LPE_i)$$

The following indicator variables are needed to program this model.

$$\delta_{1i} = 1 \text{ if } LPE_i < 300; \text{ otherwise } \delta_{1i} = 0$$

$$\delta_{2i} = 1 \text{ if } 300 \leq LPE_i < 600; \text{ otherwise } \delta_{2i} = 0$$

$$\delta_{3i} = 1 \text{ if } 600 \leq LPE_i < 3,000; \text{ otherwise } \delta_{3i} = 0$$

$$\delta_{4i} = 1 \text{ if } 3,000 \leq LPE_i; \text{ otherwise } \delta_{4i} = 0$$

Then the model is written as:

$$CPL_i = \delta_{1i} (a_1 + b_1 \times LPE_i) + \delta_{2i} (a_2 + b_2 / LPE_i) + \delta_{4i} \times M \times (a_2 + b_2 / LPE_i) \\ + P_i \times \delta_{3i} \times (a_2 + b_2 / 600) + (1 - P_i) \times \delta_{3i} \times M \times (a_2 + b_2 / 3,000)$$

This model has the linear constraint that:

$$a_1 + b_1 \times 300 = a_2 + b_2 / 300$$

Consequently,

$$a_2 = a_1 + (b_1 \times 300) - (b_2 / 300)$$

Therefore, regression model parameters are reduced to a_1 , b_1 , b_2 , and M . Substituting the constraints in the model and rearranging its terms, the model is rewritten in the following form suitable for regression estimation.

$$CPL_i = a_1 \times (A1_i + M \times A2_i) + b_1 \times (B1_i + M \times B2_i) + b_2 \times (C1_i + M \times C2_i)$$

where,

$$A1_i = \delta_{1i} + \delta_{2i} + \delta_{3i} \times P_i$$

$$A2_i = \delta_{3i} \times (1 - P_i) + \delta_{4i}$$

$$B1_i = \delta_{1i} \times LPE_i + 300 \times (\delta_{2i} + \delta_{3i} \times P_i)$$

$$B2_i = 300 \times [\delta_{3i} \times (1 - P_i) + \delta_{4i}]$$

$$C1_i = \left(-\frac{1}{300}\right) \times (\delta_{2i} + \delta_{3i} \times P_i) + \frac{\delta_{2i}}{LPE_i} + \frac{P_i \times \delta_{3i}}{600}$$

$$C2_i = \left(-\frac{1}{300}\right) \times [\delta_{3i} \times (1 - P_i) + \delta_{4i}] + \frac{\delta_{3i} \times (1 - P_i)}{3,000} + \frac{\delta_{4i}}{LPE_i}$$

Using the variables CPL_i , $A1_i$, $A2_i$, $B1_i$, $B2_i$, $C1_i$, and $C2_i$, the program NLIN (NonLINear regression)³⁰ solves for parameters a_1 , b_1 , b_2 , and M that best fit the data.

The resulting line and curve model produces two stable, continuous parts of the settlement formula with an *R-Square* statistic of 0.231, a *t-statistics* of 14.15, -3.27, 1.96, and 4.75 for a_1 , b_1 , b_2 , and M respectively. The proposed formula is shown in Section VIII.

³⁰ SAS Institute Inc., *SAS/STAT® 9.3 User's Guide*, (July, 2011).

2. Common Line TIC and Line Port Shifts

The May 2012 Second Further Average Schedules Modification provided frozen Common Line Line Port and TIC shifts amounts.³¹ NECA continues to propose these amounts for 2018, as shown in Appendix H. The total amount of Common Line TIC and Line Port Shifts for the average schedule companies in the Common Line Pool as of July 2017 is \$1,193,848 per month.

3. Consumer Broadband-Only Loop (CBOL) Settlement Formula

In this filing NECA continues the approach from last year's study in the development of CBOL settlement formula which is consistent with the cost companies' surrogate method defined in FCC rule 69.311(b). According to this method a cost company's broadband-only revenue requirement per broadband-only line is calculated as its Common Line (CL) revenue requirement per access line where common line revenue requirement is calculated as if 100% of CL investment were assigned to the interstate jurisdiction instead of 25%. Appendix G3 displays CL revenue requirements at 100% and 25% allocation for sample cost companies used in this study. The average ratio, weighted with sample and outlier weights, of the two common line revenue requirement measures for these cost companies is 3.6928. NECA used this factor to mimic the surrogate method in the development of CBOL settlement formula for average schedule companies.

The proposed average schedule CBOL settlement is the product of 3.6928 and the proposed Common Line formula per access line multiplied by the number of broadband-only lines. This amount is further adjusted down by the OpEx Limit factor discussed in the next subsection, as required by the *Report and Order*.³²

³¹ NECA 2012 Second Further Modification of Average Schedule High Cost Loop Support Formula, WC Docket. 05-337, *Connect America Fund*, WC Docket No. 10-90, (filed May 24, 2012) (May 2012 Filing), *National Exchange Carrier Association, Inc. 2012 Second Modification of Average Schedule Universal Service Support Formulas High-Cost Universal Service Support*, Order, WC Docket No. 05-337, 27 FCC Rcd 7315 (2012).

³² *Connect America Fund*, WC Docket No. 10-90, *ETC Annual Reports and Certifications*, WC Docket No. 14-58, *Developing a Unified Intercarrier Compensation Regime*, CC Docket No. 01-92, Report and Order, Order and Order on Reconsideration, and Further Notice of Proposed Rulemaking, 31 FCC Rcd. 3087 (2016). (*Report and Order*).

4. Operating Expenses Limit Factor and Capital Investment Allowances Limitation

In the *USF/ICC Transformation Order* released on November 18, 2011, the FCC imposed a limit on Corporate Operations Expense. On March 30, 2016, in the *Report and Order* the FCC added a new limit on Operating Expenses (OpEx) on top of the existing limit on Corporate Operations Expense as well as the limits on Capital Investment Allowances.

In this study, NECA continues to calculate the combined Corporate Operations Expense and OpEx limit factor using accounting data of sample average schedule study areas. For each sample study area, the sum of OpEx accounts projected by NECA as described in Section V of this filing was compared to the Commission's OpEx and Corporate Operations Expense formulas for limiting amounts that can be included in Connect America Fund Broadband Loop Support (CAF BLS). After calculating the capped and uncapped sample companies' common line revenue requirements weighted by sample weights, NECA calculated the Combined OpEx Limit Factor as follows.

$$\begin{aligned}\text{Combined OpEx Limit Factor} &= \frac{\text{Capped Sample CL Revenue Requirement}}{\text{Uncapped Sample CL Revenue Requirement}} \\ &= \frac{119,577,155}{120,704,907} \\ &= 0.990657\end{aligned}$$

Section VIII shows the use of this factor to uniformly adjust average schedule common line access line and CBOL settlements to reflect the limits.

The Capital Investment Allowance limits, although applicable to average schedule companies, has no impact on the proposed average schedule common line settlements because none of the average schedule sample companies used in the study were affected.

5. Common Line Universal Service Contribution Reimbursement Formula

NECA proposes to continue the settlement method which became effective on January 1, 1998, to compensate average schedule companies for their interstate access costs of contributions to the universal service fund. The common line universal service contribution settlement formula is thus equal to the

portion of the contribution paid that is associated with the regulated revenues of the average schedule company. This amount is assigned to the common line revenue requirement according to Commission rules.³³

D. Special Access Formulas

In this study NECA continues to propose three separate special access formulas. They are the DSL Voice-Data formula for voice-data, the Broadband-Only Second Mile formula for the Second Mile transport, and the Non-DSL formula for Non-DSL cost components.

Special access revenue requirements were first calculated for each sample study area as described in Section VI, based on projected accounts and separations models included in Section IV. In addition, using the DSL separations model in Section IV, special access revenue requirements were split into DSL and Non-DSL revenue requirements. The DSL piece was further adjusted to exclude the broadband-only cost for use in the DSL Voice-Data formula development.

1. Special Access Non-DSL Formula

The proposed Special Access Non-DSL formula consists of a basic Non-DSL formula and a frozen Non-DSL TIC shift amount.

The basic Non-DSL formula compensates average schedule companies for the cost of providing dedicated Special Access facilities, other than DSL service, including local channel electronics and mileage, service ordering costs and optional features and functions. As NECA's special access tariff includes a cost-based charge for each of the elements, revenues billed according to the tariff are a good measure of special access Non-DSL costs for each company.

The proposed basic special access Non-DSL formula calculates a uniform revenue retention ratio for each study area, based on its level of special access Non-DSL revenues per exchange. For this purpose, historical special access Non-DSL revenues were adjusted to reflect December 2017 uniform band rates,

³³ Because the NECA Tariff is designed to produce FUSC charges equal to the allowable contribution expense, NECA flows the amount of reported FUSC revenues to each company as its settlement.

as explained in Section V.E.1. NECA developed the settlement formula by relating costs of sample companies to their adjusted special access Non-DSL revenues per exchange. The proposed formula reflects economies of scale due to growing demand for special access services. It has the same structure as the current Non-DSL formula.

The proposed formula includes a Tariff Rate Index component, which keeps average schedule settlements at the proposed level, should NECA file changes to its special access tariff rates after the filing of this formula.

a. The Uniform Retention Ratio Component

By testing combinations of lines and curves joined together, NECA found the data of sample companies could best be fit to a combination of three components: two connected straight lines are used for study areas with fewer than \$800 per month in adjusted special access Non-DSL revenues per exchange, and a reciprocal curved line for study areas with higher revenues per exchange. Two formula breakpoints were chosen, BP₁ being the intersection of the two straight lines, and BP₂ being the intersection of the second straight line and the curved line. The coefficients were estimated using the following regression method.

For each sample study area (designated by *i*), the following variables are constructed.

RPE_i = Study Area *i* Special Access Non-DSL Adjusted Revenues per Exchange

RRQ_i = Monthly Special Non-DSL Revenue Requirement for study area *i*

RR_i = RRQ_i / Study Area *i* Special Access Non-DSL Adjusted Revenues

Variables indicating revenues per exchange ranges:

$$\delta_{1i} = 1 \text{ if } RPE_i \leq BP_1; \delta_{1i} = 0 \text{ otherwise}$$

$$\delta_{2i} = 1 \text{ if } BP_1 < RPE_i \leq BP_2; \delta_{2i} = 0 \text{ otherwise}$$

$$\delta_{3i} = 1 \text{ if } BP_2 < RPE_i; \delta_{3i} = 0 \text{ otherwise}$$

Then, the settlement formula is expressed as

$$RR_i = \delta_{1i} \times (a_1 + b_1 \times RPE_i) + \delta_{2i} \times (a_2 + b_2 \times RPE_i) + \delta_{3i} \times (a_3 + b_3 / RPE_i)$$

With constraints that line segments connect,

$$a_1 + b_1 \times BP_1 = a_2 + b_2 \times BP_1$$

$$a_2 + b_2 \times BP_2 = a_3 + b_3 / BP_2$$

In addition, NECA ensured that straight line components of the formula would not be so steep as to cause a settlement decrease in any range of revenue increases. Using calculus to solve for such limits on coefficients produced the following constraints, also used in the regression.

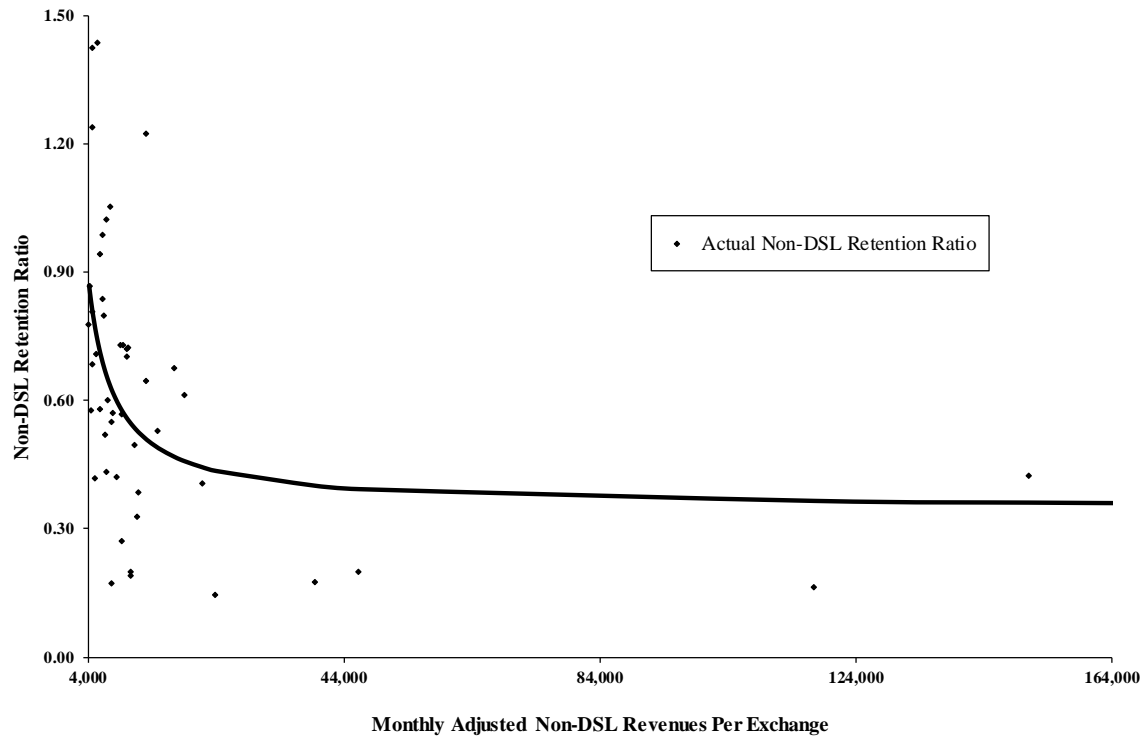
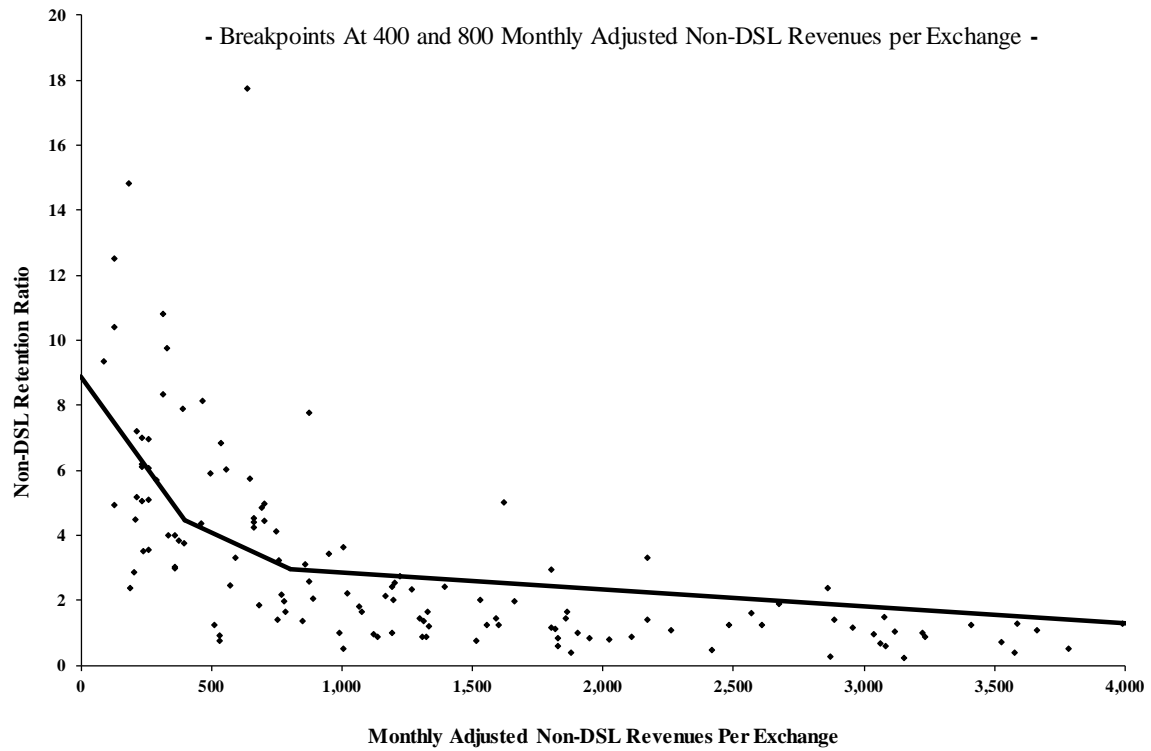
$$a_1 + 2 \times b_1 \times BP_1 \geq 0$$

$$a_2 + 2 \times b_2 \times BP_2 \geq 0$$

NECA estimated the settlement formula coefficients using constrained linear regression methods and NECA's standard regression outlier weighting method. Resulting coefficients are shown in Section VIII. The estimated model has an *R-Square* statistic of 0.655, with significant *t*-statistics. A good fit of this formula is also apparent from Exhibit 7.2 that shows the formula with the data points for sample study areas.

EXHIBIT 7.2

FIT OF NON-DSL SPECIAL ACCESS FORMULA TO DATA



b. The Tariff Rate Index

The proposed special access Non-DSL formula continues to employ a Tariff Rate Index (TRI) to reflect differences between the current tariff rates each settlement month and those in effect at the time of this average schedule filing. Such differences include average changes over time in overall rates and rate difference between company's assigned rate band and the uniform tariff rate band.

A TRI for each study area is defined as follows. For each rate band, NECA calculates a Rate Band Adjustment, equal to the ratio of revenues from the rates charged by each study area in its band to revenues it would have charged at uniform rates. Next, NECA calculates a Rate Period Adjustment, equal to the ratio of uniform rates at the time of this filing to uniform rates in effect in each upcoming settlement month. Then the TRI is calculated according to the following equation.

$$Non - DSL TRI = \frac{1}{Rate Period Adjustment \times Rate Band Adjustment}$$

Exhibit 7.3 displays NECA's method for calculating the Tariff Rate Index.³⁴ Each time NECA files new Special Access tariff rates, it will use data from that filing to calculate a Tariff Rate Index for each study area.

EXHIBIT 7.3³⁵				
<u>ILLUSTRATIVE TRI CALCULATIONS</u>				
	A	B	C	D
Study Area	Rate Band	Rate Band Adjustment	Rate Period Adjustment	TRI = 1 / (B x C)
1	10	1.47	0.95	0.7161
2	Uniform Rate	1	0.95	1.0526
5	5	0.64	0.95	1.6447

³⁴ The Tariff Rate Index reflects all Special Access tariff rates except DSL rates offered in NECA's Access Service Tariff, F.C.C. Tariff No. 5 for the period. *See* National Exchange Carrier Association, Inc., Tariff F.C.C. No. 5, Transmittal No. 1455, filed June 16, 2016 (2016 Annual Access Tariff Filing). This includes rates for recurring charges, nonrecurring charges and optional features and functions.

³⁵ NECA will recalculate the Tariff Rate Index using data from its tariff filing coincident with the effective date of any special access tariff rate change.

c. Non-DSL TIC Shift

The May 2012 Second Further Average Schedules Modification provided frozen Non-DSL TIC shift amounts, which were approved by the Commission. NECA continues to propose these amounts for 2018, as shown in Appendix H. The total amount of Non-DSL TIC shifts for the average schedule companies in Traffic Sensitive Pool as of July 2017 is \$134,096 per month.

2. The Special Access DSL Formulas

NECA proposes two average schedule DSL formulas to compensate for the provision of DSL service. The Voice-Data formula is designed to compensate for the cost of providing voice-data DSL service. The Broadband-Only Second Mile formula is designed to compensate for the cost of second mile transport associated with the provision of Broadband-Only lines. The loop cost associated with the provision of broadband-only lines is recovered through the CBOL formula described in VII.C.3 above. The Voice-Data formula will be applied to all voice-data lines and the Second Mile formula will be applied only to broadband-only lines for study areas having second mile transport costs as explained in VII.F.2.c below.

NECA also continues to propose the frozen DSL TIC shift amounts, which were approved by the Commission with the May 2012 Second Further Average Schedules Modification.

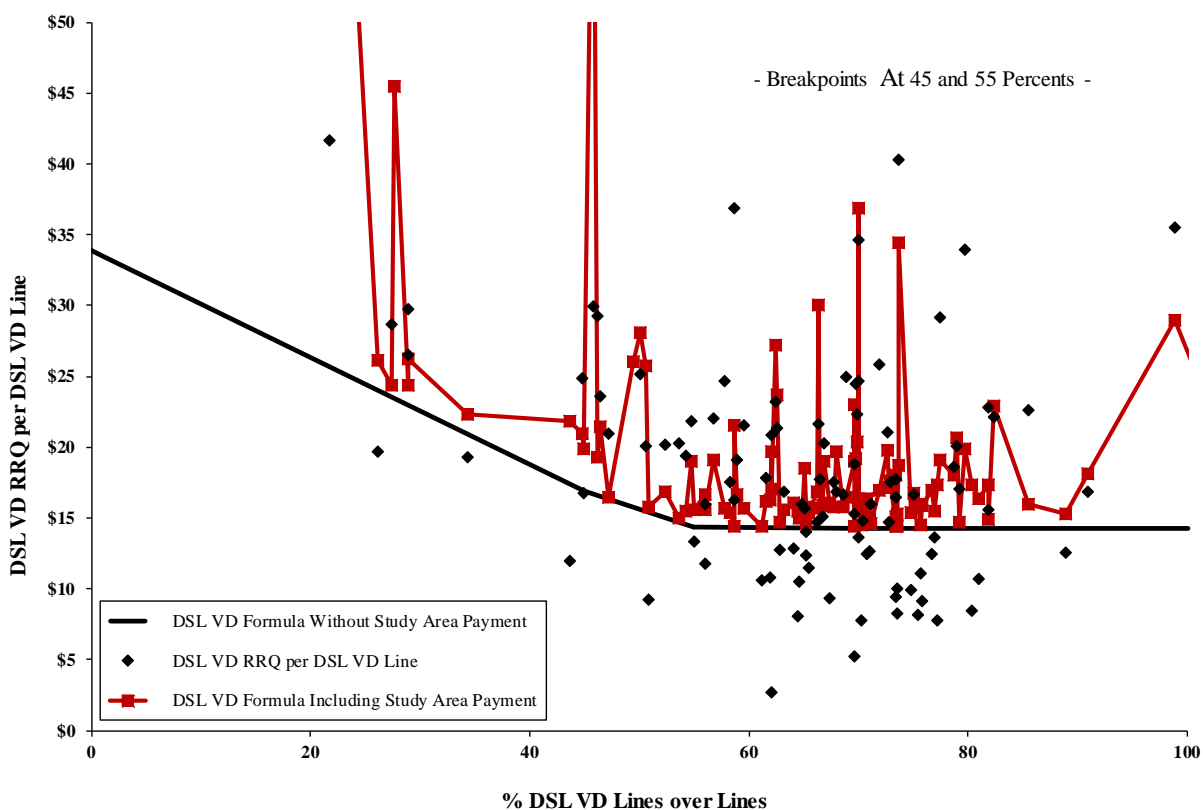
a. DSL Voice-Data (VD) Formula

The Voice-Data formula is designed to compensate average schedule companies for interstate costs associated with Digital Subscriber Lines (DSL), e.g. DSLAM and other DSL related equipment. Relative costs of much of this equipment and associated expenses are usually higher if a study area has a low percent of VD lines relative to its sum of access lines and broadband-only lines, and vice versa. To reflect this relationship, the formula relates the VD revenue requirement per VD line to the DSL penetration rate defined as the ratio of VD lines to the average monthly base period 2016/2017 access lines plus broadband-only lines. Voice-Data monthly settlements will be paid using this base period level of access lines rather than access lines reported for that month. This will ensure that DSL settlements are impacted only by changes in VD lines and are not adversely affected by losses in access lines.

The proposed formula consists of three connected straight lines used to calculate an amount per VD line, and an additional lump sum amount per study area. Two of the lines are downward sloping and one is horizontal, each corresponding to a designated range of the VD penetration rate. The intersection points of these lines are at 45% and 55% of VD penetration rate. VD lines used in the development of this formula were projected to the test period as described in Section V.D. Derivation of the VD revenue requirement is explained in Section VI.E.2.

NECA estimated the settlement formula coefficients using constrained linear regression methods and NECA's standard regression outlier weighting method. Resulting coefficients are shown in Section VIII. The estimated model has an *R-Square* statistic of 0.294, with significant *t*-statistics. Exhibit 7.4 shows how the proposed formula fits the study data.

EXHIBIT 7.4
DSL VOICE-DATA FORMULA



b. DSL TIC Shift

The May 2012 Second Further Average Schedules Modification provided frozen DSL TIC shift amounts, which were approved by the Commission. NECA continues to propose these amounts for 2018, as shown in Appendix H. The total amount of DSL TIC shifts for the average schedule companies in Traffic Sensitive Pool as of July 2017 is \$39,542 per month.

c. DSL Broadband-Only Second Mile Formula

The Broadband-Only Second Mile formula is designed to compensate for the cost of second mile transport associated with the provision of broadband-only lines. Second Mile transport is defined as interoffice facility connecting the DSL serving wire center (SWC) and the SWC where the DSL Access service connection point (ASCP) is located. No Second Mile transport is present if no interoffice facility is used, i.e. if a study area has a DSL ASCP at each of its DSL SWCs. Study areas are identified as having second mile costs based on their network configurations in FCC Tariff 4.

Due to a small number of average schedule companies with Broadband-Only Second Mile costs NECA based the Broadband-Only Second Mile formula on cost companies' costs. NECA analyzed cost data from Group C cost study areas having Second Mile Broadband -Only revenue requirements reported in their 2015 cost studies³⁶. The median monthly Broadband-Only Second Mile RRQ per broadband-only line of these companies was \$2.76. NECA proposes to use this amount as the Broadband-Only Second Mile monthly settlement rate per broadband-only line for the average schedule companies. This settlement formula is displayed in Section VIII.

³⁶ See Appendix G4.

E. Rate of Return Factor Formulas

Rate of Return Factor formulas are used by NECA each month to adjust settlements to average schedule companies to conform to the rates of return achieved by the NECA pools. Without these adjustments, average schedule settlements would correspond to the authorized rate of return of 10.5% in the proposed test period. The development of the Rate of Return (ROR) factor adjustment formulas used regression methods described in detail in last year's filing³⁷.

Exhibit 7.5 displays the ROR factors underlying the development of these regression models. The data in the exhibit are interpreted as follows: if the Common Line Pool achieves a rate of return of 10.25 percent, then the paid revenue requirement will be 99.47 percent of the revenue requirement at the authorized rate of 10.5 percent. Similarly, an achieved rate of 12.5 percent corresponds to revenue requirement that is 104.26 percent of the revenue requirement at 10.5 percent.

To recognize the fact that the Switched portion of Traffic Sensitive settlements has a higher authorized rate of return than special access (11.25% versus 10.5% in 2018/19) the reported switched settlements will be divided by 1.0107 (shown in Exhibit 7.5) to adjust down from the 11.25% ROR to 10.5% ROR before applying the Traffic Sensitive Factor at the achieved ROR.

³⁷ *December 2016 Filing, Section VII.E.*

EXHIBIT 7.5
RATE OF RETURN FACTOR RATIOS UNDERLYING ROR FORMULAS

Test Rate Of Return	Common Line Ratio	Traffic Sensitive Ratio
0.0700	0.9255	0.9500
0.0725	0.9308	0.9536
0.0750	0.9361	0.9571
0.0775	0.9415	0.9607
0.0800	0.9468	0.9643
0.0825	0.9521	0.9679
0.0850	0.9574	0.9714
0.0875	0.9627	0.9750
0.0900	0.9681	0.9786
0.0925	0.9734	0.9821
0.0950	0.9787	0.9857
0.0975	0.9840	0.9893
0.1000	0.9894	0.9929
0.1025	0.9947	0.9964
0.1050	1.0000	1.0000
0.1075	1.0053	1.0036
0.1100	1.0106	1.0071
0.1125	1.0160	1.0107
0.1150	1.0213	1.0143
0.1175	1.0266	1.0179
0.1200	1.0319	1.0214
0.1225	1.0373	1.0250
0.1250	1.0426	1.0286
0.1275	1.0479	1.0321
0.1300	1.0532	1.0357
0.1325	1.0585	1.0393
0.1350	1.0639	1.0429
0.1375	1.0692	1.0464
0.1400	1.0745	1.0500
0.1425	1.0798	1.0536
0.1450	1.0851	1.0571
0.1475	1.0905	1.0607
0.1500	1.0958	1.0643

F. Impact of Proposed Formulas

This section analyzes settlement effects of the proposed formulas. These effects take into account settlements based on formulas presented in sections VII.C and VII.D. Changes in the formula levels are a result of changes in cost and demand levels. The proposed formulas are expected to produce settlements during the test period that will match test period revenue requirements. Impacts are summarized in the following exhibits. Demand used to price out current and proposed formulas for individual companies is shown in Appendix E1 and individual settlement effects are shown in Appendix E2.

Beginning July 2018, carriers can expect, on average, an overall settlement increase of 5.6 percent as a result of the new formulas, with demand held constant. Impacts of these formula changes on individual average schedule companies will vary, depending on each company's size, demand characteristics, and participation in NECA's DSL tariff. About two thirds of study areas can expect an increase, and the rest can expect a decrease, assuming constant demand.

Most of the settlement increases are attributed to increases in the common line formula due to a positive growth in Cable & Wire investment and an increased allocation of Part 69 accounts to common line. The increase in DSL Voice-Data formula is attributed to a higher account growth than last year, while the increase in Non-DSL formula is mainly driven by a decreased Non-DSL demand growth.

Proposed settlements based on current demand are shown in Exhibit 7.6. Exhibit 7.7 shows the impact on settlements for each formula. Furthermore, when actual demand is reported for monthly settlements, NECA expects the actual increase to be lower due to projected losses of access lines and Non-DSL demand.

Effects of formulas will vary by size of study area. Exhibit 7.8 summarizes impacts by six access line size groups. All groups except the smallest line size group will experience overall settlement increases, on average.

EXHIBIT 7.6

PROPOSED MONTHLY SETTLEMENTS BY SETTLEMENT ELEMENT

A. Common Line Basic with MAG Shifts after Limits	\$9,675,004
B. Consumer Broadband Only Loop	\$1,564,865
C. CL Universal Service Contribution	\$1,068,446
D. Common Line Total (A + B + C)	\$12,308,315
E. Special Access Non-DSL with TIC Shift	\$2,860,021
F. DSL Voice-Data with TIC Shift	\$1,899,591
G. DSL Broadband-Only Second Mile	\$4,306
H. Special Access DSL with TIC Shift Total (F + G)	\$1,903,897
I. Traffic Sensitive Switched	\$3,651,168
J. Traffic Sensitive Total (E + H + I)	\$8,415,086
K. Overall Total (D + J)	\$20,723,402

EXHIBIT 7.7

SUMMARY OF PROPOSED FORMULA CHANGES

	Proposed Average Formula Change	Formula Percent of Total
A. Common Line Basic with MAG Shifts after Limits	9.55%	46.69%
B. Consumer Broadband Only Loop	16.96%	7.55%
C. CL Universal Service Contribution	0.00%	5.16%
D. Common Line Total (A + B + C)	9.53%	59.39%
E. Special Access Non-DSL with TIC Shift	4.16%	13.80%
F. Special Access DSL with TIC Shift (Voice-Data and Second Mile)	5.90%	9.19%
G. Traffic Sensitive Switched	-5.00%	17.62%
H. Traffic Sensitive Total (E + F + G)	0.33%	40.61%
I. Overall Total (D + H)	5.60%	100.00%

EXHIBIT 7.8

SETTLEMENT EFFECTS OF PROPOSED AVERAGE SCHEDULES

Access Line Size Group	Number of ECs	% Change Common Line Total	% Change Traffic Sensitive	% Change Total	Per Line Change Total
1 to 500	93	2.87	0.11	1.04	\$0.63
501 to 1000	70	5.10	0.32	2.61	\$1.24
1001 to 2500	67	7.32	0.04	3.67	\$1.39
2501 to 5000	28	8.78	-0.61	5.24	\$1.77
5001 to 10000	15	11.82	0.20	5.41	\$1.12
10001 to 20000	8	11.34	1.40	8.20	\$3.18
> 20000	3	13.14	1.58	10.50	\$2.85
All Study Areas	284	9.53	0.33	5.60	\$1.93

VIII. CURRENT AND PROPOSED AVERAGE SCHEDULE SETTLEMENT FORMULAS

A. COMMON LINE FORMULAS

COMMON LINE BASIC FORMULA

Current:

Settlement = Settlement Access Lines \times Common Line Settlement per Access Line

Common Line Settlement per Access Line

If LPE less than 300 then, $\$33.652959 - (\$0.022518 \times \text{LPE})$

If LPE between 300 and 750 then, $\$17.194142 + (\$2,911.03 / \text{LPE})$

If LPE between 750 and 3,000 then, $\$23.004936 - (\$0.002573 \times \text{LPE})$

If LPE 3,000 or more then, $0.8416 \times \{\$17.194142 + (\$2,911.03 / \text{LPE})\}$

$\text{LPE} = (\text{Access Lines} + \text{Broadband-Only Lines}) / \text{Exchange}$

Proposed:

Settlement = Settlement Access Lines \times Common Line Settlement per Access Line

Common Line Settlement per Access Line

If LPE less than 300 then, $\$37.892247 - (\$0.038185 \times \text{LPE})$

If LPE between 300 and 600 then, $\$19.321572 + (\$2,134.55 / \text{LPE})$

If LPE between 600 and 3,000 then, $\$23.950771 - (\$0.001786 \times \text{LPE})$

If LPE 3,000 or more then, $0.9281 \times \{\$19.321572 + (\$2,134.55 / \text{LPE})\}$

$\text{LPE} = (\text{Access Lines} + \text{Broadband-Only Lines}) / \text{Exchange}$

COMMON LINE FORMULA

Current:

$0.995999 \times (\text{Common Line Access Line Formula}) + \text{Baseline Line Port Shift} + \text{Baseline CL TIC Shift}$

$0.995999 = \text{Adjustment due to Corporate Operations Expense and Opex limits}$

Proposed:

$0.990657 \times (\text{Common Line Access Line Formula}) + \text{Baseline Line Port Shift} + \text{Baseline CL TIC Shift}$

$0.990657 = \text{Adjustment due to Corporate Operations Expense and Opex limits}$

Baseline Line Port Shift:

Frozen Line Port amount from NECA's June 2011 tariff filing.

Baseline CL TIC Shift:

Frozen CL TIC amount from NECA's June 2011 tariff filing.

CONSUMER BROADBAND-ONLY LOOP (CBOL) FORMULA

Current:

CBOL Settlement =

$$0.995999 \times (3.4945 \times \text{Common Line Settlement per Access Line}) \times \text{Broadband-Only Lines}$$

0.995999 = Adjustment due to Corporate Operations Expense and Opex limits

Proposed:

CBOL Settlement =

$$0.990657 \times (3.6928 \times \text{Common Line Settlement per Access Line}) \times \text{Broadband-Only Lines}$$

0.990657 = Adjustment due to Corporate Operations Expense and Opex limits

COMMON LINE RATE OF RETURN FORMULA

Monthly Common Line settlements are adjusted to reflect the Rate of Return (ROR) achieved by the total NECA Common Line pool.

Current: $0.745607 + (2.366447 \times \text{ROR})$

Proposed: $0.776483 + (2.128733 \times \text{ROR})$

UNIVERSAL SERVICE SUPPORT CONTRIBUTION FORMULA

Current:

An amount equal to the study area's contribution to the Federal Universal Service program assigned to the interstate common line access category according to Commission rules.

Proposed:

An amount equal to the study area's contribution to the Federal Universal Service program assigned to the interstate common line access category according to Commission rules.

B. TRAFFIC SENSITIVE FORMULAS

SWITCHED ACCESS FORMULA

Current:

Settlements = 95% of the prior year amount (equivalent to 73.51% of the Study Area's Baseline Switched Access Revenue Requirement, based on NECA's June 15, 2011 tariff filing)

Proposed:

Settlements = 95% of the Current Amount (equivalent to 69.83% of the Study Area's Baseline Switched Access Revenue Requirement, based on NECA's June 15, 2011 tariff filing)

SPECIAL ACCESS FORMULAS

Current Special Access Non-DSL Formula:

$$\text{Settlement} = \text{Rate Adjusted Special Access Revenues} \times \text{Retention Ratio} \\ + \text{Baseline Non-DSL TIC Shift}$$

$$\text{Rate Adjusted Special Access Revenues} = \text{Non-DSL Revenues} \times \text{Non-DSL TRI}$$

Retention Ratio

If Rate Adjusted Revenues per Exchange less than 550:

$$7.07 - 0.006423 \times \text{Rate Adjusted Revenues per Exchange}$$

If Rate Adjusted Revenues per Exchange between 550 and 1,000:

$$4.87 - 0.002436 \times \text{Rate Adjusted Revenues per Exchange}$$

If Rate Adjusted Revenues per Exchange greater than 1,000:

$$0.3411 + 2,095.23 / \text{Rate Adjusted Revenues per Exchange}$$

$$\text{Non-DSL TRI} = 1 / [(\text{Non-DSL 2017 Uniform Rate relative to December 2016 Uniform Rate}) \\ \times (\text{2017 Band Rate relative to Uniform Rate})]$$

Baseline Non-DSL TIC Shift:

The special access Non-DSL portion of the Baseline Special Access TIC shift from NECA's June 2011 tariff filing.

Proposed Special Access Non-DSL Formula:

$$\text{Settlement} = \text{Rate Adjusted Special Access Revenues} \times \text{Retention Ratio} \\ + \text{Baseline Non-DSL TIC Shift}$$

$$\text{Rate Adjusted Special Access Revenues} = \text{Non-DSL Revenues} \times \text{Non-DSL TRI}$$

Retention Ratio

If Rate Adjusted Revenues per Exchange less than 400:

$$8.89 - 0.011111 \times \text{Rate Adjusted Revenues per Exchange}$$

If Rate Adjusted Revenues per Exchange between 400 and 800:

$$5.93 - 0.003704 \times \text{Rate Adjusted Revenues per Exchange}$$

If Rate Adjusted Revenues per Exchange greater than 800:

$$0.3469 + 2,092.89 / \text{Rate Adjusted Revenues per Exchange}$$

$$\text{Non-DSL TRI} = 1 / [(\text{Non-DSL 2018 Uniform Rate relative to December 2017 Uniform Rate}) \\ \times (\text{2018 Band Rate relative to Uniform Rate})]$$

Baseline Non-DSL TIC Shift:

The special access Non-DSL portion of the Baseline Special Access TIC shift from NECA's June 2011 tariff filing.

Special Access DSL Settlements =

DSL Voice Data Settlements paid to VD Lines + Second Mile Settlement paid to Broadband-Only Lines

Current Special Access DSL Voice Data (VD) Formula:

Settlement = VD Lines \times Settlement per VD Line + \$707.94 + Baseline DSL TIC Shift

Lines = Average Base Period 2015/2016 Access Lines + DSL Broadband-Only Lines

Percent VD = (VD Lines / Lines) \times 100

Settlement per VD Line =

If Percent VD less than 50: $\$32.07 - 0.320743 \times \text{Percent VD}$

If Percent VD between 50 and 65: $\$26.06 - 0.200464 \times \text{Percent VD}$

If Percent VD greater than 65: \$13.0302

Baseline DSL TIC Shift:

The special access DSL portion of the Baseline Special Access TIC shift from NECA's June 2011 tariff filing. This settlement is paid only to study areas participating in NECA's DSL Tariff.

Proposed Special Access DSL Voice Data (VD) Formula:

Settlement = VD Lines \times Settlement per VD Line + \$924.68 + Baseline DSL TIC Shift

Lines = Average Base Period 2016/2017 Access Lines + DSL Broadband-Only Lines

Percent VD = (VD Lines / Lines) \times 100

Settlement per VD Line =

If Percent VD less than 45: $\$33.88 - 0.376422 \times \text{Percent VD}$

If Percent VD between 45 and 55: $\$28.67 - 0.2606 \times \text{Percent VD}$

If Percent VD greater than 55: \$14.333

Baseline DSL TIC Shift:

The special access DSL portion of the Baseline Special Access TIC shift from NECA's June 2011 tariff filing. This settlement is paid only to study areas participating in NECA's DSL Tariff.

Current Special Access DSL Broadband-Only (BO) Second Mile Formula:

This formula is aimed to compensate for second mile costs if a study area is identified to have second mile based on its network configuration in Tariff 4.

For average schedule study areas identified as not having 2nd mile costs:

$$\text{Monthly BO Second Mile Settlement} = 0$$

For study areas identified as having Second Mile transport costs:

$$\text{Monthly BO Second Mile Settlement} = \$2.78 \times \text{Broadband-Only Lines}$$

Proposed Special Access DSL Broadband-Only (BO) Second Mile Formula:

This formula is aimed to compensate for second mile costs if a study area is identified to have second mile based on its network configuration in Tariff 4.

For average schedule study areas identified as not having 2nd mile costs:

$$\text{Monthly BO Second Mile Settlement} = 0$$

For study areas identified as having Second Mile transport costs:

$$\text{Monthly BO Second Mile Settlement} = \$2.76 \times \text{Broadband-Only Lines}$$

TRAFFIC SENSITIVE RATE OF RETURN FORMULA

Monthly Traffic Sensitive settlements are adjusted to reflect the Rate of Return (ROR) achieved by the total NECA Traffic Sensitive pool.

Current: $0.813607 + (1.733888 \times \text{ROR})$

Proposed: $0.849983 + (1.428733 \times \text{ROR})$

GLOSSARY

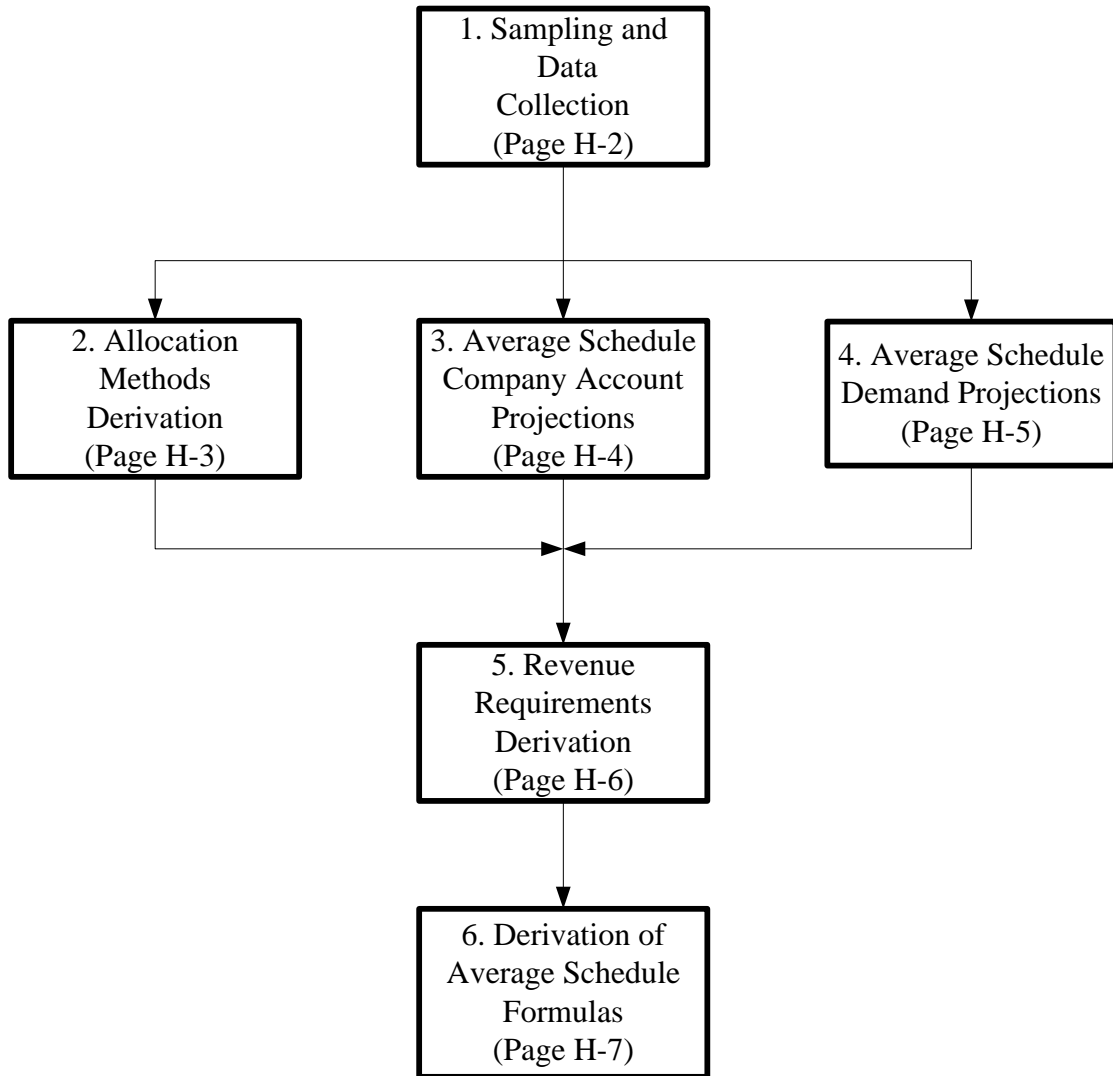
Term	Definition
Access Lines	A count of all working communication facilities extending from an end user's premises terminating in an end office (Class 5) that are or may be used for local exchange service. For multiparty service, the number of access lines equals the number of loops terminating on the mainframe of the central office. If two party lines are bridged in the field, they are counted together as an access line. The reported lines include public and semi-public pay telephone lines, access lines used for Customer Owned Coin Operated Telephone Sets (COCOTS), and employee concession lines. Excluded are company official lines and special access lines (i.e., FX service at either the closed or open end, WATS/800 Service lines at closed end, etc.). Each BRI ISDN line counts as one access line, and each PRI ISDN line and each DS1 Channel Service count as five access lines.
Access Minutes	Access minutes are the total of all premium and non-premium interstate traffic sensitive switched access minutes of use. Includes all Feature Group A, B, C, and D interstate access minutes of use that are switched in a Class 5 end office of an average schedule exchange carrier.
Adjusted Special Non-DSL Revenues	Special Access Non-DSL revenues restated at fourth quarter 2015 uniform rate band tariff rates.
Allocation Models	Statistically derived formulas used in NECA's average schedule studies to determine the portion of interstate costs of members of a statistical sample of average schedule accounts assigned to access elements, consistent with Part 69 of the Commission's rules.
Average Schedule Company Settlement Statements (AS3000)	The reports created by NECA that display an average schedule company's monthly settlement computations, using estimates or adjustments provided by the company. In addition, these reports show distributions from Interstate Common Line Support and CAF Intercarrier Compensation Support Funds.
Common Line TIC Shift	The amount of Transport settlements shifted to the common line category pursuant to the FCC's MAG order of November 8, 2001, as identified in NECA's June 2011 tariff filing, and frozen for average schedule settlement purposes in NECA's Second Further Modification of 2012 Average Schedules.
Consumer Broadband-Only Loop (CBOL)	Consumer Broadband-Only Loop (CBOL) is defined as a line without regulated local exchange service used as part of a Broadband Internet Access Service (BIAS) to connect to the Internet.
CBOL Settlement Formula	Settlement formula that compensate for the loop costs of providing broadband-only lines.
Cost	A component of an exchange carrier's accounts, attributed to a particular service or jurisdiction.
Cost Company Settlement Statements (EC3050)	The reports created by NECA that display a cost company's current month's settlement computation using estimated current month data and prior period adjustments. In addition, these reports show distributions from Interstate Common Line Support and CAF Intercarrier Compensation Support Funds.

Term	Definition
Cost Study Database	NECA's database of cost company account data, amounts assigned to interstate, and amounts assigned to each access category, determined using NECA's Cost Study program.
Customer Database	NECA's database of information related to NECA's revenue distribution agreements with individual companies (e.g. company name and address, contact persons, tax status indicator, number of exchanges, pool and tariff participation indicators, etc.).
Data Projections	The estimated amount of a sample study area's account or demand variable in a future period.
DFFITS	A statistic that measures the influence each observation has on the predicted value for that observation. It measures the change in the predicted value calculated for the <i>ith</i> observation before/after deleting the <i>ith</i> observation.
DSL Lines	Access lines that provide basic exchange service and DSL service, or lines exclusively providing DSL service, offered on a common carrier basis subject to NECA's Tariff No. 5.
DSL TIC Shift	The amount of Transport settlements shifted to the Special Access DSL category pursuant to the FCC's MAG order of November 8, 2001, as identified in NECA's June 2011 tariff filing, and frozen for average schedule settlement purposes in NECA's Second Further Modification of 2012 Average Schedules.
DSL Voice-Data Lines	Access lines that provide basic exchange service and DSL service, offered on a common carrier basis subject to NECA's Tariff No. 5.
Exchange	A unit generally smaller than a Local Access and Transport Area, established by the telephone company for the administration of communications services in a specified area which usually embraces a city, town, or village and its environs. It uses one or more central offices together with the associated facilities used in furnishing communications services within that area.
Intrastate Terminating Access Revenues	Revenues billed for terminating intrastate carrier common line, switched access services, reciprocal compensation, or access replacement revenue from state funds, pursuant to Commission rule 51.903, subject to intrastate rates.
Intrastate Terminating Access Settlement	An amount equal to Intrastate Terminating Access Revenues
Line Port Shift	The amount of Local Switching settlements shifted to the common line category pursuant to the FCC's MAG order of November 8, 2001, as identified in NECA's June 2011 tariff filing, and frozen for average schedule settlement purposes in NECA's Second Further Modification of 2012 Average Schedules.
Measure of Size	A calculation used to determine sample probabilities, equal to the square root of total access revenues used to calculate the stratum standard deviation of each study area in the stratum.
Month Sequence	A variable sequentially assigned to each month of a time series, and is used as an independent variable in modeling demand.

Term	Definition
Neyman Allocation	A method of allocating the sample size to each stratum in proportion to its standard deviation.
Non-DSL Special Access TIC Shift	The amount of Transport settlements shifted to the special access Non-DSL category pursuant to the FCC's MAG order of November 8, 2001, as identified in NECA's June 2011 tariff filing, and frozen for average schedule settlement purposes in NECA's Second Further Modification of 2012 Average Schedules.
Outlier Accommodation	The method of diminishing the variance of estimates by reducing the impact of influential data that are included in a regression model or ratio estimate.
Outlier Growth Test Ratio	The ratio measuring the impact of each study area on the Average Revenue Requirement Growth Ratio and used to determine which study areas are outliers to be excluded from all sample Annual Growth Ratio calculations.
Outlier Identification	The procedure of identifying data points that are considered to be non-representative or that have undue influence on estimated model parameters.
"Precision" or "Precision of Sample Estimates"	The range of accuracy of an estimate based on sample data.
Probability Proportionate to Size (PPS)	The method for determining the probability that a particular study area is included in the multi-year sample. The method assigns a greater probability of selection to larger study areas. The PPS sample method is used because it is statistically efficient. It produces more precise estimates from a sample of specific size than do equal probability sampling methods.
Revenue Requirement	The amount recoverable from interstate tariff charges, providing for expenses, taxes and a return on investment at the authorized rate of return.
Sample Design Criteria	A set of nine characteristics of study areas designated to ensure that the selected sample efficiently and accurately represents cost and average schedule study areas. They are used to stratify both populations into sub-groups from which the sample companies are selected.
Sample Weight	The reciprocal of the probability of including a study area in the sample in any given year. The sum of sample weights equals the total count of population units.
Second Mile Transport	The interoffice facility connecting the DSL serving wire center (SWC) and the SWC where the DSL access service connection point (ASCP) is located.
Separation Models	The statistically derived formulas used in NECA's average schedule studies to determine the interstate portion of accounts, as mandated by Part 36 of the Commission's rules.
Settlement	The amount of pooled access revenue that each exchange carrier receives for providing interstate access service to interexchange carriers and other users.

Term	Definition
Settlement Analysis Workpaper	A report prepared annually by NECA that compares a study area's current and proposed settlements, assuming constant demand. Also, an interactive worksheet prepared by NECA that assists a company in assessing formula changes based on changing demand.
Settlement Formula	One of a set of statistically derived formulas for use in calculating monthly settlements to average schedule companies, shown in Section VIII of this Filing.
Special Access Non-DSL Revenues	A study area's amount of Traffic Sensitive Interstate earned Special Access Non-DSL revenues.
Stratified Account Growth Ratio	The estimate of annual account growth calculated based on year over year changes in accounts from all average schedule study areas in each of three sample strata.
Stratified Composite Growth Ratio	An account's annual growth ratio calculated by combining growth ratios from consecutive annual samples.
Stratified Multi-year Growth Ratio	A multi-year growth ratio extrapolated from Stratified Composite Growth Ratios and used to forecast base period account values of study areas in each of three sample strata.
Test Period	A future time period when the average schedule formulas are proposed to be effective. The test period for the 2018 Modification of Average Schedules is July 1, 2018 through June 30, 2019.
Trend Change Indicator	A variable included in demand growth modeling to capture the impact of changes in historical data trends on future growth estimates.
Universal Service Contribution	The amount that telecommunications carriers, who provide interstate telecommunications services to others for a fee, contribute to the universal service support mechanisms based on their end-user telecommunication revenues as identified on the FCC's Form 499.
Universal Service Contribution Reimbursement	The portion of the universal service contribution amount reimbursed to average schedule companies. This amount is equal to FUSC Revenues earned by the company, which are designed to equal the actual paid <i>regulated</i> end user telephone operations universal service contributions which are assigned to the common line access element. Calculated in accordance with instructions for Line 12 in Section 5.0 of the Average Schedule Pool Administration Procedures.
Variance Weight	A multiplier, which is in inverse proportion to its contribution to total model variance, used to diminish effects of influential points on a regression model.

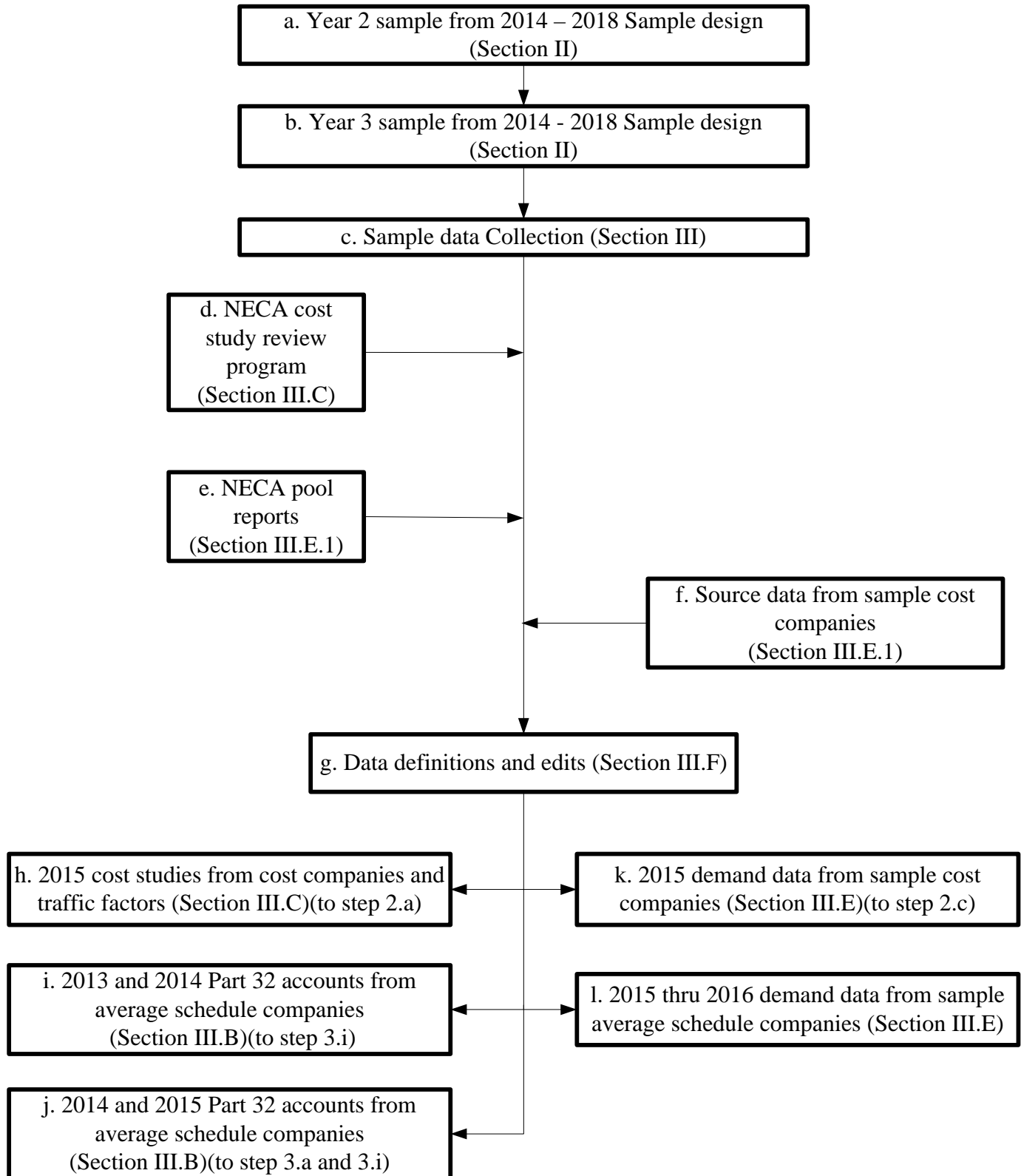
Flow Charts of Settlement Formula Development Steps



The numbered step references, used in this section, refer to other steps within this section

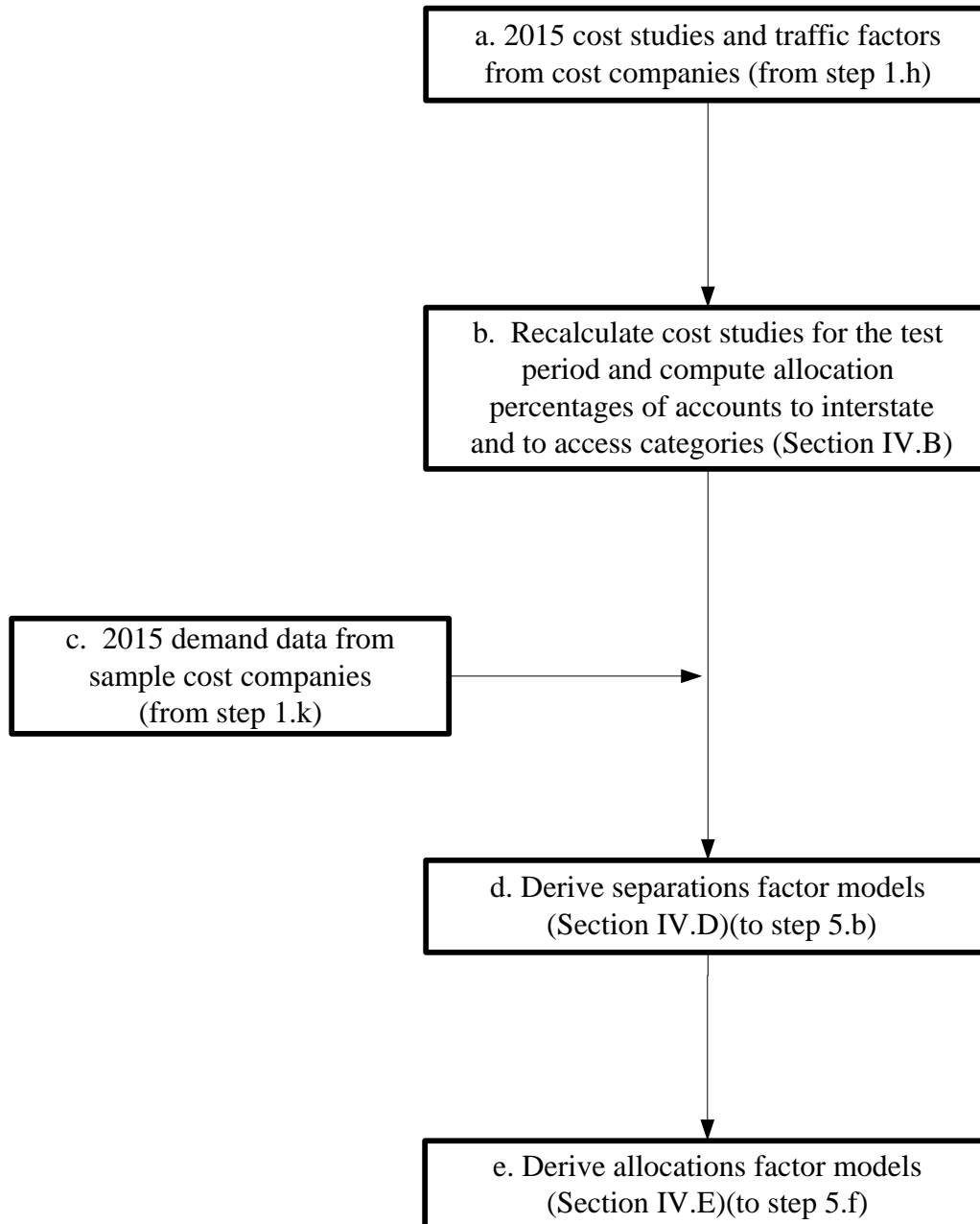
Flow Charts of Settlement Formula Development Steps

1. Sampling and Data Collection



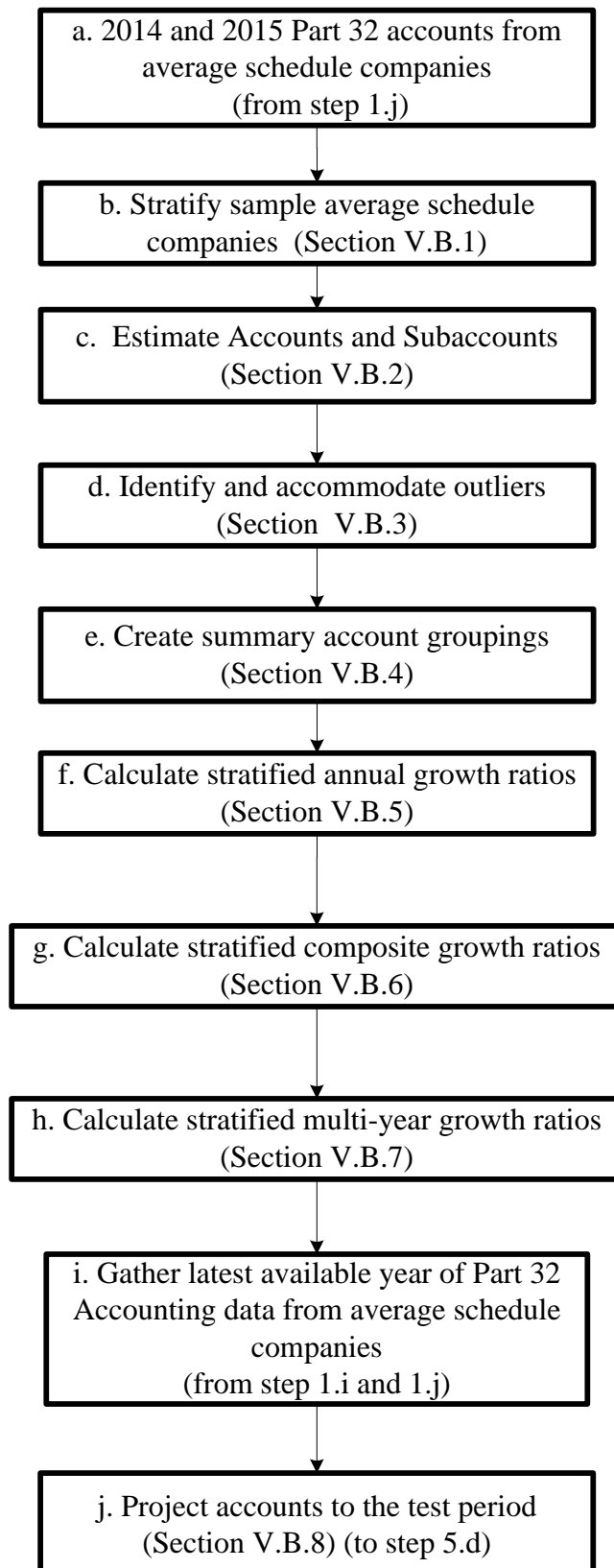
Flow Charts of Settlement Formula Development Steps

2. Allocation Methods Derivation



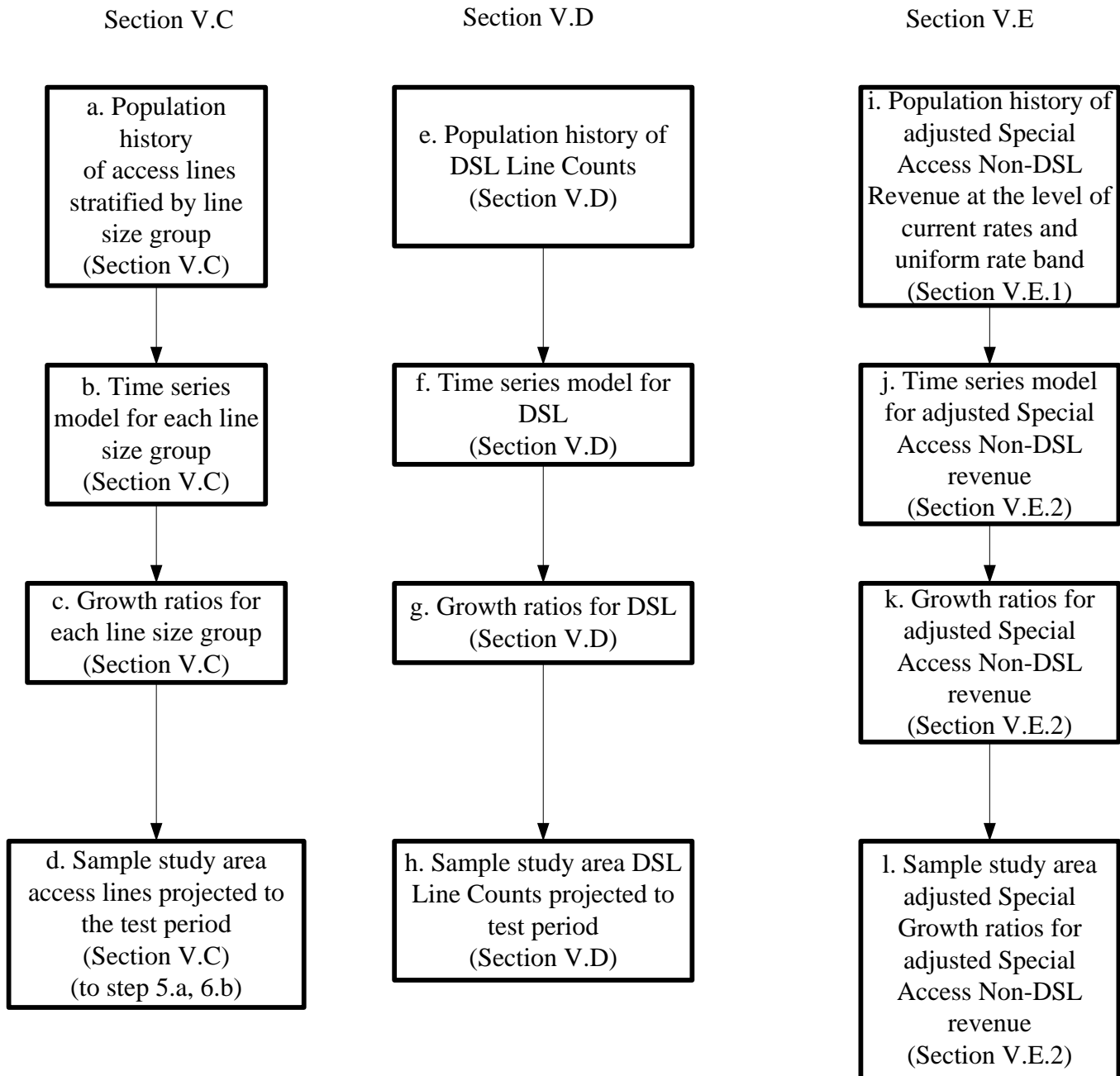
Flow Charts of Settlement Formula Development Steps

3. Average Schedule Company Account Projections



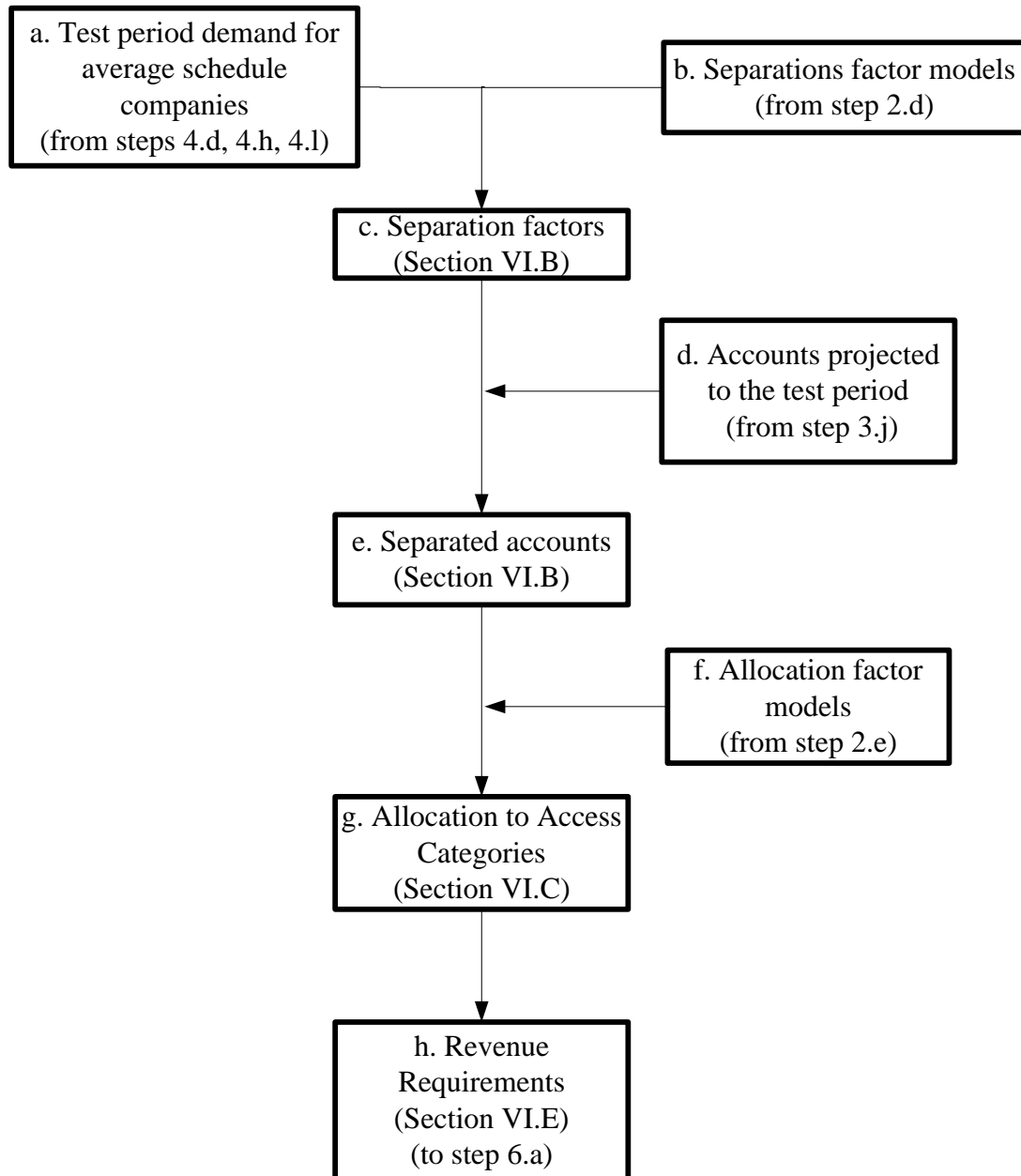
Flow Charts of Settlement Formula Development Steps

4. Average Schedule Demand Projections



Flow Charts of Settlement Formula Development Steps

5. Revenue Requirements Derivation



Flow Charts of Settlement Formula Development Steps

6. Derivation of Average Schedule Formulas

