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December 24, 2003

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

Re: National Exchange Carrier Association, Inc.
2004 Modification of Average Schedules, WC Docket No. 03-261

Dear Ms. Dortch:

Attached is NECA's *2004 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, 2004.

In accordance with the Commission's rules, this *2004 Modification of Average Schedules* has been filed electronically in the above-referenced docket.

Sincerely,

/s/ Richard A. Askoff

Attachment:

2004 Modification of Average Schedules

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## SUMMARY

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." These modifications are scheduled to be effective from July 1, 2004 to June 30, 2005.

NECA estimates carriers can expect, on average, an overall settlement decrease of 1.42% as a result of the new formulas. There are various reasons for modifications to average schedule formulas, including changes in cost and demand growth, as well as changes in technology and network configuration.

Impacts of these formula changes on individual average schedule companies will vary, depending on each company's size and demand characteristics. Overall, NECA projects that the majority of companies' settlements will decrease by ten percent or less. NECA estimates that approximately ten percent of the 489 average schedule study areas will experience an overall increase. Generally, this increase can be attributed to the increase in Common Line settlements not being offset by decreases in other (traffic sensitive) settlements. Also, because some companies are not in the traffic sensitive pool, NECA's calculations do not include their traffic sensitive settlements. Finally, NECA anticipates that eight study areas will experience a decrease in settlements greater than ten percent. This decrease is mainly attributable to the reduction in the high traffic volume coefficients.

Shortly after this filing is made, NECA will send a letter previewing the proposed average schedule formulas to all average schedule companies. This notification presents preliminary formula impacts

and offers explanations for the proposed changes. This notification will also provide information that will allow each average schedule company to calculate its new settlement amounts on its own or with the assistance of NECA regional staff.

# I. INTRODUCTION

The National Exchange Carrier Association, Inc. (NECA)[1] herein proposes modifications to current interstate average schedule formulas, for Federal Communications Commission (FCC or Commission) approval. These modifications are scheduled to be effective from July 1, 2004 to June 30, 2005.

## 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 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. 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.[2] The average schedule formulas are designed to "simulate the disbursements that would be received . . . by a [cost study] company that is representative of average schedule companies."[3]

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1 NECA administers interstate access charge tariffs and revenue pools on behalf of member ECs, and the preparation and filing of average schedule formulas, in accordance with the Commission's Part 69 rules (47 C.F.R. Part 69).

2 Compensation to ECs using these average schedule formulas is based on an EC's number of access lines, access minutes and other demand variables.

3 *See* 47 C.F.R. s 69.606(a). In lieu of the term "cost company", the text of section 69.606(a) references disbursements received "pursuant to Section 69.607" of the Commission's rules. That section, originally intended to govern payment of common line settlements to NECA pool participants, was waived by the Commission in 1985. See MTS and WATS Market Structure, CC Docket No. 78-72, Phase I, Order Granting Waiver, 98 FCC 2d 327 (1984); MTS and WATS Market Structure, CC Docket No. 78-72, Phase I, Order Granting Waiver, CC 2718 (rel. Feb. 22, 1985); MTS and WATS Market Structure, CC Docket No. 78-72, Phase I, Order Granting Waiver, CC 4710 (rel. May 23, 1986).

Settlements made on the basis of average schedule formulas benefit both ECs and interstate ratepayers. The average schedule 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.[4]

Section 69.606 (b) of the Commission's rules requires NECA either to file revised formulas on or before December 31st of each annual period, or to certify that no such revisions are necessary.[5] Accordingly, each year, NECA conducts an extensive 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.[6] NECA then develops mathematical 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 total company account data. This enables NECA to determine the interstate access portion of average schedule company total costs, thereby simulating the effects of performing interstate cost studies for these companies. Finally, NECA develops formulas

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4 *See* Revisions to the Average Schedules Proposed by NECA on October 3, 1988, *Memorandum Opinion and Order*, 4 FCC Rcd 2804 (1989) (*1989 Order*).

5 47 C.F.R. § 69.606(b). The current formulas have been in effect since July 1, 2003.

6 Statistical sampling is commonly used as a cost-effective method of deriving estimates for a population. A properly designed sample will provide an accurate representation of the entire population, but at a fraction of the cost of examining the entire population.

that relate sample average schedule company interstate access costs to various commonly-used demand units (such as access lines or access minutes) or combinations of demand units and other factors (such as lines per exchange). In developing these average schedule formulas, NECA carefully 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 an Industry Average Schedule Task Group. This group consists of EC representatives sponsored by industry associations (*i.e.* the National Telephone Cooperative Association, the Organization for the Promotion and Advancement of Small Telecommunications Companies and the United States Telecom Association). The Task Group meets several times each 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 also have an opportunity to provide input to NECA regarding the ways in which changes in the settlement formulas can affect their networks.

B. Overview of This Filing

Each of the steps followed in NECA's study are explained in detail in this Filing.[7] Section II

[7] The instant filing is referred to herein as the "2004 Filing" and the data collection and analyses upon which this filing is based are referred as the "2003 Study." The proposed settlement formulas proposed herein are referred to as the "2004 Schedules." References made herein with respect to previous years' filings, studies and settlement formulas use similar nomenclature.

describes the statistical sampling methods that NECA used in its data collection for settlement formula development. Section III contains a description of 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 in 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 for each sample average schedule study area. Section VII explains how NECA develops the "best fitting" mathematical 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 attached appendices contain all of the data used in NECA's study. These data enable the Commission and interested parties to verify NECA's Study results.

The 2004 Filing utilizes the five-year sampling design developed in 1998 (1998 Design). This Design selects a five-year sample, and then assigns members of the sample to data collection years. The 1998 Design takes extra precautions to ensure that additional "small" average schedule study areas are included.[8] The design entails defining stratification attributes, determining sample size, allocating the sample to strata, sample selection and assigning study areas to specific data collection years. The 1998 Design utilizes three study area attributes: number of access lines per exchange for a study area (large or small where small means study areas with fewer than 200 lines per exchange); traffic volume (high or normal based on switched access minutes per access line); and circuit density (high or low based on switched terminations per exchange). Section II of this filing explains the 1998 Design in

[8] "Small" study areas are defined as those with fewer than 200 access lines per exchange. This is in response to a Commission concern first brought to NECA's attention in December 1997. *See* National Exchange Carrier Association, Inc. (NECA), Proposed Modifications to the 1997 Interstate Average Schedule Formulas and Proposed Further Modifications to the 1997-98 Interstate Average Schedule Formulas, AAD 97-2, AAD 97-

detail. Additionally, Section II explains the use of a supplemental sample for average schedule study areas with non-homogenous cost per loop among companies with low values of loops per exchanges. This supplemental sample assists in producing more accurate and reliable average schedule settlement formulas.

## C. Effects of Proposed Modifications on Average Schedule Companies

### 1. Formula Changes

Beginning July 2004, carriers can expect, on average, an overall settlement decrease of 1.42% as a result of the new formulas. The overall decrease in total settlements reflects a 3.14% increase in Common Line (CL) settlements and a 6.75% decrease in overall Traffic Sensitive (TS) settlements. Changes in individual formula levels result from the effects of cost company allocation changes, and changes in cost and demand growth.

NECA estimates that its proposed modification of average schedules will result in an 8.39% increase in Common Line Basic formula settlements. There are various reasons for this change, including changes in demand and cost growth.

Central Office (CO) settlements are expected to decrease 9.66% on average. Decreases in formula levels can primarily be attributed to a decrease in cost company allocations to local switching.

The Distance Sensitive Line Haul formula will decrease by 15.90% on average. This

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109, *Order on Reconsideration and Order*, 13 FCC Rcd 10116 (1997).

decrease is primarily due to continued growth in normal and long route circuit miles and significantly lower cost per circuit mile.

NECA's proposed Non-Distance Sensitive Line Haul formula will decrease 10.42% on average. This decrease reflects an increase in circuit terminations growth and lower cost per circuit termination.

NECA is proposing a 29.09% decrease in the Intertoll Dial formula. This formula decrease is due to the significant increase in intertoll circuit growth.

NECA is proposing a 0.69% average increase in the Special Access formula. This slight increase is a result of a cost allocation shift from line haul to special access, offset by growth in special access revenues.

NECA is proposing a 12.13% on average decrease in the Signaling System (SS7) formula. The decrease is attributed to equipment and cost data updates from carriers and vendors.

2. Effects on Individual Average Schedule Companies

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, NECA projects that the majority of companies' settlements will decrease by ten percent or less. NECA estimates that approximately ten percent of the 489 average schedule study areas will experience an overall increase. Generally, this increase can be attributed to the increase in Common Line settlements not being offset by decreases in other (traffic sensitive) settlements. Also, because some companies are not in the traffic sensitive pool, NECA's calculations

do not include their traffic sensitive settlements. Finally, NECA anticipates that eight study areas will experience a decrease in settlements greater than ten percent. This decrease is mainly attributable to the reduction in the high traffic volume coefficients.

As a result of these changes, some companies may be affected more significantly than others. In the event that any average schedule company files a petition demonstrating a hardship resulting from these settlement changes, NECA requests that the Commission consider carefully the extent of individual company impacts associated with total settlement changes from all formulas and the potential need for transitional assistance in adjusting to new formula levels.

D. Communications with Average Schedule Companies

NECA will send a letter previewing the proposed average schedule formulas to all average schedule companies. This notification will present preliminary formula impacts and offer explanations for the proposed changes. This notification will also provide information that will allow each average schedule company to calculate its new 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

## A. Introduction

This section describes statistical sampling[1] methods used by NECA in its annual data collection program for average schedule formula development. The sampling design identifies the sample cost and average schedule companies to be used for collecting accounting and demand data for a given year. 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.

This average schedule study uses a five-year sample design, first introduced in the 1998 study. This sample design provides for samples of average schedule and cost study areas to supply data to NECA over the five-year period from 1998 to 2002.

Large and small ECs are distinguished according to group designations developed by NECA for use in its annual Access Tariff Filing.[2] According to this classification scheme, group A includes all Regional Bell Operating Company study areas and study areas of other large holding companies not in the NECA pools. Group B includes larger cost study area members of the NECA pools, many of which are affiliated with other study areas through holding companies.[3] Because of their size and operating characteristics, group A and B companies are not representative of average schedule

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1 Statistical sampling is a procedure used in analytical studies to provide an estimate, with an acceptable precision, of the true value of a criterion variable underlying an entire population, but at considerable savings in time and money.

2 *See, e.g.* National Exchange Carrier Association, Inc., Tariff F.C.C. No. 5, Transmittal No. 988, filed June 16, 2003 at Vol. 2, pp. 2 -3 (2003 Annual Access Tariff Filing).

3 Group B companies include: ALLTEL, Anchorage Telephone Utility, Century, Pacific Telecom, Puerto Rico Telephone, and Telephone and Data Systems (TDS). Some study areas owned by holding companies in the group are included in group D because they utilize average schedules.

companies and therefore are not asked to supply data for average schedule formula development. Group C contains smaller cost study areas that are similar to average schedule companies, and group D consists of all average schedule study areas.

In 1998, NECA developed a five-year sampling design, similar to the 1993 five-year sampling design, to draw samples for each of the five years from 1998 to 2002. In this design, NECA ensured that additional 'small' average schedule study areas were included.[4] 'Small' study areas were defined as those with fewer than 200 access lines per exchange. The design entailed defining stratification attributes, determination of sample size, and allocation of the sample to strata, sample selection and assignment of study areas to specific data collection years. The data used to design the sample included the NECA tariff filing information that designates a study area as Group B, C or D, Traffic Sensitive pool participation status, exchange counts, provision of line haul, provision of host/remote facilities, provision of special access services, provision of tandem access facilities and total net earned interstate access revenues.

Section B describes features of NECA's 1998 five-year sampling design that meet sample data needs and enable NECA to combine samples from two consecutive years to improve precision.

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[4] In a December 1997 order, the Common Carrier Bureau directed NECA to work with its staff to assure that sample data used by NECA accurately reflects all sizes of average schedule companies. *See* NECA Proposed Modification to the 1997 Interstate Average Schedule Formulas and Proposed Further Modifications to the 1997-1998 Interstate Average Schedule Formulas, AAD 97-109, *Order on Reconsideration and Order*, 13 FCC Rcd 10116 (1997) (*December 1997 Order*). The Accounting Safeguards Division also expressed concern that NECA's sample data was not representative of companies of all sizes in a June 1998 order. *See* NECA Proposed Modifications to the 1998-99 Interstate Average Schedule Formulas, AAD 98-20, *Order*, 13 FCC Rcd 17351 (1998)(*June 1998 Order*).

Section C defines the nine attributes of a study area that were used for an initial classification of the average schedule population into 39 classes and the cost company population into 52 classes. A special size criterion was included in the average schedule company classification method, to enable inclusion of proportionately smaller average schedule study areas.

Section D describes criteria used to group classes of study areas into sampling strata. Classes that include only a few study areas were combined with others, and classes that contain high variations in study area revenues were split into subclasses by revenue size. This procedure resulted in 14 cost study area strata and 14 average schedule study area strata. Stratification of the population is done to assure that the sample will provide the desired precision level and meet specialized data needs.

In Section E, NECA explains the determination of sample size, drawing upon statistical formulas found in sampling textbooks. The stratified sample with the optimum allocation[5] of the sample among strata helps produce statistical results with a desired level of precision at a fraction of the resource cost of examining the entire population. NECA demonstrates that its annual sample size of approximately 100 cost and 100 average schedule study areas is sufficient to ensure that the proposed formulas provide results with the desired level of precision.

Section F describes the allocation of the five-year sample size among different strata. NECA uses the "Neyman Allocation" method to determine the optimum number of study areas to be sampled from each stratum. In some strata, the optimum sample size equals or exceeds the total stratum size. In such strata, data will be collected for every study area over the five-year period, and from some more than once. In other cases the optimum sample size is less than the total stratum size. In such strata, not all study areas will submit data during the five-year period.

[5] The Neyman allocation is the special case of the optimum allocation.

Section G explains random sampling of study areas from each stratum using probabilities of selection proportional to the size of each study area. This procedure called Probability Proportional to Size sampling (PPS Sampling), assigns a greater probability of selection to larger study areas.
Section H explains the sample weight calculation. These weights are applied to the sample data to provide parameter estimates for the average schedule population.

Section I describes the assignment of sample study areas from each strata to sample years. This technique ensures that data from the larger study areas are included in every average schedule study with larger probabilities, and that the same study area will not be included in the sample for two consecutive years, thereby spreading the cost of responding to sample data requests among more study areas and increasing the effective sample size for average schedule studies.

Section J depicts the supplemental sample for average schedule study areas with non-homogeneous cost per unit among companies with low values of lines per exchange. This supplemental sample helps to produce accurate and reliable average schedule settlement formulas. This section discusses why the supplemental sample is needed and how it is developed, and presents details on the supplemental sample.

Data that underlie the 2003 Study are from the annual and supplemental samples of study areas collected in 2001 and 2002. This section of the filing produces the list of sample study areas, listed in Appendix A1, and their sample weights, displayed in Appendix D1 and D2, that were used in the 2003 Study.

## B. Five-Year Sampling Design

The five-year sampling design selects a five-year sample, and then assigns members of the sample to

data collection years.[6] A five-year sampling design methodology was developed in 1998 to support average schedule study activities for the 1999-2003 period. It is similar to the five-year sampling methodology developed in 1993 to support average schedule study activities for the 1994-1998 period.[7]

NECA's five-year sampling design plans for samples of cost and average schedule study areas to supply data to NECA in each year within a five-year period. NECA finds this plan an effective method because it achieves a targeted precision level while fairly distributing reporting burdens among companies. The plan uses an annual sample size, which is sufficient to maintain the desired precision level as the population changes over the five-year period. To protect against possible degradation in precision level, NECA redesigns the sample to reflect the current population every five years.

Use of a five-year sampling design allows NECA to plan a frequency of reporting for companies in each stratum. NECA tailors the reporting frequency of each stratum to reflect the significance of the data to average schedule studies. Data from strata of larger companies has a special significance because it reduces variance of sample estimates more than data from strata of smaller companies. The five-year sampling design allows NECA to combine data from two consecutive annual samples in a single estimate without loss of effective sample size. In contrast, two consecutive samples of size 100 from each of two independent one-year sampling designs combined in an estimator would achieve a lower level of precision than two consecutive annual samples of size 100 from a single five-year sampling design with commonly defined probabilities.

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6 NECA introduced the first multi-year design method in 1988, which supported average schedule studies between 1989 and 1993. *See, e.g.* National Exchange Carrier Association, Inc., 1990 Modification of Average Schedules, December 29, 1989.

7 *See, e.g.* National Exchange Carrier Association, Inc., 1995 Modification of Average Schedules, December 30, 1994.

In addition, NECA can include a larger company's data in every study while sampling it only every other year. Thus, NECA is able to use data that achieves the targeted precision level while sampling only half of the two-year sample each year. This feature significantly reduces costs incurred by NECA and by ECs, thereby reducing access charges passed on to access customers. NECA then selects an annual sample from the five-year sample, using methods detailed in Sections II.C through II.G. Finally, NECA uses a randomization procedure to determine which study areas will be included in the sample for each of the five years. This randomization procedure assures that some companies will be selected every other year, some every third year, and some every fifth year. The reporting frequency assigned to a company is coordinated with significance of its data in average schedule studies. This feature assures that a greater share of the reporting costs is borne by the larger companies.

## C. Sampling Design Attributes

In this section NECA describes nine attributes, which have an impact on the average schedule settlements and were used to classify the population of average schedule study areas. The 1998 Design employed nine attributes listed in Exhibit 2.1.

With the exception of the attribute for the size of the company, the remaining eight attributes were used to classify the cost companies. These attributes were chosen to ensure that: (1) an adequate number of average schedule study areas were selected; (2) data would support development of each average schedule settlement formula with the desired level of precision; and (3) diverse network configurations of the universe were adequately represented.

Since there are two possible outcomes from each attribute, it is possible to create a total of 512 ($2^9$) average schedule classes. However, only 39 classes contain average schedule study areas. Similarly, the 518 cost companies populated only 52 classes out of a total possible of 256 ($2^8$) classes. This classification procedure created a total of 91 cost and average schedule classes. The classes created for this sampling design assure representation of the average schedule and cost company populations in terms of the relevant attributes, which have an impact on the average schedule settlements.

**EXHIBIT 2.1**

**SAMPLE DESIGN CRITERIA**

| Criteria | Source/Date | |
|---|---|---|
| | **Average Schedule** | **Cost** |
| 1. Number of Exchanges (= 1 or > 1) | Settlement System<br>December 1997 | Customer Database<br>December 1997 |
| 2. Size of the Company (large or small)<br>Small: Size < 200 lines per exch. | Settlement System<br>December 1997<br>Size = Access Lines/Exchanges | This criterion is not used for classifying Cost companies |
| 3. Provider of Line Haul Facilities (yes or no) | AS1000 Report*<br>Line 41: Circuit Miles > 0;<br>Line 44: Switched Circ. Terms > 0 | Cost Study Database<br>(C&WF Cat. 2 + 3 + 4 > 0)<br>December 1997 |
| 4. Provider of Host/Remote Facilities (yes or no) | Line Haul Data Base<br>Second Quarter 1998 | Cost Study Database<br>(C&WF Cat. 4 > 0)<br>December 1997 |
| 5. Provider of Special Access Service (yes or no) | AS 1000 Report*<br>Line 33: TS Special Access Net Rev. > 0 | EC1050 Report* Line 22: Special Access Earned Rev. > 0 |
| 6. Provider of Access Tandem Facilities (yes or no) | AS 1000 Report*<br>Line 40: ITD Settlements > 0 | Cost Study Database<br>(COE Cat. 2 > 0)<br>December 1997 |
| 7. Traffic Volume (High or Normal)<br>High: MPL > 325 | AS 1000 Report*<br>$\text{MPL} = \frac{\text{Switched Access Minutes}}{\text{Access Lines}}$ | Cost Study Database<br>$\text{MPL} = \frac{\text{Switched Access Minutes}}{\text{Access Lines}}$ |
| 8. Density (High or Normal)<br>High : Density > 175 | AS 1000 Report*<br>$\text{Density} = \frac{\text{Switched Circ. Terms.}}{\text{Exchanges}}$ | EC1050 Report*<br>$\text{Density} = \frac{\text{Switched Circ. Terms.}}{\text{Exchanges}}$ |
| 9. Participant in NECA's 1998 Traffic Sensitive Settlement Pool (yes or no) | Customer Database | Customer Database |

*The April 1998 view of December 1997 data

A description of the 91 classes (39 average schedule and 52 cost) with the number of study areas in each of them is given in Exhibit 2.2A and 2.2B.

The columns in Exhibits 2.2A and 2.2B represent the following:

Exchanges: Number of Exchanges
Size: Size of the company
LH: Provides Line Haul
H/R: Provides Host/Remote
SA: Provides Special Access
IT: Provides Tandem Switching
MPL: Relative Access Minutes per Line
Density: Switched Circuit Terminations per Exchange
TS: Traffic Sensitive Pool Participant
Count: Number of Study Areas

**EXHIBIT 2.2A**

**CLASSES OF AVERAGE SCHEDULE STUDY AREAS**

| Class | Exchanges | Size | LH | H/R | SA | IT | MPL | Density | TS | Count |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | large | N | N | N | N | normal | normal | N | 3 |
| 2 | 1 | large | N | N | N | N | normal | normal | Y | 2 |
| 3 | 1 | large | N | N | Y | N | normal | normal | Y | 1 |
| 4 | 1 | large | N | Y | N | N | normal | normal | N | 6 |
| 5 | 1 | large | Y | N | N | N | normal | normal | Y | 6 |
| 6 | 1 | large | Y | N | Y | N | normal | normal | Y | 1 |
| 7 | 1 | large | Y | Y | N | N | normal | normal | Y | 75 |
| 8 | 1 | large | Y | Y | N | N | high | normal | Y | 4 |
| 9 | 1 | large | Y | Y | N | Y | normal | normal | Y | 1 |
| 10 | 1 | large | Y | Y | Y | N | normal | normal | Y | 138 |
| 11 | 1 | large | Y | Y | Y | N | normal | high | Y | 10 |
| 12 | 1 | large | Y | Y | Y | N | high | normal | Y | 6 |
| 13 | 1 | large | Y | Y | Y | N | high | high | Y | 3 |
| 14 | 1 | large | Y | Y | Y | Y | normal | high | Y | 3 |
| 15 | 1 | small | N | N | N | N | normal | normal | Y | 4 |
| 16 | 1 | small | N | N | Y | N | normal | normal | Y | 1 |
| 17 | 1 | small | Y | N | N | N | normal | normal | Y | 1 |
| 18 | 1 | small | Y | Y | N | N | normal | normal | Y | 12 |
| 19 | 1 | small | Y | Y | Y | N | normal | normal | Y | 3 |

**EXHIBIT 2.2A (Continued)**

**CLASSES OF AVERAGE SCHEDULE STUDY AREAS**

| Class | Exchanges | Size | LH | H/R | SA | IT | MPL | Density | TS | Count |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | >1 | large | N | N | N | N | Normal | normal | N | 2 |
| 21 | >1 | large | N | Y | N | N | Normal | normal | N | 8 |
| 22 | >1 | large | Y | N | N | N | Normal | normal | Y | 1 |
| 23 | >1 | large | Y | N | Y | N | Normal | normal | Y | 8 |
| 24 | >1 | large | Y | N | Y | Y | Normal | normal | Y | 1 |
| 25 | >1 | large | Y | Y | N | N | Normal | normal | Y | 25 |
| 26 | >1 | large | Y | Y | N | N | High | normal | Y | 1 |
| 27 | >1 | large | Y | Y | N | Y | Normal | normal | Y | 7 |
| 28 | >1 | large | Y | Y | Y | N | Normal | normal | Y | 149 |
| 29 | >1 | large | Y | Y | Y | N | Normal | high | Y | 6 |
| 30 | >1 | large | Y | Y | Y | N | High | normal | Y | 3 |
| 31 | >1 | large | Y | Y | Y | Y | Normal | normal | Y | 63 |
| 32 | >1 | large | Y | Y | Y | Y | Normal | high | Y | 14 |
| 33 | >1 | large | Y | Y | Y | Y | High | normal | Y | 3 |
| 34 | >1 | small | N | Y | N | N | Normal | normal | N | 1 |
| 35 | >1 | small | Y | Y | N | N | Normal | normal | Y | 3 |
| 36 | >1 | small | Y | Y | N | N | High | normal | Y | 1 |
| 37 | >1 | small | Y | Y | N | Y | Normal | normal | Y | 1 |
| 38 | >1 | small | Y | Y | Y | N | Normal | normal | Y | 2 |
| 39 | >1 | small | Y | Y | Y | Y | Normal | normal | Y | 4 |
| Total | | | | | | | | | | 583 |

**EXHIBIT 2.2B**

**CLASSES OF COST COMPANY STUDY AREAS**

| Class | Exchanges | LH | H/R | SA | IT | MPL | Density | TS | Count |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | N | N | N | N | Normal | normal | N | 2 |
| 2 | 1 | N | N | N | N | Normal | normal | Y | 3 |
| 3 | 1 | N | N | Y | N | Normal | normal | Y | 8 |
| 4 | 1 | N | N | Y | N | High | normal | Y | 1 |
| 5 | 1 | Y | N | N | N | Normal | normal | N | 21 |
| 6 | 1 | Y | N | N | N | Normal | normal | Y | 23 |
| 7 | 1 | Y | N | N | N | Normal | high | N | 1 |
| 8 | 1 | Y | N | N | N | High | normal | Y | 1 |
| 9 | 1 | Y | N | Y | N | Normal | normal | Y | 30 |
| 10 | 1 | Y | N | Y | N | Normal | high | Y | 2 |
| 11 | 1 | Y | N | Y | N | High | normal | Y | 4 |
| 12 | 1 | Y | N | Y | Y | Normal | high | Y | 1 |

**EXHIBIT 2.2B (Continued)**

**CLASSES OF COST COMPANY STUDY AREAS**

| Class | Exchanges | LH | H/R | SA | IT | MPL | Density | TS | Count |
|---|---|---|---|---|---|---|---|---|---|
| 13 | 1 | Y | Y | N | N | Normal | normal | N | 4 |
| 14 | 1 | Y | Y | N | N | Normal | normal | Y | 8 |
| 15 | 1 | Y | Y | N | N | Normal | high | N | 3 |
| 16 | 1 | Y | Y | N | N | High | normal | Y | 1 |
| 17 | 1 | Y | Y | Y | N | Normal | normal | Y | 11 |
| 18 | 1 | Y | Y | Y | N | Normal | high | Y | 2 |
| 19 | 1 | Y | Y | Y | N | High | normal | Y | 1 |
| 20 | 1 | Y | Y | Y | N | High | high | Y | 1 |
| 21 | 1 | Y | Y | Y | Y | Normal | high | Y | 3 |
| 22 | >1 | N | N | N | N | Normal | normal | N | 5 |
| 23 | >1 | N | N | N | N | Normal | normal | Y | 1 |
| 24 | >1 | N | N | Y | N | Normal | normal | Y | 14 |
| 25 | >1 | N | N | Y | N | High | normal | Y | 1 |
| 26 | >1 | Y | N | N | N | Normal | normal | N | 12 |
| 27 | >1 | Y | N | N | N | Normal | normal | Y | 5 |
| 28 | >1 | Y | N | N | N | Normal | high | N | 1 |
| 29 | >1 | Y | N | N | N | High | normal | Y | 2 |
| 30 | >1 | Y | N | N | Y | Normal | normal | N | 4 |
| 31 | >1 | Y | N | N | Y | Normal | normal | Y | 2 |
| 32 | >1 | Y | N | Y | N | Normal | normal | Y | 38 |
| 33 | >1 | Y | N | Y | N | Normal | high | Y | 1 |
| 34 | >1 | Y | N | Y | N | High | normal | Y | 8 |
| 35 | >1 | Y | N | Y | Y | Normal | normal | Y | 32 |
| 36 | >1 | Y | N | Y | Y | Normal | high | Y | 1 |
| 37 | >1 | Y | N | Y | Y | High | normal | Y | 4 |
| 38 | >1 | Y | N | Y | Y | High | high | Y | 1 |
| 39 | >1 | Y | Y | N | N | Normal | normal | N | 21 |
| 40 | >1 | Y | Y | N | N | Normal | normal | Y | 11 |
| 41 | >1 | Y | Y | N | N | Normal | high | N | 2 |
| 42 | >1 | Y | Y | N | N | High | normal | Y | 1 |
| 43 | >1 | Y | Y | N | Y | Normal | normal | N | 8 |
| 44 | >1 | Y | Y | N | Y | Normal | normal | Y | 4 |
| 45 | >1 | Y | Y | N | Y | Normal | high | N | 7 |
| 46 | >1 | Y | Y | N | Y | High | high | Y | 1 |
| 47 | >1 | Y | Y | Y | N | Normal | normal | Y | 115 |
| 48 | >1 | Y | Y | Y | N | Normal | high | Y | 1 |
| 49 | >1 | Y | Y | Y | N | High | normal | Y | 7 |
| 50 | >1 | Y | Y | Y | Y | Normal | normal | Y | 65 |
| 51 | >1 | Y | Y | Y | Y | Normal | high | Y | 9 |
| 52 | >1 | Y | Y | Y | Y | High | normal | Y | 3 |
| Total | | | | | | | | | 518 |

D. Stratification of the Population

NECA consolidated the 39 average schedule classes into 11 average schedule preliminary strata as shown in Exhibit 2.3A. Similarly, the 52 cost company classes were consolidated into 10 cost company preliminary strata, as shown in Exhibit 2.3B. This consolidation was based upon the number of study areas in each class and on the similarity of criteria in classes. Some of the classes listed in Exhibit 2.2A and 2.2B had too few members from which to sample and were subsequently combined with other classes. For example, classes 22 and 23 in Exhibit 2.2A were combined to form stratum A11 as shown in Exhibit 2.3A. Both of these classes shared common values for all attributes except Provision of Special Access.

**EXHIBIT 2.3A**

**PRELIMINARY STRATUM DEFINITION-AVERAGE SCHEDULE STUDY AREAS**

| Prelim. Stratum | Classes | Exch | Size | LH | H/R | SA | IT | MPL | Density | TS | Tot. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 15, 16, 17, 18, 19, 34, 35, 36, 37, 38, 39 | 1: 21<br>>1: 12 | small | n: 6<br>y: 27 | n: 6<br>y: 27 | n: 23<br>y: 10 | n:28<br>y: 5 | high: 1<br>nrml:32 | normal | n: 1<br>y:32 | 33 |
| A2 | 1, 4, 20, 21 | 1: 9<br>>1: 10 | large | n | n: 5<br>y: 14 | n | n | normal | normal | n | 19 |
| A3 | 8, 12, 13, 26, 30, 33 | 1: 13<br>>1: 7 | large | y | y | n: 5<br>y: 15 | n:17<br>y:3 | high | high: 3<br>nrml: 17 | y | 20 |
| A4 | 11, 14, 29, 32 | 1: 13<br>>1: 20 | large | y | y | y | n:16<br>y: 7 | normal | high | y | 33 |
| A5 | 9, 24, 27, 31 | 1: 1<br>>1: 71 | large | y | n: 1<br>y: 71 | n: 8<br>y: 64 | y | normal | normal | y | 72 |
| A6 | 10 | 1 | large | y | y | Y | n | normal | normal | y | 138 |
| A7 | 25 | >1 | large | y | y | N | n | normal | normal | y | 25 |
| A8 | 28 | >1 | large | y | y | Y | n | normal | normal | y | 149 |
| A9 | 7 | 1 | large | y | y | N | n | normal | normal | y | 75 |
| A10 | 2, 3, 5, 6 | 1 | large | n: 3<br>y: 7 | n | n: 8<br>y: 2 | n | normal | normal | y | 10 |
| A11 | 22, 23 | >1 | large | y | n | n:1<br>y: 8 | n | normal | normal | y | 9 |
| Total | | | | | | | | | | | 583 |

The grouping of classes causes some strata to not be completely homogeneous with regard to all of the sampling attributes. These exceptions are noted in Exhibits 2.3A and 2.3B.

For example, in stratum A1, 12 study areas have only one exchange and 21 have more than one exchange, 27 study areas have line haul facilities and 6 do not have it, 27 study areas have host remote facilities and 6 do not have it, 23 study areas do not provide Special Access services and 10 provide it, 28 study areas do not have intertoll circuits while 5 have it, one study area has high traffic volume and 32 have normal volume and all except one study area participates in the traffic sensitive pool.

**EXHIBIT 2.3B**

**PRELIMINARY STRATUM DEFINITION–COST COMPANY STUDY AREAS**

| Prelim. Stratum | Classes | Exch. | LH | H/R | SA | IT | MPL | Density | TS | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| C1 | 1, 5, 7, 13, 15, 22, 26, 28, 30, 39, 41, 43, 45 | 1: 31<br>>1: 60 | n: 7<br>y: 84 | n: 46<br>y: 45 | n | n: 19<br>y:72 | normal | high: 14<br>nrml: 77 | n | 91 |
| C2 | 4, 8, 11, 16, 19, 20, 25, 29, 34, 37, 38, 42, 46, 49, 52 | 1: 9<br>>1: 28 | n: 2<br>y: 35 | n: 22<br>y: 15 | n: 6<br>y: 31 | n: 28<br>y: 9 | high | high: 3<br>nrml: 34 | y | 37 |
| C3 | 10, 12, 18, 21, 33, 36, 48, 51 | 1: 8<br>>1: 12 | y | n: 5<br>y: 15 | y | n: 6<br>y: 14 | normal | high | y | 20 |
| C4 | 31, 35, 44, 50 | >1 | y | n: 34<br>y: 69 | n: 6<br>y: 97 | y | normal | normal | y | 103 |
| C5 | 17 | 1 | y | y | y | n | normal | normal | y | 11 |
| C6 | 40 | >1 | y | y | n | n | normal | normal | y | 11 |
| C7 | 47 | >1 | y | y | y | n | normal | normal | y | 115 |
| C8 | 14 | 1 | y | y | n | n | normal | normal | y | 8 |
| C9 | 2,3,6,9 | 1 | n: 11<br>y: 53 | n | n: 26<br>y: 38 | n | normal | normal | y | 64 |
| C10 | 23,24,27,32 | >1 | n: 15<br>y: 43 | n | n: 6<br>y: 52 | n | normal | normal | y | 58 |
| Total | | | | | | | | | | 518 |

Some preliminary strata were subdivided based on the range of interstate access revenues within the stratum. For example, the average schedule preliminary stratum A4 was subdivided into strata A4A and A4B, with total revenue <100,000 and total revenue >=100,000 respectively. Exhibits 2.4A and 2.4B show the criterion for the average schedule and cost study areas.

The average access revenue by stratum is shown in Exhibits 2.5A and 2.5B. The significant variation in the average access revenue among strata shows that this stratification effectively distinguishes companies by revenue size. For example, the average revenue for average schedule stratum A4B, is about seven times as large as that for stratum A4A.

**EXHIBIT 2.4A**

**REVENUE SIZE CRITERION – AVERAGE SCHEDULE STUDY AREAS**

| Preliminary Stratum | Final Stratum | Access Revenue Criterion |
|---|---|---|
| A1 | A1 | N/A |
| A2 | A2 | N/A |
| A3 | A3 | N/A |
| A4 | A4A | < 100,000 |
| A4 | A4B | >= 100,000 |
| A5 | A5A | < 100,000 |
| A5 | A5B | >= 100,000 & < 200,000 |
| A5 | A5C | >= 200,000 |
| A6 | A6 | N/A |
| A7 | A7 | N/A |
| A8 | A8 | N/A |
| A9 | A9 | N/A |
| A10 | A10 | N/A |
| A11 | A11 | N/A |

**EXHIBIT 2.4B**

**REVENUE SIZE CRITERION – COST COMPANY STUDY AREAS**

| Preliminary Stratum | Final Stratum | Access Revenue Criterion |
|---|---|---|
| C1 | C1A | < 100,000 |
| C1 | C1B | >= 100,000 |
| C2 | C2 | N/A |
| C3 | C3A | < 200,000 |
| C3 | C3B | >=200,000 |
| C4 | C4A | < 100,000 |
| C4 | C4B | >= 100,000 & < 200,000 |
| C4 | C4C | >= 200,000 |
| C5 | C5 | N/A |
| C6 | C6 | N/A |
| C7 | C7 | N/A |
| C8 | C8 | N/A |
| C9 | C9 | N/A |
| C10 | C10 | N/A |

**EXHIBIT 2.5A**

**DISTRIBUTION OF ACCESS REVENUES BY FINAL STRATA**

**AVERAGE SCHEDULE STUDY AREAS**

| Stratum | Count | Average |
|---|---|---|
| A1 | 33 | 6,633 |
| A2 | 19 | 69,752 |
| A3 | 20 | 119,279 |
| A4A | 10 | 60,847 |
| A4B | 23 | 422,641 |
| A5A | 43 | 39,797 |
| A5B | 18 | 121,150 |
| A5C | 11 | 627,533 |
| A6 | 138 | 27,127 |
| A7 | 25 | 26,905 |
| A8 | 149 | 81,629 |
| A9 | 75 | 11,067 |
| A10 | 10 | 16,186 |
| A11 | 9 | 132,477 |

**EXHIBIT 2.5B**

**DISTRIBUTION OF ACCESS REVENUES BY FINAL STRATA**

**COST COMPANY STUDY AREAS**

| Stratum | Count | Average Revenue |
|---|---|---|
| C1A | 69 | 25,600 |
| C1B | 22 | 261,997 |
| C2 | 37 | 114,399 |
| C3A | 8 | 144,368 |
| C3B | 12 | 504,400 |
| C4A | 51 | 56,437 |
| C4B | 28 | 139,174 |
| C4C | 24 | 382,062 |
| C5 | 11 | 48,092 |
| C6 | 11 | 27,748 |
| C7 | 115 | 83,800 |
| C8 | 8 | 12,552 |
| C9 | 64 | 40,656 |
| C10 | 58 | 64,505 |

E. Determination of Sample Size

This section describes how NECA determined the annual sample size required to support the development of the settlement formulas. As demonstrated in previous filings, the determination is based on well-documented and widely accepted statistical sampling techniques. Sample size was determined by balancing the need to acquire reliable data against the cost and burden that such an effort places upon sampled study areas.

Experience has shown that an annual sample of approximately 100 average schedule study areas and 100 cost study areas strikes this balance when two consecutive annual samples are combined in each average schedule study. In order to ensure that a sufficient number of study areas are selected to account for non-response, mergers, study areas converting from average schedule to cost settlement

status, and study areas exiting the NECA pools, NECA targets a higher number of study areas, about 230 per year. Of these, 115 are average schedule study areas and 115 are study areas settling on the basis of individual costs, resulting in a five-year sample size of 1150 (230 x 5).

Using data from sample companies, NECA confirmed that the resulting sample size is sufficient to provide average schedule formulas developed each year with the desired level of precision, by analyzing the precision of a sample ratio estimate of total average schedule interstate revenue requirements per access line.[8] NECA found that this ratio would be accurate within 2.5% of the true value with 95% confidence, a level sufficient for developing the average schedule formulas.

Statistical sampling textbooks, such as *Sampling Techniques* by William Cochran,[9] provide formulas to measure the precision of sample estimates. "Precision" is a range about the estimate that is shown to include the true value of the universe with a designated level of confidence. NECA estimates the total average schedule revenue requirement using a stratified ratio estimate. Formulas used to calculate the precision of a stratified ratio estimate are shown below:

The standard error of a ratio, $\hat{R}_h$, within a stratum is given by the following formula:[10]

$$s(\hat{R}_h) = \frac{\sqrt{1 - f_h}}{\sqrt{n_h'}\,\overline{X}_h}\sqrt{\frac{\sum_i (y_{i,h} - \hat{R}_h x_{i,h})^2}{N_h - 1}}$$

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8 Total interstate revenue requirements were used in this test to ensure that the total average schedule settlements pursuant to proposed formulas would be accurate. Access line counts were used because this demand unit is the most significant determinant of total average schedule settlements. For this purpose, NECA used the April 1998 view of December 1997 data.

9 William G. Cochran, *Sampling Techniques*, John Wiley & Sons, Inc., New York, (2nd ed., 1963).

10 *Id*. at p.31.

where:

$\hat{R}_h$ is the ratio estimate of average revenue requirement per access line for stratum $h$.

$n_h^{'}$ is the size of the responding sample in stratum $h$. Stratum sample sizes are explained in Section II. F.

$N_h$ is the number of study areas in stratum $h$.

$x_{i,h}$ is the number of access lines for study area i in stratum $h$, and is taken from the April 1998 view of December 1997 data.

$y_{i,h}$ is the total interstate revenue requirement for study area $i$ in stratum $h$, and is taken from the April 1998 view of December 1997 data.

$f_h$ is the ratio of the responding two-year sample size in stratum $h$ ($n_h^{'}$) to the total number of study areas ($N_h$) in stratum $h$.

$\overline{X}_h$ is the mean of access lines for stratum $h$ displayed in Column H of Exhibit 2.7.

In this formula, the value $\hat{R}_h$ and the summation are calculated using data from all study areas in each stratum $h$.

Exhibit 2.6 shows an example of the calculation of the standard error and variance of the ratio estimate for average schedule stratum A2. Study areas in this exhibit correspond to those in average schedule stratum A2 in Appendix A1. Columns B, C and D show the calculation of components of $\hat{R}_{A2}$. Column E shows the calculation of the sum of squares component of the variance.

**EXHIBIT 2.6**

**REVENUE REQUIREMENTS AND ACCESS LINES FOR AVERAGE SCHEDULE STRATUM A2**

| (A) Study Area Observation No. | (B) Revenue Requirement | (C) Access Lines | (D) $\frac{\sum(Col.\ B)}{\sum(Col.\ C)}$ | (E) $((B) - (D)(C))^2$ |
|---|---|---|---|---|
| | $(y_{i,h})$ | $(x_{i,h})$ | $(\hat{R}_h)$ | $(y_{i,h} - \hat{R}_h x_{i,h})^2$ |
| 1 | 15,283 | 2,031 | | 140,898.17 |
| 2 | 20,543 | 2,765 | | 61,389.66 |
| 3 | 20,977 | 2,724 | | 965,721.53 |
| 4 | 27,025 | 3,568 | | 698,413.61 |
| 5 | 27,315 | 3,710 | | 6,959.69 |
| 6 | 32,224 | 4,395 | | 1,260.79 |
| 7 | 34,052 | 4,447 | | 1,990,384.62 |
| 8 | 38,616 | 5,287 | | 36,416.00 |
| 9 | 39,309 | 5,079 | | 4,116,435.45 |
| 10 | 48,097 | 6,610 | | 176,998.81 |
| 11 | 54,747 | 7,538 | | 339,045.47 |
| 12 | 65,506 | 8,830 | | 4,576,913.25 |
| 13 | 71,286 | 8,633 | | 41,904,685.58 |
| 14 | 86,936 | 11,725 | | 763,781.77 |
| 15 | 107,684 | 14,925 | | 3,482,721.42 |
| 16 | 145,518 | 20,103 | | 4,157,397.45 |
| 17 | 256,718 | 35,417 | | 10,526,476.33 |
| 18 | 259,371 | 36,092 | | 30,757,950.19 |
| 19 | 370,313 | 50,659 | | 2,330,059.44 |
| TOTAL | 1,721,520 | 234,538 | 7.34 | 107,033,909.22 |

$$\hat{R}_{A2} = \frac{1{,}721{,}520}{234{,}538} = 7.34$$

$$s(\hat{R}_{A2}) = \frac{\sqrt{1 - 0.52632}}{(\sqrt{10})(12{,}344.11)} \sqrt{\frac{107{,}033{,}909.22}{19 - 1}} = 0.042426$$

$$Var(\hat{R}_{A2}) = s(\hat{R}_h)^2 = (0.042426)^2 = 0.0019$$

Exhibit 2.7 shows the resulting variance of the ratio estimate for each stratum. Column C shows the resulting stratum variances. The stratum variances were then used to determine the variance of the overall stratified ratio estimator, $\hat{R}$, using the following formula:[11]

$$Var(\hat{R}) = \frac{\sum_{h=1}^{L} X_h^2 Var(\hat{R}_h)}{X^2}$$

Where: $X_h$ is the total of access lines in stratum $h$.

$X$ is the total of population access lines.

Columns B, C and D of Exhibit 2.7 show the components of this calculation.

[11] *Id.* at p. 90. Formula 5.3 found in <u>*Sampling Techniques*</u> note 6 *supra* is a similar expression. NECA used the sum of access lines as the weighting factor. However, note this is approximate since ratio estimate is biased.

**EXHIBIT 2.7**

**AVERAGE SCHEDULE STRATUM VARIANCE DATA**

| (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H)=(B)/(E) |
|---|---|---|---|---|---|---|---|
| **Stratum** | **Access Lines** | $Var(\hat{R}_h)$ | **$(B)^2$ x (C)** | $N_h$ | $n'_h$ | **(F)/(E)** | **Mean Access Lines** |
| A1 | 11,406 | 8.9328 | 1,162,128,528 | 33 | 13 | 0.39 | 345 |
| A2 | 234,538 | 0.0019 | 101,682,214 | 19 | 10 | 0.53 | 12,344 |
| A3 | 71,146 | 0.0000 | 0 | 20 | 20 | 1.00 | 3,557 |
| A4A | 32,476 | 7.1118 | 7,500,706,165 | 10 | 4 | 0.40 | 3,247 |
| A4B | 484,159 | 0.0000 | 0 | 23 | 23 | 1.00 | 21,050 |
| A5A | 105,359 | 6.6424 | 73,734,507,772 | 43 | 12 | 0.28 | 2,450 |
| A5B | 120,935 | 3.5861 | 52,447,111,668 | 18 | 4 | 0.22 | 6,718 |
| A5C | 433,309 | 0.0000 | 0 | 11 | 11 | 1.00 | 39,391 |
| A6 | 223,769 | 0.8352 | 41,819,379,046 | 138 | 34 | 0.25 | 1,621 |
| A7 | 43,153 | 12.9344 | 24,086,151,806 | 25 | 5 | 0.20 | 1,726 |
| A8 | 689,543 | 0.3693 | 175,571,616,270 | 149 | 74 | 0.50 | 4,627.81 |
| A9 | 55,540 | 9.7597 | 30,105,541,420 | 75 | 9 | 0.12 | 740 |
| A10 | 10,333 | 1.0843 | 115,768,272 | 10 | 4 | 0.40 | 1,033 |
| A11 | 72,496 | 4.7161 | 24,786,280,412 | 9 | 4 | 0.44 | 8,055 |
| Total | 2,588,162 | | 431,430,873,573 | | | | |

Using values from the exhibit, the overall variance of the ratio estimate is calculated as follows:

$$Var(\hat{R}) = \frac{431{,}430{,}873{,}573}{(2{,}588{,}162)^2} = 0.064406$$

NECA then developed a 95% confidence interval to determine the relative precision of the estimator, using the formula below:[12]

$$\Pr(|\hat{R} - R| / R \geq d) = 0.05$$

Or

$$d = \frac{Z_{0.05} \times s(\hat{R})}{R}$$

where

$Z_{0.05}$ is the value of standard normal distribution N(0,1) corresponding to 95% confidence level, which is 1.96.

$d$ is the difference between the estimated and true value of $R$.

$R$ is the ratio of revenue requirements to access lines for the entire population of average schedule study areas for December 1997, a value of 19.743137.

Substituting data results in the following:

$$d = \frac{1.96 \times \sqrt{0.064406}}{19.743137} = 0.0252$$

This calculation shows that the average schedule sample is precise within 2.52% at the 95% confidence level, a level sufficient for average schedule development.

F. Allocation of Sample to Strata

NECA allocated the total sample size to strata using a method, known as "Neyman Allocation", a method which produces optimum precision results for stratified sampling.[13] The Neyman Allocation determines the size of the sample in each stratum in proportion to an estimate of the standard deviation of a measure of size in each stratum. The Neyman allocation is optimum (improves precision most)

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12 *Id.* at p. 75.

13 *Id.* at p. 97.

when the measure of size is correlated with the variable to be estimated (revenue requirement). The Neyman allocation to a stratum also depends upon the total count of study areas in the stratum (Column C of Exhibit 2.8A and 2.8B), and the number of study areas in the five-year sample. Following are derivations of these standard deviations and the count of study areas in the sample.

NECA defined a study area's measure of size to be the square root of its total interstate access revenues for two reasons. This measure relates to the variation in revenue requirements among average schedule companies, and it reduces the likelihood of over-allocation to strata of large study areas that would result from use of a measure of size that did not use the square root. These values are shown in Appendix A1.

Next, the standard deviation of measure of size in each stratum is calculated. These values are shown in Column B of Exhibits 2.8A and 2.8B. For example, for average schedule stratum A1, the standard deviation of the measure of size is 49.85.

The total five-year sample size of 1150 was allocated in the following steps:

1. Study areas in strata with high traffic volume (> 325 minutes per line, strata A3, C2) were designated to be censused and sampled every other year.
2. The remaining sample size was allocated using the Neyman Allocation.
3. Each allocation was tested to assure that no study area would be sampled more often than every other year. Strata with sample size allocations larger than this were also censused and sampled every other year.
4. The remaining sample size was allocated according to the Neyman Allocation.

By this method, strata A3, A4B, A5C, C2 and C3B were censused and the remaining total trial five-year sample size of 893 $(1150 - \frac{103 \times 5}{2})$ was allocated according to the Neyman Allocation.

Exhibits 2.8A and 2.8B show the use of standard deviations and the total trial five year sample size to calculate trial stratum five year sample sizes for average schedule and cost companies.

The sample allocation weight (Column D) is calculated as the product of the standard deviation of the measure of size (Column B) and the number of study areas (Column C). The sample allocation weight for a particular stratum, divided by the sum of all sample allocation weights, produces a stratum allocation fraction. This fraction was multiplied by the total trial five-year sample size to produce a trial five-year sample size in each stratum (Column E).

sample allocation $\text{weight}_h = SD_h(MOS) \times N_h$

sample allocation $\text{fraction}_h$ = allocation $\text{weight}_h / \Sigma(\text{allocation weight}_h)$

trial stratum five-year sample size = sample allocation $\text{fraction}_h$ x total trial five-year sample size

For example, for average schedule stratum A2 in Exhibit 2.8A, the trial stratum five-year sample size is calculated as follows:

sample allocation $\text{weight}_{A2}$ = 123.347 x 19 = 2343.59

sample allocation $\text{fraction}_{A2}$ = 2343.59 / 87704.42 = 0.0267215

trial stratum five-year sample $\text{size}_{A2}$ = 0.0267215 x 892.5 = 23.849 (~ 24)

The trial stratum annual sample size is calculated as the integer part of

$$\frac{\text{trial stratum five year sample size}}{5} + 0.5.$$

The sampling term, which represents how often a study area will be sampled, is calculated as the integer part of $\frac{N_h}{\text{trial annual sample size}} + 0.5$, but limited to a value between 2 and 5.

**EXHIBIT 2.8A**

**FINAL STRATA – AVERAGE SCHEDULE STUDY AREAS**

| (A) Stratum No. | (B) Standard Deviation of M. O. S.[14] | (C) No. of Study Areas | (D) Sample Allocation Weight | (E) Trial Five Year Sample Size | (F) Sampling Term | (G) Final Annual Sample Size | (H) Final Five Year Sample Size |
|---|---|---|---|---|---|---|---|
| A1 | 49.85 | 33 | 1645.08 | 17 | 5 | [7,6] | 33 |
| A2 | 123.35 | 19 | 2343.59 | 24 | 4 | [5,4] | 23 |
| A3 | 199.61 | 20 | 0.00 | 0 | 2 | 10 | 50 |
| A4A | 55.30 | 10 | 552.95 | 6 | 5 | 2 | 10 |
| A4B | 308.23 | 23 | 0.00 | 0 | 2 | [12,11] | 58 |
| A5A | 71.00 | 43 | 3053.00 | 31 | 5 | 6 | 30 |
| A5B | 25.33 | 18 | 455.89 | 5 | 5 | 2 | 10 |
| A5C | 444.04 | 11 | 0.00 | 0 | 2 | [6,5] | 28 |
| A6 | 65.04 | 138 | 8976.07 | 91 | 5 | 17 | 86 |
| A7 | 55.89 | 25 | 1397.30 | 14 | 5 | 3 | 15 |
| A8 | 122.47 | 149 | 18248.03 | 186 | 4 | [38,37] | 186 |
| A9 | 31.54 | 75 | 2365.35 | 24 | 5 | 5 | 25 |
| A10 | 34.22 | 10 | 342.17 | 3 | 5 | 2 | 10 |
| A11 | 106.71 | 9 | 960.38 | 10 | 5 | [2,1] | 9 |
| | | | | | | | |
| TOTAL | | 583 | 40339.82 | 411 | | [108] to [116] | 574 |

[14] M. O. S. is "Measure of Size." It is the square root of access revenues.

## EXHIBIT 2.8B

## FINAL STRATA – COST STUDY AREAS

| (A) Stratum No. | (B) Standard Deviation of M. O. S. | (C) No. of Study Areas | (D) Sample Allocation Weight | (E) Trial Five Year Sample Size | (F) Sampling Term | (G) Final Annual Sample Size | (H) Final Five Year Sample Size |
|---|---|---|---|---|---|---|---|
| C1A | 78.68 | 69 | 5,429.13 | 55 | 5 | [11,12] | 57 |
| C1B | 148.04 | 22 | 3,256.88 | 33 | 3 | [7,8] | 37 |
| C10 | 128.49 | 58 | 7,452.48 | 76 | 4 | [14,15] | 72 |
| C2 | 179.87 | 37 | 0.00 | 0 | 2 | [18,19] | 93 |
| C3A | 71.42 | 8 | 571.34 | 6 | 5 | [1,2] | 8 |
| C3B | 218.38 | 12 | 0.00 | 0 | 2 | 6 | 30 |
| C4A | 55.56 | 51 | 2,833.46 | 29 | 5 | [5,6] | 28 |
| C4B | 38.05 | 28 | 1,065.37 | 11 | 5 | 2 | 10 |
| C4C | 142.91 | 24 | 3,429.77 | 35 | 3 | 8 | 40 |
| C5 | 78.74 | 11 | 866.11 | 9 | 5 | 2 | 10 |
| C6 | 47.02 | 11 | 517.21 | 5 | 5 | 2 | 10 |
| C7 | 110.22 | 115 | 12,675.30 | 129 | 4 | [28,29] | 143 |
| C8 | 48.17 | 8 | 385.38 | 4 | 5 | [1,2] | 8 |
| C9 | 138.79 | 64 | 8,882.24 | 90 | 4 | 16 | 80 |
| | | | | | | | |
| TOTAL | | 518 | 47364.67 | 482 | | [119] to 129] | 629 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| GRAND TOTAL[15] | | 1101 | 87704.42 | 893 | | | 1203 |

[15] The Grand Total is the sum of the Totals from Exhibits 2.8A and 2.8B. The Sample Allocation Weight Grand Total is used to calculate Column E.

G. Selection of Sample

In this section, NECA describes methods for selecting sample study areas. To obtain reliable estimates from a sample requires that each member of the population has a well-defined probability of inclusion in the sample. NECA chose a special method of defining probabilities because it produces greater precision than other methods.

NECA determined the probability of including a specific study area in the five-year sample using one of two methods. Study areas in the census strata[16] were assigned a probability of one for inclusion in the multi-year sample. Study areas from other sample strata were assigned probabilities proportionate to size (PPS). The PPS method was used because it provides more precise estimates than other probability sampling methods.

Calculations supporting the PPS method are detailed in Appendix A1. Study areas within a stratum are ordered, according to their measure of size, starting with the largest. For example, in cost stratum C4B study area number one has the highest measure of size (443.5). Next, the cumulative measure of size is computed as a running total of measures of size. The cumulative measure of size associates a range of measure of size values with each study area, including all values between the study area's cumulative measure of size and the cumulative measure of size of the preceding study area. For example, the range of measure of size associated with study area one in cost stratum C4B is 0 to 443.5. Similarly, the range of size associated with the next study area is from 443.5 to 877.14.

The stratified PPS method divides each stratum into sampling intervals, then selects one sample member from each interval. The sampling interval is determined by dividing the stratum total measure of size by the stratum five-year sample size reported in Column H of Exhibit 2.8. For example, in cost

[16] Specifically, cost strata C2, C3B and average schedule strata A3, A4B, A5C

stratum C4B, the stratum sampling interval is:

$$\textit{Stratum Sampling Interval} = \frac{10393.2}{10}$$

$$= 1039.32$$

The PPS method selects sample members from intervals systematically, selecting the first member by a random start, then successively adding an interval to the random start to select other sample members. The random start for each stratum was computed by multiplying a random number by the stratum sampling interval. Random starts calculated by this method are displayed in Exhibit 2.9.[17]

In each stratum, the sample study area whose Measure of Size range included the stratum's random start was selected. A sequence of sample selection numbers was identified by progressively adding the stratum sampling interval to the random start. Each study area whose measure of size range included one of these values was included in the multi-year sample. For example, for cost stratum C4B shown in Appendix A1, this method first selects the study area with sequence number 3 because the random start for this stratum (955.46) is within study area 1 range of measure of size, which extends from 877.14 to 1308.69. Similarly, study area 8 is included in the sample because by calculating a second random number in the stratum (random start + 2×sampling interval = 955.46 + 2078.64 = 3034.1), it is determined that 3034.1 is within the study area 8 range of measure of size. Results for all strata are displayed in Appendix A1.

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17 Random numbers were generated using the RANUNI function of the SAS computer software. The function returns a number generated from the uniform distribution on the interval [0,1] using a prime modulus multiplicative generator with modulus $2^{31}$ - 1, and multiplier 397,204,094. *See* SAS Institute, *SAS Language: Reference, Version 6*, 592 (1st ed. 1990).

**EXHIBIT 2.9**

**RANDOM STARTS FOR EACH STRATUM**

| Stratum | Random Start |
|---|---|
| A1 | 0.506911 |
| A2 | 0.558424 |
| A3 | 0.444686 |
| A4A | 0.844831 |
| A4B | 0.277616 |
| A5A | 26.194459 |
| A5B | 250.336799 |
| A5C | 0.3911658 |
| A6 | 71.611490 |
| A7 | 176.341963 |
| A8 | 0.841177 |
| A9 | 299.349308 |
| A10 | 0.015482 |
| A11 | 0.017919 |
| C1A | 44.343804 |
| C1B | 0.883257 |
| C10 | 0.761835 |
| C2 | 0.009090 |
| C3A | 0.907439 |
| C3B | 0.597745 |
| C4A | 407.681308 |
| C4B | 955.464763 |
| C4C | 0.882367 |
| C5 | 127.413264 |
| C6 | 152.189704 |
| C7 | 0.897793 |
| C8 | 0.460138 |
| C9 | 0.232646 |

When a sample is selected by this method, the probability that a particular study area is included in the five-year sample is:

$$Probability\ of\ Inclusion\ in\ the\ Five\text{-}Year\ Sample = \frac{Stratum\ \ Five\text{-}Year\ Sample\ Size\ \ x\ \ Study\ Area\ Measure\ of\ \ Size}{Total\ \ Stratum\ \ Measure\ \ of\ \ Size}$$

For example, for study area one within cost stratum C4B,

$$Probability\ of\ Inclusion\ in\ the\ Five\text{-}Year\ Sample = \frac{10 \times 443.5}{10393.2} = 0.42672$$

According to this formula, larger study areas have a higher probability of inclusion than smaller ones. In cases where this formula would produce a value greater than one, a probability of inclusion equal to one was assigned.

The average Probability of Selection in a particular year's sample is given by:

$$Probability\ of\ Selection = \frac{Probability\ of\ \ Inclusion\ in\ Five\text{-}Year\ Sample}{Stratum\ Sampling\ Term}$$

For example, the probability of selecting Study Area 1 within Stratum C4B in any given year is:

$$Probability\ of\ Selection\ = \frac{0.42672}{5} = 0.085344$$

H. <u>Sample Weights</u>

In all probability samples, each member of the sample represents a determined share of the population. For example, in a simple random sample of 5 out of 50, each sample member represents 10

population members, and so has a probability of selection equal to 0.1. To derive an estimate of the population total from such a sample, we multiply the sample total by 10. In this case, 10 is the sample weight, applied equally to each member of the simple random sample. In a probability sample which is not a simple random sample, probabilities of selection are unequal. Correspondingly, sample weights are unequal and are unique for each member of the sample. Each sample weight is the reciprocal of the probability of selection:

$$Sample\ Weight = \frac{1}{Probability\ of\ Selection}$$

For example, when using data from study area 1 within cost stratum C4B, as part of a single year sample to estimate a population total, the sample weight would be:

$$Sample\ Weight = \frac{1}{0.085344} = 11.72$$

NECA's studies combine data from two consecutive samples. Consequently, probabilities of inclusion in the double sample are twice the probability of selection in the one-year sample. Therefore, the sample weights used by NECA with the double sample equal one-half the one-year sample weights.

## I. Assignment of Study Areas to Sample Years

This section describes how study areas selected for inclusion in the five-year sample are assigned to at least one, and to as many as three years of the five sample years.

Column F of Exhibits 2.8A and 2.8B specify the sampling term assigned to each stratum. A sampling term of three, for example, means that a company selected in the 1999 sample would be selected next

for the 2002 Sample, or every third year. Shorter sampling terms were assigned to strata consisting of larger study areas, while longer sampling terms were assigned to strata consisting of smaller study areas. For example, in Exhibit 2.8A, cost stratum C1A was assigned a sampling term of five, while cost stratum C1B was assigned a sampling term of three.

To make this assignment, for each stratum, a list of consecutive integers was assembled in random order, which counts from 1 to t, where t is the stratum sampling term. For example, in cost stratum C1A (which has a sampling term of five), the first random number was 1, followed in sequence by 4, 2, 3, and 5. Next, these randomly ordered numbers were assigned consecutively to sample study areas. Study areas, which were assigned a random number equal to 1 are sampled in the first year; those with a number equal to 2 are sampled in the second year, etc.

In strata with sampling terms less than 5, study areas are repeated in random number order in sample years after the term is reached. For example, in a stratum with a term of 2, a study area with a random number equal to 1 would also be sampled in the third and fifth year.

The annual sample size for each stratum, which was produced by this randomization method, is shown in Column G of Exhibits 2.8A and Exhibit 2.8B. In some strata, the sample sizes are not the same in every year because the multi-year sample size did not divide evenly by the term. In such cases, numbers in parenthesis designate alternative sample sizes.

Thus, the current five-year sample design accurately and efficiently represents the total average schedule population. Methods described herein assure that sample data represent the costs of each settlement function, for large and small companies, having normal, low and high cost conditions.

J. Supplemental Sample of Average Schedule Study Areas with High Variance in Cost per Unit

Average schedule studies during the past year have determined that three groups of study areas now have data that contribute to high variance in cost per unit. To provide for continuing reliability of statistical derivation of settlement formulas, NECA designed a supplemental sample from these three groups. Two groups consist of study areas with low values of lines per exchange in Nebraska and South Dakota, respectively. The third group consists of study areas in thirteen other states, which include very few average schedule study areas, with potentially high contributions to variance. Three new strata: Nebraska, South Dakota, and 13 Other States were constructed, and a supplemental sample of average schedule companies was designed. All 52 study areas in these three strata are censused, and randomly assigned to six data collection years: 2002 through 2007 [18]. As a result, 9 supplemental study areas were selected for year 2002. Details on this supplemental sample are shown in Exhibit 2.10. The assignment of study areas to sample years is shown in appendix A1.

**EXHIBIT 2.10**

**SUPPLEMENTAL SAMPLE**

| **Stratum** | **No. of Study Areas** | **Random numbers** | **Sampling Term** | **Final Annual Sample Size** | **Final Six Year Sample Size** |
|---|---|---|---|---|---|
| Nebraska | 11 | 2, 1, 6, 4, 5, 3 | 6 | [2, 1] | 11 |
| South Dakota | 17 | 5, 1, 3, 2, 4, 6 | 6 | [2, 3] | 17 |
| 13 other States | 24 | 2, 5, 1, 6, 4, 3 | 6 | 4 | 24 |
| TOTAL | 52 | | | [8, 9] | 52 |

[18] This supplemental sample is designed to provide data for the current average schedule filing, and to continue in parallel with the new five-year sample design that will support NECA filings beginning in 2004.

# III. DATA COLLECTION

## A. Introduction

One of the first steps necessary in developing settlement formulas is compiling accurate data. This section describes the sources and types of data NECA collected to support average schedule formula development. For the 2004 Modification of Average Schedules, NECA gathered data from several different sources, including NECA's settlement system, NECA's annual data collection, NECA's Cost Study Database, network schematics and line haul worksheets, Tariff No. 4, the Customer Database, and SS7 investment and expense information.

An overview of NECA's annual data collection from sample cost and average schedule study areas is discussed in Section III.B. NECA requested demand data from both sample[1] cost and average schedule study areas and accounting data from sample average schedule study areas.

Cost company accounting data comes from the sampled cost company's annual cost separations studies submitted to NECA as described in Section III.C. These data are used to develop statistical models of separations (Part 36) and access allocations (Part 69), which are applied to average schedule companies.

Since average schedule companies do not perform cost separations studies, the sampled average schedule companies report financial data to NECA at a total company level. Collection of these data is described in Section III.D.

Demand data reported to the NECA pool by average schedule companies are used to forecast base period demand to the test period and to calculate average schedule separations and allocation factors needed to derive revenue requirements. Forecasted demand is used to create new settlement formula

[1] The selection of the annual sample is described in Section II.

models. Section III.E details the sources of cost company and average schedule demand data.

Section III.F discusses the demand and accounting data used for high traffic volume average schedule companies.

Section III.G summarizes the collection of average schedule line haul demand data supporting development of the distance sensitive and non-distance sensitive line haul formulas, and describes how circuit mile data were obtained from sample cost companies in order to develop Part 36 separation factor models for Central Office Equipment Category 4.3 and for Cable & Wire Facilities Categories 1.3, 3 and 4.

Section III.H describes the collection of SS7 cost data and A-Link access information from average schedule companies.

All the data listed above were subjected to several edit checks to ensure their validity. As in the past, the data were screened to ensure accuracy in developing the proposed 2004 average schedule formulas. Company personnel or source documents were consulted whenever questions or inconsistencies arose to determine if corrections should be made. Section III.I describes the edits performed on each type of data.

The methods outlined in Section III produced the validated data that was used throughout this study.

## B. NECA's Annual Data Collection

In 2001 and 2002, NECA requested demand data from both sample cost and average schedule study areas and accounting data from sample average schedule study areas to support development of average schedule settlement formulas, tariff rates, the average schedule USF loop cost formula and the average schedule local switching support formula. The 2001 sample provided accounting data from calendar years 1999 and 2000 and demand data from 2001. The 2002 sample provided accounting data from calendar years 2000 and 2001 and demand data from 2002. Sample companies for both years were based on the sample design, described in Section II.

As in the past, NECA personnel offered to assist companies in completing the data forms. Many companies availed themselves of this opportunity. In some cases, this assistance took the form of telephone consultation with representatives from the sample companies. In other cases, NECA personnel compiled data from company source documents on behalf of companies. This additional assistance is sometimes needed by smaller companies lacking the personnel and resources required to respond fully to the data request.

The 2001 annual data collection requested data from 133 cost study areas. One of these study areas merged into another study area and was excluded from this study. A total of 132 cost study areas were derived from the 2001 annual data collection.

The 2001 annual data collection also requested data from 105 average schedule study areas. Of these, two study areas did not participate due to lack of resources to complete the survey. In addition, two more study areas were excluded from the study because of lack of sufficient and accurate supporting documents. A total of 101 average schedule study areas were derived from the 2001 annual data collection.

The 2002 annual data collection requested data from 139 cost study areas. Two of these study areas were excluded from this study. Of these, one very small company did not supply data. Another one had recently converted from average schedule to cost and did not have cost data available for the point in time requested. Data from the remaining 137 cost study areas were combined with data from the 132 cost study areas in the 2001 annual data collection. As a result, the two years of data collection yielded valid data from 269 cost study areas.

The 2002 annual data collection requested data from 107 average schedule study areas (98 from the original multi-year sample design and 9 from the new supplemental sample of high variance strata). Of these, two study areas did not participate due to lack of resources to complete the survey. Data from the remaining 105 average schedule study areas were combined with data from the 101 average schedule study areas in the 2001 annual data collection. As a result, the two years of data collection yielded valid data from 206 average schedule study areas.
This number excludes study areas that were selected in the sample design as average schedule, but subsequently converted to cost.

C. Cost Company Cost Data

NECA used detailed cost study data as the foundation of average schedule separations and allocation models (discussed in Section IV). As part of its member company data review activities, NECA

routinely acquires cost company cost studies to validate pool settlement distributions and to support tariff rate filings.

In 2002, all cost companies participating in the NECA pools were asked to provide a copy of their 2001 cost studies, showing total company (Part 32) amounts, total interstate (Part 36) amounts, and access category (Part 69) amounts. The data, submitted annually, was entered into NECA's cost study separations/allocator software program. NECA personnel reconciled discrepancies between the calculation results of its cost study program and results from the exchange carrier's cost studies. This reconciliation process provided additional assurance that cost studies are performed in accordance with Commission rules and orders, and that the data necessary for calculating separations transitions are present.[2] The use of a single allocator program also provided NECA with a uniform data format for the analyses performed in this Study. The data was placed in NECA's Cost Study Database. Sample cost data is provided in Appendix B1.

D. Average Schedule Company Accounting Data

Average Schedule company accounting data were used to develop the Part 69 revenue requirements, described in Section VI.

Total company account specific data (Part 32) from calendar years 2000 and 2001 were requested

from each average schedule study area in the 2002 sample[3]. These companies were required to

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[2] *See, e.g.*, Safeguards to Improve the Administration of Interstate Access Tariff and Revenue Distribution Process, CC Docket No. 93-6, NECA Comments (filed April 14, 1993) at Attachment A, pp. 1-3.

[3] Because of timing, study areas in the supplemental sample were asked to provide 2001 accounting only. Data from these nine study areas were, consequently, not used to determine account growth rates, as described in section V.

exclude from reported account balances, costs associated with non-regulated activities, in accordance with the Commission's Part 64 rules. Each company was also asked to supply copies of 2000 and 2001 financial documents supporting its accounting data, such as summarized General Ledgers, Annual Reports or final Trial Balances. These documents were used as sources for the verification steps described in Section III.I. The 2000 and 2001 accounting data from the 2002 sample are displayed in Appendices C1 and C2, respectively.

Similar accounting data from calendar years 1999 and 2000 were obtained from average schedule study areas in the 2001 sample. Source documents for these data were also obtained for verification purposes. Average schedule company accounting data obtained from the 2001 sample are displayed in Appendices C4 and C5.

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 Settlement 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 Settlement System or Customer Database.
    a. For average schedule companies, NECA used the average month of the period from July 2002 through June 2003, including all adjustments through July 2003

for the following data elements:[4]

- Common Line Access Lines
- Traffic Sensitive Switched Access Minutes of Use
- Number of Exchanges
- Switched Interstate Circuit Terminations
- Interstate Circuit Miles
- Intertoll Dial Circuits
- Interstate Circuits
- Special Access Revenues

b. For average schedule companies, NECA used the average month of the period from January 2000 through December 2001, including all adjustments through September 2003 for the analyses underlying the forecast of Interstate Special Access Revenues[5], described in Section V.H.1.

c. SS7 facility and cost data reported to NECA's SS7 database

- SS7 capital investment in Service Switching Points (SSPs) and Consolidation Points (CPs)

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4 Throughout the remainder of this Filing, Common Line Access Lines are referred to as "access lines"; Traffic Sensitive Switched Access Minutes are referred to as "access minutes"; Switched Interstate Circuit Terminations are referred to as "circuit terminations" and Interstate Circuit Miles are referred to as "circuit miles".

5 Average schedule and cost interstate special access revenues have been adjusted to reflect revenues that would have been collected if average schedule companies had achieved the authorized rate of return during all of the historical data months examined. Section V.H.1 describes the development of the rate of return adjustment factors. Adjusted special access revenues are referred to in this Filing as "adjusted special access revenues."

- Location and number of fully connected or partially connected SSPs
- Location of CP Data links and Signal Transfer Points (STPs)
- Number of CP Data links and A-link pairs
- A-link providers

d. For cost companies, NECA used the average month of the period from January 2001 through December 2001[6], including all adjustments through June 2003 for the following data elements:

- Common Line Access Lines
- Common Line Minutes of Use
- Traffic Sensitive Switched Access Minutes of Use[7]

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6 Cost company demand data from 2001 correspond to 2001 cost studies used in this average schedule Filing, the latest available for this analysis.

7 Since prior to July 2003 cost companies report common line access minutes on a monthly basis, but do not report traffic sensitive switched access minutes as average schedule companies do, NECA derived cost company traffic sensitive switched access minutes from their reported common line access minutes data. NECA used a simple regression estimation technique based on data reported by average schedule study areas for settlements to estimate the ratio of traffic sensitive to common line access minutes for cost companies. This ratio was used to calculate traffic sensitive access minutes for each sample cost study area. Influential points were identified and accommodated using the method described in Section IV.C. The model follows:

*Traffic Sensitive Access Minutes = 1.000121 x Premium Common Line Access Minutes*

$R^2 = 0.9999$ *t-statistic = 2,738.45* *F-statistic = 7,499,121*

- Special Access Revenues
- Number of Exchanges

2. Cost company documents and schematics, describing exchange locations at remote offices reported in response to the 2001 and 2002 sample data requests. Included in these documents are the following:
    - Working Lines
    - Route Miles

3. Interstate toll circuit miles from the 2001 Cost Study database derived from:
    - Interstate Message Circuit Miles
    - Joint Message Total Circuit Miles
    - Interstate Conversation Minute-Mile Factor

4. 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. Average Schedule High Traffic Volume Demand and Accounting Data

In this Filing, NECA documents special analyses of accounting and demand data for average schedule study areas with high traffic volumes. To support these analyses, NECA used accounting data from the 2001 and 2002 data collection and demand data reported for settlements that were coincident with each of these calendar years. A company was designated as having high traffic volume if its minutes

of use per access line per month exceeded 350 during the data years included in this study. Wherever possible, the accounting data from the highest traffic volume year between 1999 and 2001 was used. If no accounting data was available during the highest traffic year, the period with the next highest traffic volume was selected. Accounting data used in this study are displayed in Appendix C3. Demand data for the high traffic volume study areas corresponding to the accounting data year (1999, 2000 or 2001) were selected from the NECA settlement system and are displayed in Appendix D3.

## G. Line Haul Data

Average schedule line haul demand data (i.e., circuit miles, circuit terminations and interstate circuits) are used to calculate separations factors and to support the development of the Line Haul Distance Sensitive, Line Haul Non-Distance Sensitive, and SS7 settlement formulas. Cost company line haul data are used to develop Part 36 separation factor models for Central Office Equipment Category 4.3 and for Cable & Wire Facilities Categories 1.3, 3 and 4, as described in Section IV.

### 1. Average Schedule Companies

NECA procedures require average schedule study areas to provide updated line haul worksheets and schematics at least once a year or whenever significant changes occur in their transport networks. Carriers report counts of access lines, as well as counts of circuits, circuit miles and circuit terminations, to NECA to support their settlement claims.

To determine which study areas required updates of line haul schematics, NECA compared line haul demand from its database with line haul demand reported to the monthly settlement system. Average schedule study areas whose settlement reports indicated material differences when compared with data in the line haul database, were asked to reconcile these differences

and provide updates in time for use in this average schedule study. Each average schedule sample company's circuits, circuit miles and circuit terminations data, as reported to the NECA settlement system, are displayed in Appendix D1.

2. Cost Companies

Cost company circuit mile data were obtained by combining interstate circuit miles to remote switches with interstate toll circuit miles connected to other switches, as reported in 2001 cost studies. Circuit miles to remote offices were derived from counts of circuits at remote offices (determined according to NECA's Traffic Engineering Circuit Count Method) [8] and route miles to remote offices.

*Total Circuit Miles = Interstate Toll Circuit Miles + Interstate Circuit Miles at Remote Offices*

*Interstate Toll Circuit Miles = Interstate Message Circuit Miles*
*+ Joint Message Interstate Circuit Miles*

*Joint Message Interstate Circuit Miles = Joint Message Total Circuit miles*
*x 2001 Cost Study Interstate Conversation Minute-Mile Factor*

The traffic engineering method uses route mile data and access line counts at each remote office to develop circuit miles. NECA determined that 178 sample cost companies have host/remote circuits (COE Category 4.3 equipment). Sample cost companies provided route mile data and access line counts at each remote office. Sample cost company total interstate

[8] The circuit count method is first described in Exhibit 5.11 of NECA's 1994 Modification of Average Schedules, and has been included in NECA's Pool Administration Procedures for Average Schedule Companies. *See* National Exchange Carrier Association, Inc., 1994 Modification of Average Schedules, Dec. 30, 1993 at

circuit mile data are displayed in Appendix D2.

H. Signaling System 7 (SS7) Data

NECA collects Signaling System 7 (SS7) network configuration and cost data for Service Switching Points (SSPs) and Consolidation Points (CPs) installed by average schedule companies that receive SS7 settlements.

One set of data is collected from average schedule exchange carriers that have installed SSP or CP equipment and are connected to the nationwide signaling network or are expected to connect to the network during the 2004/2005 settlement period. Information on SSP or CP equipment investment and expenses related to the provision of SS7 signaling links (e.g., CP data links) was collected, and the STP or access service provider was identified. NECA collects data on the connection charges of these access service providers. These data are displayed in Appendix G. NECA used these data to update the SS7 settlement formula for those exchange carriers connected to the nationwide SS7 signaling network, as described in Section VII.J.1.

Another set of data is collected from average schedule exchange carriers that have installed SSP or CP equipment, but have not yet connected to the nationwide signaling network. Types of investments incurred by these companies are the same as those connected to the network, except that they do not pay for links connecting their SSP to the network. These data, displayed in Appendix G, were used to update the SS7 settlement formula for those exchange carriers not yet connected to the nationwide signaling network, as described in Section VII.J.2.

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V- 35.

Data from SSPs that were reported with incomplete cost data were replaced with the average cost of SSPs of the same model type. In a few cases, when the carrier did not identify the model type of SSP, the overall average cost was used.

## I. Data Edits

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

Several edits were performed on cost study area 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 area 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.

b. A review of data ensured that all study areas provided sufficient account detail.

c. Individual study area investment per line and investment per minute ratios were compared to average sample ratios. Extreme values were investigated to ensure accuracy.

d. Individual accounts for each study area were compared to their total investments and expenses for reasonability.

e. 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. Errors were corrected, and reasons for any inconsistencies were provided.

4) Signaling System 7 (SS7) Data Edits

The methods used for these edits included the following:

a. SS7 facility data were reviewed for consistency with source documents and settlement claims.

b. Source documents were reviewed to determine that SS7 cost components are complete.

# 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 2001.[1] 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, 2004 through June 30, 2005). From each cost study, NECA then calculates fractions of unseparated accounts that are allocated to interstate, and fractions of interstate accounts that are allocated to access categories. These separation and allocation fractions, in turn, are used in the construction of statistical models of separation and allocation ratios.

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 separations and allocations of accounts of each sample average schedule company.

The following is an illustration of a straight line equation model for separating an account.

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

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.

[1] Data from 2002 cost studies do not become available until the second half of 2003, which was too late for inclusion in this Study.

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:

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

To ensure that all models represent the average schedule population, influential data points were identified and accommodated according to the method described in Section IV.C. The outlier accommodation method was used for all separation and allocation models except for models with the independent variable being the separation fraction of another account prescribed by Part 36 rules. These cases exhibit a near perfect fit and outlier accommodation method would have been irrelevant.

## B. Jurisdictional Cost Separations and Access Category Allocations

The following sections discuss cost allocation methods underlying data obtained from 2001 cost studies for cost companies in the 2001 and 2002 samples. The summary of cost 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

In an order released May 22, 2001, the FCC adopted the Federal-State Joint Board recommendation to impose an interim separations freeze effective July 1, 2001.[2] The freeze included all Part 36 category relationships and interstate separations factors for price cap

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

carriers, and all interstate separations factors for rate-of-return carriers. The freeze is in effect for five years or until the Commission has completed comprehensive separations reform, whichever comes first.

As a result of the separations freeze, the Local Switching separations factors underlying the 2000 cost studies no longer need to be projected to reflect the future test period. However, to account for the changes in DEM weighting factor when companies crossed an access line threshold since 2000,[3] NECA instead separated local switching investment using the 2001 Local Switching separations factor in this average schedule study.

2. Scope of Changes to Separation and Allocation Methods

The MAG Order requires that part of General Purpose Computer (GPC) costs, which is included in General Support Facilities (GSF), is to be allocated to the Billing and Collection (B&C) category, effective January 1, 2002.[4] NECA adjusted the 2001 cost studies to reflect this rule change. For each sample study area, NECA used 2003 investment amounts underlying the 2003 Annual Access Tariff Filing to develop a ratio of GPC costs used for non-tariffed B&C to total GSF costs. Then, each sample study area's ratio was multiplied by its total GSF amount from the 2001 cost study to estimate the amount of GPC in the 2001 cost study to be allocated to B&C. That amount was then allocated to B&C based upon rule 69.307 of the Commission's Rule published in the MAG Order. Remaining GSF costs were allocated using the existing GSF allocation methodology.

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3 47 C.F.R. § 36.125.

4 MAG Order at ¶ 115.

3. Summary of Cost Allocation Methods

Using the 2001 cost studies separations factors, NECA calculated interstate costs of each sample cost study. These calculated costs are shown in Appendix B1. Exhibit 4.1 summarizes the basis of this calculation. The first column of Exhibit 4.1 identifies accounts or categories. The second column identifies the basis of jurisdictional separations. The third column provides the basis for apportioning interstate accounts to access categories.

The entry "Cost Study" appearing in the second or third columns indicates that no change to the historical account allocation has been made. All other entries describe the basis of separations or allocation recalculations used to reflect the changes described above.

4. Cost Study Separations Factors

Using these recalculated interstate costs, a set of separations factors was calculated for each sample cost study area. The set includes one separations factor for each category of Central Office Equipment and Cable & Wire Facilities, and one factor for each of selected investment, expense, reserve, and tax calculation accounts. The separations factor is calculated as follows:

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

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

5. Cost Study Access Allocation Factors

Using the recalculated accounts, a set of access allocation factors was calculated for each sample cost study area. The set includes one access allocation factor 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.

**EXHIBIT 4.1**

**COST SEPARATION AND ALLOCATION METHODS**

| 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 directly 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 |

**EXHIBIT 4.1 (Continued)**

**COST SEPARATION AND ALLOCATION METHODS**

| **Account or Category** | **Part 36 Separations Basis** | **Part 69 Allocation Basis** |
|---|---|---|
| General Support Facilities | COE+IOT+C&WF | COE+IOT+C&WF[5] |
| 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 | 2001 Excluding 2690 | COE+IOT+C&WF+GSF |
| Telecom. Plant Held for Future Telecom. Use | 2001 | 2001 |

[5] NECA has also allocated some GSF cost to the B&C element according to rule 69.307 of the Commission's Rule published in the MAG Order, as explained on page IV-3.

**EXHIBIT 4.1 (Continued)**

**COST SEPARATION AND ALLOCATION METHODS**

| Account or Category | Part 36 Separations Basis | Part 69 Allocation Basis |
|---|---|---|
| Telecom. Plant Under Construction (Includes AFUDC) | 2001 | 2001 |
| Telecom. Plant Acquis. Adjustment | 2001 | 2001 |
| Materials & Supplies | C&WF | COE+IOT+C&WF+GSF |
| RTB Stock | 2001 | 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 | 2002 | COE+IOT+C&WF+GSF |
| Accumulated Amortization - Tangible | 2680 | Associated 2680 Investment |
| Accumulated Amortization - Intangible | 2690 | COE+IOT+C&WF+GSF |
| Accumulated Amortization - Other 2005 | 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 | 2001 Excluding Land | 2001 |

**EXHIBIT 4.1 (Continued)**

**COST SEPARATION AND ALLOCATION METHODS**

| 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 | 2001 Excluding Land | 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 | 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 | 2001 | 2001 |
| Amortization - Tangible Assets | 2680 | 2680 |
| Amortization - Intangible Assets | 2690 | 2690 |
| Amortization - Other | 2005 | 2005 |

**EXHIBIT 4.1 (Continued)**

**COST SEPARATION AND ALLOCATION METHODS**

| 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 |
| Executive & Planning Expense | Big Three Expenses | Big Three Expenses |
| General & Administrative Exp. | Big Three Expenses | Big Three Expenses |
| Other Operating Taxes | 2001 | COE+IOT+C&WF+GSF |
| Investment Tax Credit | 2001 | COE+IOT+C&WF+GSF |
| Funds During Construction | 2004 | COE+IOT+C&WF+GSF |
| Contributions | Corporate Expenses | COE+IOT+C&WF+GSF |
| Interest on Capital Leases | 2680 - Capital Leases | COE+IOT+C&WF+GSF |
| Other Interest & Related Items | Net Telecommunication Plant | 2001 or Net Investment |
| Other Jurisdictional Assets | Cost Study | Cost Study |
| Other Jurisdictional Liabilities & Deferred Credit - Net | Cost Study | Cost Study |
| Investment Allowance/ Disallowance | 2001 | COE+IOT+C&WF+GSF |
| Capitalized Payroll | 2001 | COE+IOT+C&WF+GSF |
| Depreciation Adjustment | 2001 | COE+IOT+C&WF+GSF |
| Expense Allowance/Disallowance | 2001 | COE+IOT+C&WF+GSF |
| Customer Deposits | 2001 Excluding Land | COE+IOT+C&WF+GSF |
| Accumulated Depreciation Allowance/Disallowance | 2001 Excluding Land | COE+IOT+C&WF+GSF |
| FIT Allowance/Disallowance | 2001 | COE+IOT+C&WF+GSF |

## C. Outlier Accommodation Methods

In constructing average schedule study regression and ratio models, influential data points that were considered to be non-typical of average schedule companies or that have an undue influence on estimated model parameters are present in the data. Since its 1998 filing, NECA has employed an Outlier Accommodation Method ("Method") to moderate the impact of these influential points in model development. This Method responds to FCC concerns raised in the *June 1998 Order*[6] that recommended NECA use a more accurate and consistent method to address outliers.

The inclusion of influential points in Average Schedule Study regression and ratio estimate models is a two step process involving: (1) identification of influential points, and (2) accommodation of influential data in model development.

### 1. Outlier Accommodation Method in Regression Models

#### a. Identification of Outliers in Regression Models

There are numerous methods available in statistical literature[7] to identify influential data points in linear regression models. NECA adopts the DFFITS measure of influence proposed by Belsley.[8] The DFFITS statistic is a scaled measure of the influence on the predicted value for the *i*th observation and is calculated by deleting

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

7 A good comparison study can be found in Chatterjee, S. and Hadi, A.S. "Influential Observations, High Leverage Points, and Outliers in Linear Regression", *Statistical Science*, 1986, Vol. 1, No. 3, pp. 379-416.

8 Belsley, David A., *(et al.)*, *Regression Diagnostics: Identifying Influential Data and*

the *i*th observation from the regression data. This calculated statistic is obtainable only from classical linear regression models.[9] Large values of DFFITS indicate influential observations. A distinct size-adjusted absolute cutoff point can be defined. The cutoff point is used to distinguish high influence points from others.[10]

The cutoff point suggested by Chatterjee[11] is defined as

$$C = 2\sqrt{\frac{P+1}{N-P-1}}$$

where

P = number of model coefficients

N = number of observations included in model

b. <u>Accommodation of Outliers in Regression Models</u>

Outlier accommodation methods have the purpose of diminishing the variance of estimates by reducing the impact of influential data on models. Statistical texts conclude that methods of weighted regression will optimize the variance of a model if each point is given a weight in inverse proportion to its contribution to total model variance. In other words, if the weights for the observations are proportional to the

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<u>*Sources of Collinearity*</u>, John Wiley & Sons 1980.

9 For non-linear models, an additional step is required before using the Outlier Accommodation Method. *See* Section VII.B.

10 As Belsley points out that DFFITS is "*a t-like diagnostic. - - - (that) has been scaled by an appropriate estimated standard error, which, under the Gaussian assumption, is stochastically independent of the given diagnostic*." As such, a distinct size-adjusted absolute cutoff point can be defined. *Id.* at p. 28.

11 Chatterjee, S., and Hadi, A.S., <u>*Sensitivity Analysis in Linear Regression*</u>, John Wiley & Sons 1988, pp. 121-122.

reciprocals of the error variances, then the weighted least-squares estimates are Best Linear Unbiased Estimators.[12]

NECA uses variance weights as follows:

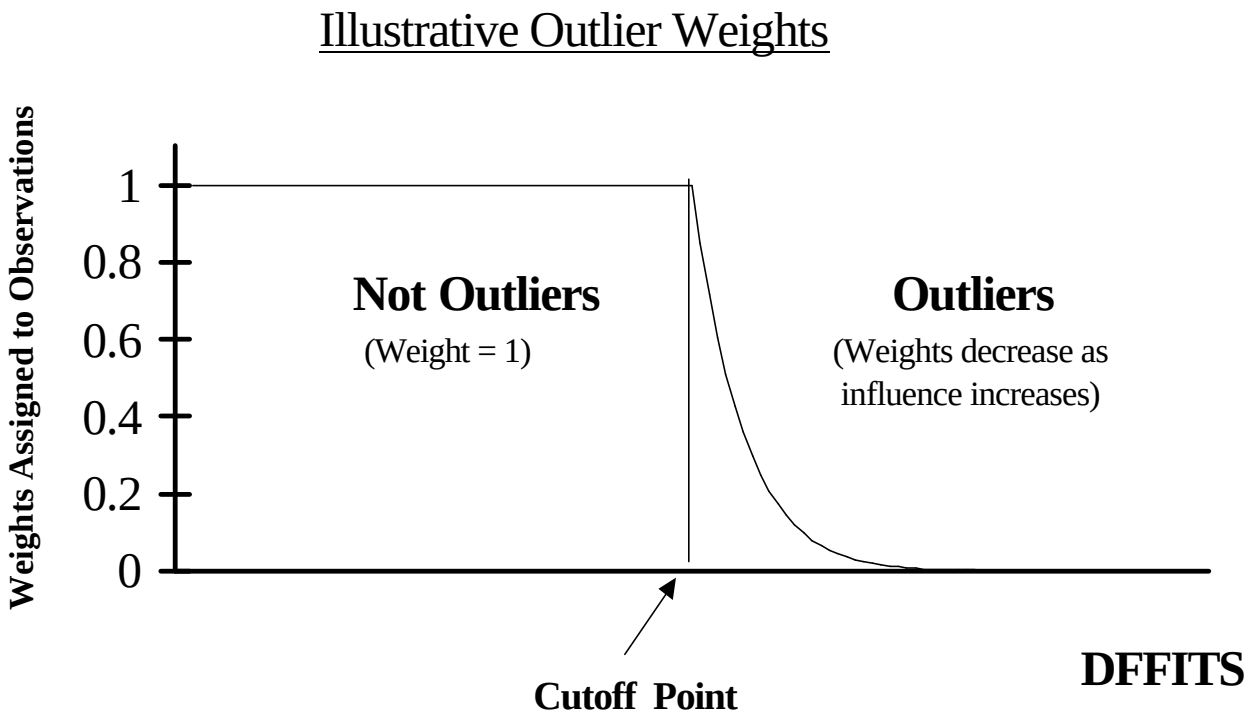
$$If\ \ DFFITS_i \le C\ , Then\ Variance\ Weight_i = 1$$
$$Else\ Variance\ Weight_i = \left( \frac{C\ /\ 2}{DFFITS_i} \right)^2$$

where C is the cutoff point.

The numerator of the variance weight is the median DFFITS value of points which are not influential. Thus, this variance weight compares a point which is influential to points which are not influential. Exhibit 4.2 is a graph that illustrates these variance weights. Using weights obtained by this method, weighted regression models were developed.

[12] *See* Draper, Norman *(et al.)*, Applied Regression Analysis, John Wiley & Sons, 1966, pp. 108-115, and Judge, George *(et al.)*, *The Theory and Practice of Econometrics*, John Wiley & Sons, 1980, pp. 420-421.

**EXHIBIT 4.2**


Illustrative Outlier Weights
Weights Assigned to Observations
1
0.8
0.6
0.4
0.2
0
Not Outliers
(Weight = 1)
Outliers
(Weights decrease as influence increases)
Cutoff Point
DFFITS

2. Outlier Accommodation Method for Ratio Estimates

a. Identification of Outliers for Ratio Estimates

For ratio estimates, the influence of each observation on the ratio can be calculated directly by excluding each point from the ratio one at a time. This is technically parallel to the DFFITS method adopted in regression models in identifying influential points.

$$Ratio = \frac{\sum\left(SampleWeight_i \times Y_i\right)}{\sum\left(SampleWeight_i \times X_i\right)}$$

$$Influence_j = Ratio - \frac{\sum\left(SampleWeight_i \times Y_i\right) - SampleWeight_j \times Y_j}{\sum\left(SampleWeight_i \times X_i\right) - SampleWeight_j \times X_j}$$

The cutoff point of variance weights for ratio estimates is determined by testing various scaled standard deviations of influence to produce the same proportion of influence points as in regression cases.

$$C = 2.33 \text{ x } Std\ Deviation\left(Influence_i\right)$$

Study areas with influence exceeding cutoff point C are then accommodated.

b. Accommodation of Outliers for Ratio Estimates

In parallel to the method of calculating variance weights for regression models, variance weights for ratio estimates are assigned as:

$$If\ \ Influence_i \le C\ , Then\ Variance\ Weight_i = 1$$
$$Else\ Variance\ Weight_i = \left( \frac{C\ /\ 2}{Influence_i} \right)^2$$

The final ratio estimate would be calculated using both sample weights and variance weights. All ratio models in this filing use this method of outlier accommodation.

D. Part 36 Separations Factor Modeling

This section describes the use of cost company separations factor data to develop models of separations factors. Separations models were developed for certain categories of Central Office Equipment and Cable & Wire Facilities, and for each Class B account of investment, expense, reserve and tax account. The separations models rely on 2001 cost company demand data (defined in Section III.E), and cost study separations factors (defined in Section IV.B.4).

1. Model Forms

For each cost category, NECA developed a model of simplest structure with the least number of statistically significant variables, that explains the largest percentage of the variation of the separations fraction and that has correct signs for all regression coefficients.

Graphical displays and statistical regression diagnostic tools have been utilized to determine

whether alternative forms and combinations of variables would lead to improved models. Simple weighted average ratios were chosen when data did not demonstrate statistically significant regression relationships between separations fractions and other variables.

Different model forms were tested to relate the separations percentage to various independent variables. An independent variable is one used as a predictor of another variable in a regression model. The simplest of these related the separation percentage to a single independent variable. In each case, simple straight line (linear) forms were tested. The form that estimated the fraction of dollars in the account or category most accurately was chosen. These model forms are illustrated below.

$$P = \textit{Dependent Variable in the Model}$$

$$= \frac{\textit{Categorized Interstate Account}}{\textit{Unseparated Account}}$$

$$X = \textit{Independent Variable in the Model}$$

$$\textit{General Straight Line Model Form: } P = a + bX$$

When the intercept is not statistically significant a proportional model results.

$$\textit{Proportional Model Form: } P = bX$$

When the slope of the straight line is not statistically significant (for any or all prospective independent variables), a simple average ratio form results.

$$\textit{Simple Average Ratio Form: } P = a$$

All Part 36 models used one of two structures. In the following paragraphs, *P* represents the

estimated value of P (the separations factor) obtained from the corresponding separations model.

When no statistically significant relationship with an independent variable could be found, a simple average ratio is employed. An example of this form is Category 2 C&WF. Where interstate Cat. 2 C&WF is not zero, then:

$$P = \frac{Interstate\ Cat.\ 2\ C\ \&\ WF}{Total\ C\ \&\ WF}$$

$$= \quad 0.016272$$

Whenever a statistically significant relationship could be found, NECA developed a regression model to estimate separations fractions. NECA tested independent variables that logically related to the fraction to be estimated in each model. For example, the Category 4.2 COE (Interexchange Circuit) fraction is logically related to the adjusted Special Access Revenues per line.

$$P = \frac{Interstate\ Cat.\ 4.2\ COE}{Total\ COE}$$

$$= \quad 0.047334 + 0.005264\ \ x\ \ Adj.\ Special\ Access\ Revenue\ Per\ Line$$

This relationship is expected because the adjusted special access revenues per line variable is known to correlate strongly with the interstate fraction of COE category 4.2.

In some instances no statistically significant evidence that the intercept was different from zero

was found. A simpler proportional model (P = b X) was utilized. An example of the proportional form for GSF Equipment is:

$$P = \frac{Interstate\ GSF}{Total\ GSF\ \ Expense}$$

$$= \quad \%\ Interstate\ of\ [COE + C\&WF + IOT]$$

$$R^2 = 0.99 \qquad F = 36{,}338 \qquad t = 191$$

The separation of GSF is significantly related to the separation of COE, C&WF and IOT investment, as seen by an *R-Square* value of 0.99.

Similar evaluations of possible independent variables were made for all models. A variable was included in a model if a basis was found in separations rules or in economic relationships, if the *t-statistic* for inclusion of the variable was significant and if the sign of the coefficient was logically acceptable.

Variables were considered for inclusion in these models only if they could be obtained from both cost and average schedule companies. In some cases, logical variables were available for cost companies, but not for average schedule companies. For example, cost study areas that have Category 2 COE investment measure tandem switched minutes for separations studies. This variable could not be used to evaluate the separations model for average schedule companies, however, since average schedule companies do not measure tandem switched minutes.

For COE Category 3 Local Switching separation model, access minutes per line were grouped into categories of either normal volume or high volume using 350 minutes per line as the

breakpoint. Normal volume and high volume minutes were defined as:

*Normal Volume Minutes Per Line*
*= Minimum (Total Minutes Per Line, 350)*

*High Volume Minutes Per Line*
*= Total Minutes Per Line – Normal Volume Minutes Per Line*

The breakpoint of 350 minutes per line separates study areas into groups of either high or normal COE3 separation fractions. In addition, the use of the 350 minutes per line break point is consistent with the development of high traffic volume coefficients for average schedule study areas.

Only normal volume minutes per line were weighted by the Dial Equipment Minutes (DEM) weight, because study areas with high volume traffic generally have their separation factors capped at 0.85, reducing the relationship between DEM weight and high volume minutes per line. Using this specification more accurately allocates total COE to interstate Category 3 for study areas with high traffic volumes.

For C&WF Category 3 separation model, circuit miles per line were grouped into categories of either normal route or long route using 4.0 circuit miles per line as the breakpoint. This breakpoint was determined graphically by examining the relationship between the interstate percent of C&WF Category 3 and circuit miles per line. For the C&WF Category 4 (Host/Remote message) separations model, only normal circuit miles per line were used because host/remote facilities generally do not include long routes.

NECA determines minimum and maximum values of separation factors from cost company sample data as shown in Exhibit 4.3. These values are used to limit average schedule company separations factors obtained from separations models. If the average schedule

company interstate portion calculated from a model was higher than the cost company maximum limit or lower than the cost company minimum limit, 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 limits.

2. Separation Factor Models

All separations factor models are displayed in Exhibit 4.3. When a regression model was used, the associated *t-statistic*, *R-Square statistic*, and *F-statistic* values are shown.

**EXHIBIT 4.3**

**PART 36 SEPARATION FACTOR MODELS**

**COE Category 1 - Operator Systems**

If interstate Cat. 1 COE is not zero, then:

$$P = \frac{\text{Interstate Cat. 1 COE}}{\text{Total COE}}$$

$$= 0.000899$$

**COE Category 2 - Tandem Switching**

If interstate Cat. 2 COE is not zero, then:

$$P = \frac{\text{Interstate Cat. 2 COE}}{\text{Total COE}}$$

$$= 0.019661$$

**COE Category 3 - Local Switching**

If interstate Cat. 3 COE is not zero, then:

$$P = \frac{\text{Interstate Cat. 3 COE}}{\text{Total COE}}$$

= 0.058169 + 0.000343 x DEM Weight x Normal Volume Minutes per Line + 0.000243 x High Volume Minutes per Line

Minimum = 0.042877
Maximum = 0.695822

$R^2 = 0.26$ $F = 40.25$ $t_1 = 7.86$ $t_2 = 0.73$

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

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

$$P = \frac{\text{Interstate COE Cat. 4.11 + Cat. 4.12}}{\text{Total COE}}$$

$$= 0.016021$$

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

**COE Category 4.13 - Exchange Line Circuit Excluding Wideband**

If interstate Cat. 4.13 COE is not zero, then:

$$P = \frac{\text{Interstate Cat. 4.13 COE}}{\text{Total COE}}$$

$$= 0.081001$$

**COE Category 4.2 - Interexchange Circuit**

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

$$P = \frac{\text{Interstate Cat. 4.2 COE}}{\text{Total COE}}$$

$$= 0.047334 + 0.005264 \times \text{Adjusted Special Access Revenues per Line}$$

Minimum = 0.000269
Maximum = 0.411544

$R^2$ = 0.05 $F$ = 11.44 $t$ = 3.38

**COE Category 4.3 - Host/Remote Message Circuit**

If interstate Cat. 4.3 COE is not zero, then:

$$P = \frac{\text{Interstate Cat. 4.3 COE}}{\text{Total COE}}$$

$$= 0.011470 + 0.002818 \times \text{Circuit Miles per Line}$$

Minimum = 0.000117
Maximum = 0.308604

$R^2$ = 0.11 $F$ = 18.95 $t$ = 4.35

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

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

If interstate Cat. 1.2 C&WF is not zero and Adjusted Special Access Revenues per Line is less than 6, then:

$$P = \frac{\text{Interstate Cat. 1.2 C\&WF}}{\text{Total C\&WF}}$$

$$= 0.004059 + 0.002456 \times \text{Adjusted Special Access Revenues per Line}$$

Minimum = 0.000145
Maximum = 0.076582

$R^2$ = 0.23 $F$ = 65.44 $t$ = 8.09

If interstate Cat. 1.2 C&WF is not zero and Adjusted Special Access Revenues per Line is greater or equal to 6, then:

P = 0.018795

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

If interstate Cat. 1.3 C&WF is not zero, then:

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

$$= 0.225242 - 0.002920 \times \text{Circuit Miles per Line}$$

Minimum = 0.035250
Maximum = 0.247920

$R^2$ = 0.12 $F$ = 34.83 $t$ = -5.90

**C&WF Category 2 - Wideband Exchange Trunk**

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

$$P = \frac{\text{Interstate Cat. 2 C\&WF}}{\text{Total C\&WF}}$$

= 0.016272

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

**C&WF Category 3 - Interexchange**

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

$$P = \frac{\text{Interstate Cat. 3 C\&WF}}{\text{Total C\&WF}}$$

= 0.008331 + 0.011613 x Normal Route Circuit Miles per Line +
0.002227 x Long Route Circuit Miles per Line +
0.002851 x Adjusted Special Access Revenue per Line

Minimum = 0.000108
Maximum = 0.545990

$R^2$ = 0.22 $F$ = 22.20 $t_1$ = 4.76 $t_2$ = 2.49 $t_3$ = 2.29

**C&WF Category 4 - Host/Remote Message**

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

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

= 0.005966 + 0.004461 x Normal Route Circuit Miles per Line

Minimum = 0.000055
Maximum = 0.343672

$R^2$ = 0.11 $F$ = 20.45 $t$ = 4.52

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

**GSF - General Support Facilities Equipment**

$$P = \frac{\text{Interstate GSF}}{\text{Total GSF}}$$

$$= \text{\% Interstate of Total [COE + C\&WF + IOT]}$$

$R^2$ = 0.99 $F$ = 36,338 $t$ = 190.63

**Tangibles - Account 2680**

$$P = \frac{\text{Interstate Tangibles}}{\text{Total Tangibles}}$$

$$= \text{1.007982 x \% Interstate of Total [COE + C\&WF + IOT]}$$

$R^2$ = 0.95 $F$ = 882.57 $t$ = 29.71

**Intangibles - Account 2690**

$$P = \frac{\text{Interstate Intangibles}}{\text{Total Intangibles}}$$

$$= \text{1.008293 x \% Interstate of Total 2001 (Excluding 2690)}$$

$R^2$ = 1.00 $F$ = 198,866 $t$ = 445.94

**Telecommunications Plant - Other - Accounts 2002 + 2003 + 2005**

$$P = \frac{\text{Interstate of Total 2002}}{\text{Total 2002}}$$

$$= \text{\% Interstate of Total 2001}$$

$R^2$ = 1.00 $F$ = 1,882,045 $t$ = 1,372

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

**Materials & Supplies - Account 1220**

$$P = \frac{\text{Interstate Materials \& Supplies}}{\text{Total Materials \& Supplies}}$$

$$= \text{\% Interstate of C\&WF}$$

$R^2$ = 1.00 $F$ = 3.16E14 $t$ = 1.777E7

**RTB Stock - Account 1402**

$$P = \frac{\text{Interstate RTB Stock}}{\text{Total RTB Stock}}$$

$$= \text{\% Interstate of Total 2001}$$

$R^2$ = 1.00 $F$ = 627,732 $t$ = 792.30

**Accumulated Depreciation - Accounts 3100 + 3200**

$$P = \frac{\text{Interstate Accumulated Depreciation}}{\text{Total Accumulated Depreciation}}$$

$$= \text{1.018278 x \% Interstate of Total 2001}$$

$R^2$ = 1.00 $F$ = 97,439 $t$ = 312.15

**Accumulated Amortization - Accounts 3400 + 3500 + 3600**

$$P = \frac{\text{Interstate Accumulated Amortization}}{\text{Total Accumulated Amortization}}$$

$$= \text{1.007393 x \% Interstate of Total 2001}$$

$R^2$ = 1.00 $F$ = 23,703 $t$ = 153.96

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

$$P = \frac{\text{Interstate Net Deferred Federal Income Taxes}}{\text{Total Net Deferred Federal Income Taxes}}$$

$$= 0.336841$$

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

**Network Support Expense - Account 6110**

$$P = \frac{\text{Interstate of Network Support Expense}}{\text{Total Network Support Expense}}$$

$$= \text{\% Interstate of Total [COE + C\&WF + IOT]}$$

$R^2 = 1.00$ $F = 5{,}743{,}711$ $t = 2{,}397$

**General Support Expense - Account 6120**

$$P = \frac{\text{Interstate of GSF Expense}}{\text{Total GSF Expense}}$$

$$= \text{\% Interstate of Total [COE + C\&WF + IOT]}$$

$R^2 = 1.00$ $F = 9{,}238{,}357$ $t = 3{,}039$

**COE Expense - Account 6210**

$$P = \frac{\text{Interstate of COE}}{\text{Total COE}}$$

$$= \text{1.001764 x \% Interstate of COE}$$

$R^2 = 1.00$ $F = 6{,}463{,}580$ $t = 2{,}542$

**C&WF Expense - Account 6410**

$$P = \frac{\text{Interstate of C\&WF Expense}}{\text{Total C\&WF Expense}}$$

$$= \text{\% Interstate of C\&WF}$$

$R^2 = 1.00$ $F = 644{,}793$ $t = 802.99$

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

**Other Property, Plant & Equipment Expense - Account 6510**

$$P = \frac{\text{Interstate of Account 6510}}{\text{Total Account 6510}}$$

$$= \text{\% Interstate of Total 2001}$$

$R^2$ = 1.00 $F$ = 430,469 $t$ = 656.10

**Network Operations Expense - Account 6530**

$$P = \frac{\text{Interstate of Network Operations Expense}}{\text{Total Network Operations Expense}}$$

$$= \text{\% Interstate of Total [COE + C\&WF + IOT]}$$

$R^2$ = 1.00 $F$ = 9,665,433 $t$ = 3,109

**Depreciation and Amortization Expense - Account 6560**

$$P = \frac{\text{Interstate Depreciation and Amortization Expense}}{\text{Total Depreciation and Amortization Expense}}$$

$$= -0.030088 + 1.171784 \times \text{\% Interstate of Total 2001}$$

$R^2$ = 0.94 $F$ = 4,580 $t$ = 67.68

**Marketing Expense - Account 6610**

$$P = \frac{\text{Interstate Marketing Expense}}{\text{Total Marketing Expense}}$$

$$= 0.916845 \times \text{\% Interstate of Total [COE + C\&WF + IOT]}$$

$R^2$ = 0.90 $F$ = 1,914 $t$ = 43.75

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

**Services Expense - Account 6620**

$$P = \frac{\text{Interstate Services Expense}}{\text{Total Services Expense}}$$

$$= 0.172694 + 0.379740 \times \text{\% Interstate of Total 2001}$$

$R^2 = 0.08$ $F = 24.29$ $t = 4.93$

**Executive & Planning Expense - Account 6710**

$$P = \frac{\text{Interstate Executive and Planning Expense}}{\text{Total Executive and Planning Expense}}$$

$$= \text{\% Interstate of Total Big Three Expenses}$$

$R^2 = 1.00$ $F = 1.209E7$ $t = 3,477$

**General & Administrative Expense - Account 6720**

$$P = \frac{\text{Interstate General and Administrative Expense}}{\text{Total General and Administrative Expense}}$$

$$= 1.119227 \times \text{\% Interstate of Total Big Three Expenses}$$

$R^2 = 0.99$ $F = 30,110$ $t = 173.52$

**Other Operating Taxes - Account 7200**

$$P = \frac{\text{Interstate Account 7200}}{\text{Total Account 7200}}$$

$$= 0.032761 + 0.947943 \times \text{\% Interstate of Total 2001}$$

$R^2 = 0.81$ $F = 1,125$ $t = 33.54$

**EXHIBIT 4.3 (Continued)**

**PART 36 SEPARATION FACTOR MODELS**

**Federal Investment Tax Credit**

If study area is subject to Federal Income Tax,

$$P = \frac{\text{Interstate of Investment Tax Credit}}{\text{Total Investment Tax Credit}}$$

$$= 0.037630 + 0.915770 \times \text{\% Interstate of Total Net Plant}$$

$R^2 = 0.90$ $F = 727.37$ $t = 26.97$

**Non-Operating Income and Expense**

$$P = \frac{\text{Interstate of Non-Operating Income and Expense}}{\text{Total Non-Operating Income and Expense}}$$

$$= \text{\% Interstate of Total 2001}$$

$R^2 = 0.98$ $F = 12{,}002$ $t = 109.55$

**Interest & Related Items - Account 7500**

$$P = \frac{\text{Interstate of Total 2001}}{\text{Total 2001}}$$

$$= 0.992391 \times \text{\% Interstate of Total 2001}$$

$R^2 = 1.00$ $F = 97{,}567$ $t = 312.36$

## E. Part 69 Allocation Factor Modeling

This section describes the use of access allocation factor data to develop models relating access allocations to other variables.

### 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.[13]

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 coefficients with acceptable 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.

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

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

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

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

Exhibit 4.4 lists all variables tested as independent variables in these allocation factor models. Results are shown in Exhibits 4.5, 4.6, and 4.7.

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 Category 3 Cable & Wire Facilities model is an example of such a model. The ratio of adjusted special access revenues to access minutes is correlated with the usage-based assignment prescribed by Part 69.

**EXHIBIT 4.4**

**INDEPENDENT VARIABLES TESTED IN MODEL DEVELOPMENT**

| | | |
|---|---|---|
| % Access of Interstate 2001 | = | Access Category Telecommunications Plant in Service / Total Interstate Telecommunications Plant in Service |
| % Access of Interstate Other Plant | = | Access Category Telecommunications Plant – Other / Total Interstate Telecommunications Plant – Other |
| % Access of Interstate Big Three Expenses | = | Access Category Big Three Expenses / Total Interstate Big Three Expenses |
| % Access of Interstate Big Three Expenses Less Services Expense | = | Access Category Big Three Expenses Minus Services / Total Interstate Big Three Expenses Minus Services |
| % Access of Plant Specific Expense | = | Access Category Plant Specific Expense / Total Interstate Plant Specific Expense |
| % Access of Plant Non-Specific Expense | = | Access Category Plant Non-Specific Expense / Total Interstate Plant Non-Specific Expense |
| % Access of Customer Operations Expense | = | Access Category Customer Operations Expense / Total Interstate Customer Operations Expense |
| Access Lines | = | Access Lines Reported to NECA |
| Number of Exchanges | = | Count of Exchanges Served by the Study Area |
| Minutes per Line | = | Access Minutes / Access Lines |
| Adjusted Special Access Revenues per Line | = | Adjusted Special Access Revenues / Access Lines |
| Adjusted Special Access Revenues per Minute | = | Adjusted Special Access Revenues / Access Minutes |
| Normal Route Circuit Miles Per Line | = | Normal Route Circuit Miles / Access Lines |
| Long Route Circuit Miles Per Line | = | Long Route Circuit Miles / Access Lines |
| Normal Volume Minutes Per Line | = | Normal Volume Minutes / Access Lines |
| High Volume Minutes Per Line | = | High Volume Minutes / Access Lines |

## 2. Part 69 Allocation Models

### a. Expense and Reserve Models

Structured according to Part 69 allocation rules, these models related 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 4.5 displays models developed for certain expense and reserve accounts.

**EXHIBIT 4.5**

**PART 69 – EXPENSE AND RESERVE ALLOCATION MODELS**

**Accumulated Depreciation**

| | | | | |
|---|---|---|---|---|
| %CL | = | 0.982503 | x | % CL of Interstate 2001 |
| %CO | = | 1.040696 | x | % CO of Interstate 2001 |
| %SA | = | 0.991524 | x | % SA of Interstate 2001 |
| %TR | = | 0.963771 | x | % TR of Interstate 2001 |

| | $R^2$ | $F$ | $t$ | Minimum | Maximum |
|---|---|---|---|---|---|
| %CL Model | 0.99 | 25,711 | 160 | 0.054551 | 0.982257 |
| %CO Model | 0.96 | 6,374 | 80 | 0.000000 | 0.813701 |
| %SA Model | 0.99 | 26,372 | 162 | 0.002189 | 0.401496 |
| %TR Model | 0.99 | 21,710 | 147 | 0.001237 | 0.868568 |

**Net Deferred Income Taxes**

| | | |
|---|---|---|
| %CL | = | 0.469287 |
| %CO | = | 0.323442 |
| %SA | = | 0.099053 |
| %TR | = | 0.090098 |

**Accumulated Amortization**

| | | | | |
|---|---|---|---|---|
| %CL | = | 0.999297 | x | % CL of Interstate 2001 |
| %CO | = | 1.002138 | x | % CO of Interstate 2001 |
| %SA | = | 1.001729 | x | % SA of Interstate 2001 |
| %TR | = | 0.997220 | x | % TR of Interstate 2001 |

| | $R^2$ | $F$ | $t$ | Minimum | Maximum |
|---|---|---|---|---|---|
| %CL Model | 1.00 | 2,238,169 | 1,496 | 0.055946 | 0.807719 |
| %CO Model | 1.00 | 1,248,489 | 1,117 | 0.022623 | 0.706848 |
| %SA Model | 1.00 | 139,384 | 373 | 0.002024 | 1.000000 |
| %TR Model | 1.00 | 148,560 | 385 | 0.006432 | 0.898573 |

**Depreciation and Amortization Expense**

| | | | | | | |
|---|---|---|---|---|---|---|
| %CL | = | -0.057879 | + | 0.960583 | x | % CL of Interstate 2001 |
| %CO | = | 0.059439 | + | 1.080883 | x | % CO of Interstate 2001 |
| %SA | = | 0.979953 | x | % SA of Interstate 2001 | | |
| %TR | = | 0.951018 | x | % TR of Interstate 2001 | | |

| | $R^2$ | $F$ | $t$ | Minimum | Maximum |
|---|---|---|---|---|---|
| %CL Model | 0.91 | 2,674 | 52 | 0.054889 | 0.906323 |
| %CO Model | 0.84 | 1,442 | 38 | 0.000000 | 0.859634 |
| %SA Model | 0.98 | 13,738 | 117 | 0.001773 | 0.408969 |
| %TR Model | 0.98 | 11,661 | 108 | 0.001140 | 0.854075 |

**EXHIBIT 4.5 (Continued)**

**PART 69 – EXPENSE AND RESERVE ALLOCATION MODELS**

**Services Expenses**

| | | | | | | |
|---|---|---|---|---|---|---|
| %CL | = | 0.217496 | | | | |
| %CO | = | 0.231843 | | | | |
| %SA | = | 0.013508 | + | 0.482235 | x | % SA of Interstate 2001 |
| %TR | = | 0.009616 | + | 0.631107 | x | % TR of Interstate 2001 |

| | $R^2$ | $F$ | $t$ | Minimum | Maximum |
|---|---|---|---|---|---|
| %CL Model | - | - | - | - | - |
| %CO Model | - | - | - | - | - |
| %SA Model | 0.35 | 141 | 11.86 | 0.000574 | 0.401304 |
| %TR Model | 0.66 | 505 | 22.47 | 0.000506 | 0.475032 |

b. Central Office Equipment Models

Exhibit 4.6 lists those categories of Central Office Equipment that require models. Direct assignment rules used for other categories are summarized in Exhibit 6.5.

For combined COE Categories 4.11 and 4.12, NECA developed weighted average allocation fractions because the data did not display significant correlations with other variables.

For COE Category 2 - Tandem Switching Equipment, the allocation was nearly 100 percent transport, a small residual portion being non-access.

For COE Category 4.13, Exchange Line Circuit Equipment (excluding Wideband) and for COE Category 4.2, Interexchange Circuit Equipment, NECA developed models to estimate the percentage of investment in the various access categories as a function of adjusted special access revenues per line.

**EXHIBIT 4.6**

**PART 69 – CENTRAL OFFICE EQUIPMENT ALLOCATION MODELS**

**COE Category 1 - Operator Systems**

%CL = 0.00
%CO = 0.661881
%SA = 0.00
%TR = 0.00

**Category 2 - Tandem Switching Equipment**

%CL = 0.00
%CO = 0.00
%SA = 0.00
%TR = 0.999871

**Category 4.11 and 4.12 - Exchange Circuit**

If Adjusted Special Access Revenues are not equal to zero:

%CL = 0.00
%CO = 0.00
%SA = 0.995947
%TR = 0.004053

If Adjusted Special Access Revenues equal zero:

%CL = 0.00
%CO = 0.00
%SA = 0.00
%TR = 1.00

| **Category 4.13 - Exchange Line Circuit Equipment Excluding Wideband** | | | | | | | $R^2$ | $F$ | $t$ |
|---|---|---|---|---|---|---|---|---|---|
| If Adjusted Special Access Revenues are not equal to zero: | | | | | | | | | |
| %CL | = | 0.975171 | - | 0.008233 | x | Adjusted SA Revenues per Line | 0.17 | 44.72 | -6.69 |
| %CO | = | 0.00 | | | | | | | |
| %SA | = | 0.024829 | + | 0.008233 | x | Adjusted SA Revenues per Line | 0.17 | 44.72 | 6.69 |
| %TR | = | 0.00 | | | | | | | |

If Adjusted Special Access Revenues equal zero:

%CL = 1.00
%CO = 0.00
%SA = 0.00
%TR = 0.00

**EXHIBIT 4.6 (Continued)**

**PART 69 – CENTRAL OFFICE EQUIPMENT ALLOCATION MODELS**

| **Category 4.2 - Interexchange Circuit Equipment** | | | | | | | $R^2$ | $F$ | $t$ |
|---|---|---|---|---|---|---|---|---|---|
| If Adjusted Special Access Revenues are not equal to zero: | | | | | | | | | |
| %CL | = | 0.00 | | | | | | | |
| %CO | = | 0.00 | | | | | | | |
| %SA | = | 0.291714 | + | 0.018454 | x | Adjusted SA Revenues per Line | 0.02 | 4.65 | 2.16 |
| %TR | = | 0.708286 | - | 0.018454 | x | Adjusted SA Revenues per Line | 0.02 | 4.65 | -2.16 |
| If Adjusted Special Access Revenues equal zero: | | | | | | | | | |
| %CL | = | 0.00 | | | | | | | |
| %CO | = | 0.00 | | | | | | | |
| %SA | = | 0.00 | | | | | | | |
| %TR | = | 1.00 | | | | | | | |

c. Cable & Wire Facilities Models

Exhibit 4.7 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.

For Category 2 - Wideband and Exchange Trunk, and Category 4 - Host/Remote Message, NECA used weighted averages because the data did not demonstrate any significant correlations.

For Category 3 - Interexchange, NECA developed models to estimate the percentage of special access and transport investment to total interstate investment as a function of adjusted special access revenues per minute.

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

**EXHIBIT 4.7**

**PART 69 - CABLE & WIRE FACILITIES ALLOCATION MODELS**

**Category 2 - Wideband and Exchange Trunk**

If Adjusted Special Access Revenues are not equal to zero:

| | | |
|---|---|---|
| %CL | = | 0.00 |
| %CO | = | 0.00 |
| %SA | = | 0.966508 |
| %TR | = | 0.033492 |

If Adjusted Special Access Revenues equal zero:

| | | |
|---|---|---|
| %CL | = | 0.00 |
| %CO | = | 0.00 |
| %SA | = | 0.00 |
| %TR | = | 1.00 |

**Category 3 - Interexchange**

If Adjusted Special Access Revenues are not equal to zero:

| | | | | | | | | $R^2$ | $F$ | $t$ |
|---|---|---|---|---|---|---|---|---|---|---|
| %CL | = | 0.00 | | | | | | | | |
| %CO | = | 0.00 | | | | | | | | |
| %SA | = | 0.165573 | + | 12.414487 | x | Adjusted SA Revenues per Minute | | 0.12 | 26.66 | 5.16 |
| %TR | = | 0.834427 | - | 12.414487 | x | Adjusted SA Revenues per Minute | | 0.12 | 26.66 | -5.16 |

If Adjusted Special Access Revenues equal zero:

| | | |
|---|---|---|
| %CL | = | 0.00 |
| %CO | = | 0.00 |
| %SA | = | 0.00 |
| %TR | = | 1.00 |

**Category 4 - Host/Remote Message**

| | | |
|---|---|---|
| %CL | = | 0.00 |
| %CO | = | 0.00 |
| %SA | = | 0.00 |
| %TR | = | 1.00 |

## F. Additional Account Adjustments

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

### 1. Interest on Customer Deposits

The operating portion of total Interest and Related Items was further multiplied by a factor of 0.006589 to calculate Interest on Customer Deposits. Interest on Customer Deposits receives different treatment than other Interest expense in the Commission's rules governing revenue requirement calculation and hence must be derived for average schedule companies. The factor was calculated as the weighted average fraction of Interest on Customer Deposits to Interest and Related Items from sample 2001 cost study data. This factor is applied to Average Schedule Company Total Interest and Related Items.

### 2. Investment Tax Credits

The uniform system of accounts does not prescribe the reporting of Investment Tax Credit (ITC). Although ITC data are developed in reports of income tax liabilities, these amounts are not reported by Average Schedule study areas. Consequently, NECA used a factor based on sample cost companies to estimate Average Schedule amounts of ITC. The factor of 0.000368 was calculated as the ratio of weighted unseparated ITC over weighted unseparated Net Plant from 2001 Cost Study data. This factor is applied to Average Schedule Company Total Net Plant amounts.

### 3 Charitable Contributions

Similarly, not all sample average schedule companies separate data on amounts for Charitable Contributions. Since the charitable contribution data are available from cost companies, a factor based on sample cost companies was developed to estimate Average Schedule amounts of charitable contributions. The factor of 0.001657 was calculated as the weighted ratio of unseparated charitable contributions over unseparated Expenses and Other Taxes (EOT) from 2001 Cost Study data. This factor is applied to Average Schedule Company Total EOT amounts.

## G. Cost Study Factors

Three cost study factors were used in Section VII.J to allocate SS7 costs to the interstate jurisdiction and to apply loading for maintenance and corporate operations expenses. These factors were developed from weighted sample cost company cost studies as shown in Exhibit 4.8.

**EXHIBIT 4.8**

**DEVELOPMENT OF SS7 COST STUDY FACTORS**

$$\text{COE Switching Factor} = \frac{S\ [\ (\text{Sample Weight})\ x\ (\text{Interstate COE Cat. 3})]}{S\ [\ (\text{Sample Weight})\ x\ (\text{Unseparated COE Cat. 3})]}$$

$$= 0.472571$$

$$\text{COE Maint. Factor} = \frac{S\ [\ (\text{Sample Weight})\ x\ (\text{Central Office Expense})]}{S\ [\ (\text{Sample Weight})\ x\ (\text{Central Office Investment})]}$$

$$= 0.081676$$

$$\text{COE Corporate Operations Factor} = \frac{S\ [\ (\text{Sample Weight})\ x\ (\text{CO Corporate Operations Expense})]}{S\ [\ (\text{Sample Weight})\ x\ (\text{CO Telecom. Plant In Service})]}$$

$$= 0.063483$$

An additional cost study factor was developed to calculate the average effective Federal Income Tax rate. The effective tax rate is defined as the total tax payment over total income. To estimate the effective tax rate for average schedule companies, the 2001 cost study data of sample cost companies that are subject to federal income tax were used. The average effective tax rate was calculated as the mean of sample cost companies' effective tax rates weighted by both total average net investment and sample weight. The average effective tax rate is used to calculate Average Schedule Company Federal Income Tax in Section VI. F.

$$\text{Average Effective Tax Rate} = \frac{S\ [\ (\text{Tax rate})\ x\ (\text{Sample Weight})\ x\ (\text{Total Average Net Investment})]}{S\ [(\text{Sample Weight})\ x\ (\text{Total Average Net Investment})]}$$

$$= 0.329039$$

# V. DATA PROJECTIONS

## A. Introduction

For average schedule settlement formula development, NECA used historical demand and accounting data from average schedule study areas. Demand data used were those accepted by NECA from companies for monthly settlements. Accounting data were taken from the financial statements prepared by individual carriers and submitted as a part of NECA's annual data collection. These sources of data are preferred over budgets or forecasts done by the exchange carriers because they reflect each carrier's actual cost and demand levels and reduce the burden on individual study areas caused by additional requests.

NECA used these data to uniformly develop test period projections of account balances and demand. The test period for the 2003 Study is the year beginning July 1, 2004 and ending June 30, 2005, the period when the settlement formulas from this study would be in effect. Settlement formulas derived from these projected data would be used to calculate monthly settlements for each carrier during the upcoming test period.

This study continues using the stratified method of account growth analysis introduced in the 2000 Study. The 2002 Sample companies were assigned to 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 balance growth tends to vary according to company size.

For additional reliability, NECA computed stratified composite average growth ratios by separately averaging 2002 Sample growth ratios with 2001 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 were based on trends measured from a multi-year history of the average schedule population. Historical demand data taken from data reported to the NECA pool were used to develop growth models and calculate multi-year growth ratios. These multi-year growth ratios were multiplied by the average base period demand value of each sample average schedule study area to calculate test period demand values. Sections V.C through V.H describe the use of these methods to forecast each demand variable. The forecasted data described in this section were used to calculate test period access category revenue requirements described in Section VI.F, and settlement formulas described in Section VII.

## B. Account Forecasting

Year over year growth ratios were calculated for each account in each stratum of the 2002 Sample. Calculation of these ratios involved the Outlier Accommodation Method For Ratio Estimates, described in Section IV.C.2. To lower the variance found in growth ratios computed from a single sample, NECA used composite growth ratios developed by averaging the 2003 Study growth ratios with those developed in the 2002 Study.[1]

### 1. Stratification of the 2002 Sample

In prior studies, NECA found that different growth trends were experienced by companies of different sizes. NECA introduced stratification into account growth analysis to reflect these differences. The 2003 Study continues using this methodology. Study areas in the 2002 Sample were separated into three strata based on access line size as of December

2000, including all adjustments through December 2002.

To confirm optimum stratification, NECA performed a Sum of Squares Test, which measures the variation of each study area's growth around the stratum's average growth rate. This test revealed that the revenue requirement growth experienced by companies varied significantly by access line size groupings and that study area growth rates were closer to stratum average rates than to the overall average rate. As a result, NECA determined that improvements to the accuracy of account forecasts could continue to be achieved through stratification.

NECA then conducted a Variance of Ratio Estimate Test, which measured the accuracy improvement obtained by using stratified growth rates. This test was used to identify the breakpoint values that would maximize the growth rate differentiation among strata. Since no other breakpoint combinations improved upon the growth rate differentiation among strata used for the 2002 Study, NECA continues to calculate separate account growth ratios for the following three strata of 2002 Sample companies:

- Stratum 1 - Study Areas with less than 4,000 access lines
- Stratum 2 - Study Areas with between 4,000 and 10,000 access
- Stratum 3 - Study Areas with more than 10,000 access lines

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[1] Accounting data supplied by the 2002 Average Schedule Sample are reported in Appendices C1 and C2. Accounting data supplied by the 2001 Average Schedule Sample are reported in Appendices C4 and C5.

2. Account Adjustments

In order to include only telephone operating costs in this study, NECA apportioned the Interest and Related Items account between the operating and non-operating categories. NECA adjusted some total company accounts reported by sample study areas to remove costs that would not be included in cost studies and apportioned some accounts to subaccounts not provided by sample average schedule companies.

- For companies that reported a Federal Income Tax liability, NECA used the ratio of non-operating Federal Income Tax charges to total Federal Income Tax charges. For other average schedule companies NECA used the average ratio of Non-Operating Federal Income Tax Charges to Total Federal Income Tax Charges of average schedule companies that did report a liability.

- The FCC rules governing the calculation of interstate revenue requirements mandate different treatment for Interest on Customer Deposits than for other Operating Interest and Related Items.[2] Since sample average schedule companies do not provide separate subaccount data for Interest on Customer Deposits, this subaccount was derived by applying a factor, 0.006589, 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 Federal Investment Tax Credits (FITC) for average schedule companies was derived based on the average ratio of FITC to Net Investment reported by sample cost companies. The development of this ratio, 0.000368, was

discussed in Section IV.F.2.

- The amount of Charitable Contributions included in Account 7370, Non-Operating Income and Expense, was derived based on the average ratio of Contributions to Expenses and Other Taxes reported by sample cost companies. The development of this ratio, 0.001657, was discussed in Section IV.F.3.

- The account balances of Information Origination/Termination investment and expense were set to zero for all sample study areas, because the trend of reduction displayed by these accounts would produce zero account balances during the July 2004 to June 2005 test period.

- The amount of State Income Taxes (SIT) for sample Subchapter S companies was derived based on the average ratio of SIT to Expense (Plant Specific expense, Non-Plant Specific expense, Customer Operations expense, Corporate Operations expense plus Depreciation & Amortization expense) reported by other Sample average schedule companies. The resulting factors of 0.034529 for 2001 and 0.039535 for 2000 were multiplied by Expense to calculate SIT for each sample Subchapter S study area.

3. Identification and Accommodation of Outliers

Annual growth ratios were calculated for Part 32 accounts using 2000 and 2001 accounting data from the 2002 Sample. To ensure that no company's data exerted undue influence on these ratios, NECA applied an Outlier Accommodation Method, first introduced in the

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[2] *See* 47 C.F.R. §§ 65.820 and 65.830.

1998 Study and described in Section IV.C.2, which reduced the relative weight of highly influential points and allowed them to be included in account growth ratio development.

In the first step of this process, NECA computed 2000 and 2001 unseparated revenue requirement amounts for each 2002 Sample study area in each stratum, using the revenue requirement calculation method described in Section VI.F of this Filing. An average unseparated revenue requirement growth ratio was calculated for each stratum of the 2002 Sample as follows:

$$2002\,Sample\,Average\,Revenue\,Requirement\,Growth\,Ratio_i =$$

$$\frac{\sum_{Stratum_i} (SampleWeight_i \ x \ VarianceWeight_i \ x \ 2001\,Unseparated\ Revenue\,Requirement)}{\sum_{Stratum_i} (SampleWeight_i \ x \ VarianceWeight_i \ x \ 2000\,Unseparated\ Revenue\,Requirement)}$$

Variance weights, which quantify study area specific growth relative to the average growth within a stratum, were obtained by applying the Outlier Accommodation Method For Ratio Estimates (described in Section IV.C.2). These variance weights, which were calculated based on relative growth in unseparated revenue requirement, were then used in the calculation of all account growth ratios.

Two groups of study areas were removed from the calculation of the Operating Other Taxes growth rate. First, four study areas located in one state were excluded because there was a one-time change in that state's tax laws. Therefore, the year over year changes for these study areas were not representative of future changes for average schedule study areas. Second, the data for subchapter S companies was excluded from the calculation of

the Other Taxes growth rate, since the SIT component of Other Taxes for these study areas was imputed as described in section V.B.2.

4. Account Groupings

A separate annual growth ratio was computed for most accounts using the combined ratio estimate technique, described in Section V.B.5. The remaining accounts, which typically exhibited wider than average variations in year over year growth from sample to sample, were assigned to account groupings and then a growth ratio for each group was calculated. Exhibit 5.1 shows the account groupings used.

5. The 2002 Sample Stratified Annual Growth Ratios

NECA used the combined ratio estimate technique to determine stratified annual growth rates. For the 2002 Sample, the Stratified Annual Growth Ratios were calculated within each stratum, using the following formula:

$$2002\,Sample\,Stratified\,Annual\,Growth\,Ratio_i = \frac{\sum_{Stratum_i}(SampleWeight_i\ x\ VarianceWeight_i\ x\ 2001\,Account\,Balance_i)}{\sum_{Stratum_i}(SampleWeight_i\ x VarianceWeight_i\ x\ 2000\,Account\,Balance_i)}$$

| EXHIBIT 5.1<br><br>ACCOUNT GROUPINGS FOR GROWTH CALCULATION | | |
|---|---|---|
| **Account Group** | **Accounts Included in Group** | **Part 32 Account Number** |
| Accumulated Depreciation & Amortization | Accumulated Depreciation - Telecommunications Plant in Service<br>Accumulated Depreciation - Held for Future Telecommunications Use<br>Accumulated Amortization - Tangible<br>Accumulated Amortization - Intangible<br>Accumulated Amortization - Other | 3100<br>3200<br>3400<br>3500<br>3600 |
| Plant Specific Expense | Network Support Expense<br>General Support Expense<br>Central Office Equipment Expense<br>Cable & Wire Facilities Expense | 6110<br>6120<br>6210, 6220, 6230<br>6410 |
| Plant Non-Specific Expense | Other Property, Plant and Equipment Expense<br>Network Operations Expense | 6510<br>6530 |
| Customer Operations Expense | Marketing Expense<br>Services Expense | 6610<br>6620 |
| Corporate Operations Expense | Executive & Planning Expense<br>General & Administrative Expense | 6710<br>6720 |
| Other Telecommunications Plant | Deferred Maintenance and Retirement<br>Property Held for Future Telecommunications Use<br>Telecommunications Plant Under Construction<br>Telecommunications Plant Adjustment | 1438<br>2002<br>2003<br>2005 |
| Other Operating Taxes | Operating State and Local Income Taxes<br>Operating Other Taxes | 7230<br>7240 |
| Net Deferred Income Taxes | Net Current Deferred Operating Income Taxes<br>Net Non-Current Deferred Operating Income Taxes<br>Other Jurisdictional Liabilities and Deferred Credits | 4100<br>4340<br>4370 |
| Total Plant | Materials & Supplies<br>RTB Stock<br>Telecommunications Plant in Service<br>Other Telecommunications Plant | 1220<br>1402<br>2001<br>2002, 2003, 2005 |

Columns C, G and K of Exhibit 5.2 display the resulting 2002 Sample Stratified Annual Growth Ratios for each of the three access line size strata.

## EXHIBIT 5.2

## AVERAGE SCHEDULE ACCOUNT GROWTH RATIOS

| | Small Study Areas | | | |
|---|---|---|---|---|
| **Account** | **(A) 2001 Sample Annual Growth** | **(B) 2001 Sample Adjusted Growth** | **(C) 2002 Sample Annual Growth** | **(D) 2002 Composite Growth** |
| Telecommunications Plant In Service | 1.0792 | 1.0734 | 1.0712 | 1.0723 |
| Land & Support Assets | 1.0822 | 1.0760 | 1.0476 | 1.0618 |
| Central Office Equipment | 1.0742 | 1.0691 | 1.0578 | 1.0634 |
| Cable & Wire Facilities | 1.0821 | 1.0759 | 1.0908 | 1.0833 |
| Tangible Assets | 1.0000 | 1.0000 | 1.0476 | 1.0238 |
| Intangibles | 1.0742 | 1.0691 | 1.0578 | 1.0634 |
| Materials And Supplies | 1.3365 | 1.2518 | 0.9099 | 1.0808 |
| Rural Telephone Bank Stock | 0.9705 | 0.9696 | 1.0804 | 1.0250 |
| Other Telecommunications Plant | 1.0809 | 1.0748 | 1.0697 | 1.0723 |
| Total Telecommunications Plant | 1.0809 | 1.0748 | 1.0697 | 1.0723 |
| Other Non-Current Assets | 1.0601 | 1.0567 | 1.0839 | 1.0703 |
| Accum. Depreciation & Amortization | 1.1070 | 1.0967 | 1.0767 | 1.0867 |
| Net Telecommunications Plant | 1.0601 | 1.0567 | 1.0839 | 1.0703 |
| Net Deferred Operating Income Tax | 0.9745 | 0.9738 | 0.8113 | 0.8926 |
| Plant Specific Expense | 1.0575 | 1.0544 | 1.0373 | 1.0458 |
| Plant Non-specific Expense | 1.1071 | 1.0967 | 1.0289 | 1.0628 |
| Customer Service Expense | 1.0919 | 1.0842 | 1.0391 | 1.0616 |
| Corporate Operations Expense | 1.0823 | 1.0760 | 1.0513 | 1.0637 |
| Depreciation & Amortization Expense | 1.0483 | 1.0461 | 1.0698 | 1.0579 |
| Charitable Contributions | 1.0809 | 1.0748 | 1.0697 | 1.0723 |
| Interest & Related Items | 1.0641 | 1.0602 | 1.0088 | 1.0345 |
| Patronage Dividends | 1.0601 | 1.0567 | 1.0839 | 1.0703 |
| Interest On Customer Deposits | 1.0641 | 1.0602 | 1.0088 | 1.0345 |
| Other Long Term Liabilities | 1.0601 | 1.0567 | 1.0839 | 1.0703 |
| Federal Investment Tax Credits | 1.0601 | 1.0567 | 1.0839 | 1.0703 |
| Other Operating Taxes | 0.9998 | 0.9998 | 1.0988 | 1.0493 |
| Allow. For Funds Used During Const. | 1.0809 | 1.0748 | 1.0697 | 1.0723 |
| Expenses & Other Taxes | 1.0702 | 1.0656 | 1.0502 | 1.0579 |
| Revenue Requirement | 1.0639 | 1.0601 | 1.0598 | 1.0599 |

**EXHIBIT 5.2**

**AVERAGE SCHEDULE ACCOUNT GROWTH RATIOS**
**(Continued)**

| | Medium Study Areas | | | |
|---|---|---|---|---|
| **Account** | **(E) 2001 Sample Annual Growth** | **(F) 2001 Sample Adjusted Growth** | **(G) 2002 Sample Annual Growth** | **(H) 2002 Composite Growth** |
| Telecommunications Plant In Service | 1.0863 | 1.0794 | 1.0910 | 1.0852 |
| Land & Support Assets | 1.0512 | 1.0487 | 1.0327 | 1.0407 |
| Central Office Equipment | 1.0972 | 1.0886 | 1.1109 | 1.0997 |
| Cable & Wire Facilities | 1.0888 | 1.0816 | 1.0976 | 1.0896 |
| Tangible Assets | 1.0000 | 1.0000 | 1.0327 | 1.0164 |
| Intangibles | 1.0972 | 1.0886 | 1.1109 | 1.0997 |
| Materials And Supplies | 1.3255 | 1.2456 | 0.8516 | 1.0486 |
| Rural Telephone Bank Stock | 1.0485 | 1.0463 | 1.0401 | 1.0432 |
| Other Telecommunications Plant | 1.0873 | 1.0803 | 1.0876 | 1.0839 |
| Total Telecommunications Plant | 1.0873 | 1.0803 | 1.0876 | 1.0839 |
| Other Non-Current Assets | 1.0766 | 1.0711 | 1.0849 | 1.0780 |
| Accum. Depreciation & Amortization | 1.0817 | 1.0755 | 1.0981 | 1.0868 |
| Net Telecommunications Plant | 1.0766 | 1.0711 | 1.0849 | 1.0780 |
| Net Deferred Operating Income Tax | 1.2573 | 1.2046 | 0.8922 | 1.0484 |
| Plant Specific Expense | 1.1435 | 1.1255 | 1.1519 | 1.1387 |
| Plant Non-specific Expense | 1.0399 | 1.0384 | 1.0789 | 1.0586 |
| Customer Service Expense | 1.0421 | 1.0404 | 1.0633 | 1.0518 |
| Corporate Operations Expense | 1.0041 | 1.0041 | 1.0408 | 1.0224 |
| Depreciation & Amortization Expense | 1.0634 | 1.0596 | 1.0666 | 1.0631 |
| Charitable Contributions | 1.0873 | 1.0803 | 1.0876 | 1.0839 |
| Interest & Related Items | 0.9719 | 0.9711 | 1.0336 | 1.0023 |
| Patronage Dividends | 1.0766 | 1.0711 | 1.0849 | 1.0780 |
| Interest On Customer Deposits | 0.9719 | 0.9711 | 1.0336 | 1.0023 |
| Other Long Term Liabilities | 1.0766 | 1.0711 | 1.0849 | 1.0780 |
| Federal Investment Tax Credits | 1.0766 | 1.0711 | 1.0849 | 1.0780 |
| Other Operating Taxes | 1.0697 | 1.0652 | 0.9599 | 1.0125 |
| Allow. For Funds Used During Const. | 1.0873 | 1.0803 | 1.0876 | 1.0839 |
| Expenses & Other Taxes | 1.0616 | 1.0580 | 1.0788 | 1.0684 |
| Revenue Requirement | 1.0681 | 1.0638 | 1.0750 | 1.0694 |

**EXHIBIT 5.2**

**AVERAGE SCHEDULE ACCOUNT GROWTH RATIOS**
**(Continued)**

| | Large Study Areas | | | |
|---|---|---|---|---|
| **Account** | **(I) 2001 Sample Annual Growth** | **(J) 2001 Sample Adjusted Growth** | **(K) 2002 Sample Annual Growth** | **(L) 2002 Composite Growth** |
| Telecommunications Plant In Service | 1.0752 | 1.0699 | 1.0785 | 1.0742 |
| Land & Support Assets | 1.0484 | 1.0462 | 1.0917 | 1.0689 |
| Central Office Equipment | 1.0869 | 1.0800 | 1.0951 | 1.0875 |
| Cable & Wire Facilities | 1.0742 | 1.0691 | 1.0611 | 1.0651 |
| Tangible Assets | 1.0000 | 1.0000 | 1.0917 | 1.0459 |
| Intangibles | 1.0869 | 1.0800 | 1.0951 | 1.0875 |
| Materials And Supplies | 1.5929 | 1.3722 | 0.8957 | 1.1340 |
| Rural Telephone Bank Stock | 0.9754 | 0.9748 | 1.0228 | 0.9988 |
| Other Telecommunications Plant | 1.0805 | 1.0745 | 1.0766 | 1.0756 |
| Total Telecommunications Plant | 1.0805 | 1.0745 | 1.0766 | 1.0756 |
| Other Non-Current Assets | 1.0557 | 1.0528 | 1.0334 | 1.0431 |
| Accum. Depreciation & Amortization | 1.1065 | 1.0962 | 1.1216 | 1.1089 |
| Net Telecommunications Plant | 1.0557 | 1.0528 | 1.0334 | 1.0431 |
| Net Deferred Operating Income Tax | 1.0469 | 1.0448 | 0.9864 | 1.0156 |
| Plant Specific Expense | 1.0789 | 1.0731 | 1.0830 | 1.0781 |
| Plant Non-specific Expense | 1.1056 | 1.0955 | 1.0338 | 1.0647 |
| Customer Service Expense | 1.1019 | 1.0925 | 1.0266 | 1.0595 |
| Corporate Operations Expense | 1.0282 | 1.0274 | 1.0582 | 1.0428 |
| Depreciation & Amortization Expense | 1.0726 | 1.0677 | 1.1186 | 1.0931 |
| Charitable Contributions | 1.0805 | 1.0745 | 1.0766 | 1.0756 |
| Interest & Related Items | 1.0071 | 1.0070 | 0.9736 | 0.9903 |
| Patronage Dividends | 1.0557 | 1.0528 | 1.0334 | 1.0431 |
| Interest On Customer Deposits | 1.0071 | 1.0070 | 0.9736 | 0.9903 |
| Other Long Term Liabilities | 1.0557 | 1.0528 | 1.0334 | 1.0431 |
| Federal Investment Tax Credits | 1.0557 | 1.0528 | 1.0334 | 1.0431 |
| Other Operating Taxes | 1.0315 | 1.0305 | 1.0067 | 1.0186 |
| Allow. For Funds Used During Const. | 1.0805 | 1.0745 | 1.0766 | 1.0756 |
| Expenses & Other Taxes | 1.0732 | 1.0682 | 1.0781 | 1.0732 |
| Revenue Requirement | 1.0669 | 1.0627 | 1.0645 | 1.0636 |

6. The 2003 Study Stratified Composite Growth Ratios

NECA uses composite growth ratios from two annual samples to provide more stable account growth estimates and substantially smaller statistical variance. Derivation of composite growth rates entails adjusting 2001 Sample annual straight line growth ratios to the next year, and averaging these adjusted growth ratios with the 2002 Sample Stratified Growth Ratios.

The 2001 Sample Stratified Annual Growth Ratios, representing growth from 1999 to 2000, are shown in Columns A, E and I of Exhibit 5.2. Each of these growth ratios was adjusted forward one year to reflect the equivalent straight line rate of growth from 2000 to 2001. This adjustment method is illustrated in Exhibit 5.3, using the Central Office Equipment (COE) investment growth ratio for small study areas, as an example.[3] Adjusted 2001 Sample Stratified Annual Growth Ratios are displayed in Columns B, F and J of Exhibit 5.2.

**EXHIBIT 5.3**

**ADJUSTMENT OF 2001 SAMPLE STRATIFIED ANNUAL GROWTH RATIOS FOR STUDY AREAS WITH LESS THAN 4,000 ACCESS LINES USING COE INVESTMENT AS AN EXAMPLE**

| | | |
|---|---|---|
| A. | 2001 Sample Stratified Small Company Annual Growth Ratios (1999 to 2000) | 1.0742 |
| B. | 2001 Sample Stratified Small Company Two Year Growth Ratios (1999 to 2001) {2 x (Line A - 1)} + 1 | 1.1484 |
| C. | Adjusted 2001 Sample Stratified Small Company Annual Growth Ratio (Line B/Line A) | 1.0691 |

This Study developed composite growth ratios for each account within each access line

[3] NECA used a straight-line forecasting method to project average schedule accounts, because it has less risk of over-estimating accounts.

size stratum. A composite growth ratio is the arithmetic average of the Adjusted 2001 Sample Stratified Annual Growth Ratio and the related 2002 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 4,000 access lines follows.

*2003 Study Stratified Composite Growth Ratio for Stratum 1*

$$= \{\text{Adjusted 2001 Stratified Stratum}_1 \text{ Growth Ratio} + \text{2002 Stratified Stratum}_1 \text{ Annual Growth Ratio}\} / 2$$

$$= (1.0691 + 1.0578)/ 2$$

$$= 1.0634$$

The 2002 Study Stratified Composite Growth Ratios are displayed in Columns D, H and L of Exhibit 5.2.

7. <u>Other Growth Rates</u>

For some accounting data from smaller accounts that exhibit significant year over year growth variation, NECA used growth ratios derived from other logically related accounts to reduce significant sample variance.

- The test period values for Contributions, Allowance for Funds Used During Construction and Other Telecommunications Plant were calculated using the growth rate calculated for Total Plant.
- Interest on Customer Deposits values were projected using the growth rate

developed for Interest and Related Items.

- Patronage Dividends, Federal Investment Tax Credit, Other Non-Current Assets and Other Long Term Liabilities were projected at the same rate as Net Plant.

- Test period values for Provision for Deferred Operating Income Taxes were calculated using the Other Taxes growth ratio.

8. 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 2000 accounts submitted by the 2001 Sample, the multi-year growth rates reflect the fact that the test period extends four and one-half years beyond the end of 2000. For accounts in each stratum of the 2002 Sample multi-year growth ratios reflect three and one-half years between the end of 2001 and the test period. The calculation for multi-year growth ratios is as follows:

For 2001 Accounts:

$$\textit{2001 Stratified Multi-year Growth Ratio}_i = 1 + [(\textit{2003 Study Stratified Composite Growth Ratio}_i - 1) \times 3.5]$$

For 2000 Accounts:

$$\text{2000 } \textit{Stratified Multi-year Growth Ratio}_i = 1 + [(\textit{2002 Study Stratified Composite Growth Ratio}_i - 1) \times 4.5]$$

9. 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. Prior to forecasting, study areas included in the 2001 Sample were separated into access line size stratum based on the number of lines reported in the final view (December 2002) of settlements in December 2000. The forecasted amounts in each stratum were computed by multiplying the 2000 account balance by the 2000 Stratified Multi-year Growth Ratio by stratum.

Similarly, study areas from the 2002 Sample were first assigned to an access line stratum and then projected to the test period by multiplying the 2001 account balance by the corresponding multi-year growth ratio. The set of composite multi-year growth ratios used to project a study area's account balances from the 2002 Sample were chosen based on the study area's access line size, as reported for settlements in December 2000 and including all adjustments through December 2002.

*Study Area Forecast of 2001 Account =*

*(Study Area 2001 Account Value) x (2001 Stratified Multi-year Growth Ratio$_i$)*

*Study Area Forecast of 2000 Account =*

*(Study Area 2000 Account Value) x (2000 Stratified Multi-year Growth Ratio$_i$ )*

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

## C. Access Minute Forecasting

To forecast traffic sensitive access minutes of use, NECA developed an econometric model based on the historical growth of access minutes from the average schedule population. This model was

used to prepare an Access Minute Growth Ratio, which was used to forecast Average Schedule sample study area minutes to the test period.[4] The modeling process and calculation of forecasts are described below.

1. Econometric Model for Access Minutes

Traffic sensitive access minutes data reported to the NECA pool by the population[5] of average schedule companies from July 1999 through August 2003, including all adjustments through September 2003, were used to develop the model. These data are displayed in Appendix D4.

In this model, the Natural Log of access minutes was the dependent variable. The independent variables were Natural Log of Real Disposable Personal Income (Income), Natural Log of Real Price Index for Long Distance Services (Price), Natural Log of Real Price of Cellular Services, Natural Log of Employment, a constant term and eleven seasonal dummy variables. The price, income and employment variables are national aggregates. To perform these calculations, the following data were used:

1. Consumer Price Index (CPI) – Macroeconomic Advisers, LLC (MA) provides a measure of the rate of inflation to NECA in their August 2003 view. The U.S. Government Bureau of Labor Statistics is the original source for the historical data and MA is the developer of the forecast data. The CPI series is used in the model to adjust the price and income variables for inflation.

[4] Access Minute Growth Ratios for NECA average schedule companies were derived using the econometric modeling techniques that support NECA's Annual Tariff Filing. *See, e.g.*, National Exchange Carrier Association, Inc., Tariff F.C.C. No. 5, Transmittal No. 988, filed June 16, 2003 at Vol. 3, Sec. 2, p. 5.

2. Real Price Index – Because of changes in data availability, the nominal price index for long distance services is developed by splicing together two separate series:

   - The AT&T Basket 1 Actual Price Index (API) from the AT&T Price Cap filings available through the middle of 1995, (after which it was then discontinued), and,
   - A comparable series from the Bureau of Labor Statistics subsequent to the discontinuation of AT&T's API.

   The combined series are converted into real prices by dividing the nominal long distance price series by the CPI series.

3. Real Disposable Personal Income – MA's August 2003 view of the outlook for nominal disposable income is adjusted for inflation using the CPI index.

4. Employment – The Bureau of Labor Statistics compiles historical data on employment. MA projects employment for the forecast period using an econometric model that links employment level to the growth in Gross Domestic Product (GDP) and National Income. The projections of employment were obtained from MA's August 2003 economic outlook.
5. Real Price Index of Cellular Services – Because of the limitations of the available data, the nominal price index for cellular services is constructed by splicing together two separate series:

   - A series developed from the Cellular Telecommunications & Internet

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[5] NECA did not use outlier accommodation during the development of growth models for demand data. Data points in demand trend analyses were population aggregate values by

Association (CTIA) semi-annual data on Average Local Monthly Bills.[6] The CTIA series covers the time periods prior to June of 1999. The data has been collected by CTIA since June of 1987 in June and December of each year. Values for months in which the data was not collected were estimated by linear interpolation, and,

- The BLS series for "Cellular and other wireless voice grade services", covering the time span from June of 1999 to the present.[7]

The complete spliced series was converted into a real price series by dividing the nominal cellular price indices by the CPI series. It is assumed that the nominal price of cellular services will not change during the forecast period of the model.

6. Seasonal Dummy Variables – Eleven seasonal dummy variables for the months of February through December are used to capture monthly patterns in the data that repeat across the years.

The lag structure for real price is 3 months, while that of real disposable income is 6 months. The lag structure for employment is 9 months, while the lag structure for real cellular prices is also set at 9 months. The sign of the cellular price variable is positive, since wireless services can be used as a substitute for land-line services. In other words,

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month, which are virtually free from influence by changes of individual study areas.

6 Cellular Telecommunications & Internet Association, The CTIA Semi-annual Wireless Industry Survey – Semi-Annual Wireless Industry Results – June 1985 to June 2001. http://www.wow-com/industry/stats/articles.cfm?ID=239.

7 Rod Meaney, et.al., Producer Price Index Detailed Report – Data for September 2001, U.S. Department of Labor, Bureau of Labor Statistics, Cellular and Other Wireless Voice Grade Services, Series ID: pcu4812#1, 1999 to 2001, August 2002. http://data.bls.gov/cgi-bin/srgate.

a decline in the price of cellular services will reduce the demand for access service. The model was corrected for autocorrelation.

The coefficient of each independent variable in the model is its elasticity relative to access minutes, and represents the percent change in access minutes resulting from a percent change in each independent variable.

Model coefficients together with the diagnostic *t-statistic, F-statistic and R-Square* statistics are given in Exhibit 5.4. The model fits the data well, explaining 92.93 percent of the variance in access minutes. The F-statistic of 50.59 shows that this regression is statistically significant at the 99 percent confidence level.

2. Access Minute Growth Ratios

An access minute growth ratio was used to project demand to the test period. Because average schedule sample study area demand data were collected for the base period (July 2002 through June 2003), an access minute growth ratio was developed to project access minutes data from the average month of the base period to the average month of the test period. The calculation of the access minutes growth ratio is described below.

| EXHIBIT 5.4<br><br>ACCESS MINUTES ECONOMETRIC MODEL | | |
|---|---|---|
| **Variable** | **Coefficient** | **T-Statistic** |
| Log Real Price | -0.0654 | -1.21 |
| Log Real Income | 0.4727 | 1.39 |
| Log of Real Price of Cellular Services | 0.4731 | 4.96 |
| Log of Employment | 3.2209 | 10.54 |
| Constant | -19.9917 | -6.32 |
| February | -0.0115 | -1.38 |
| March | -0.0259 | -2.90 |
| April | -0.0094 | -1.05 |
| May | -0.0352 | -3.93 |
| June | -0.0375 | -4.17 |
| July | -0.0255 | -3.01 |
| August | 0.0078 | 0.91 |
| September | 0.0019 | 0.22 |
| October | -0.0169 | -1.99 |
| November | -0.0316 | -3.75 |
| December | -0.0373 | -4.48 |
| $R^2 = 0.9293$ | F-statistic = 50.59 | Durbin-Watson = 1.99 |

The econometric model was used to estimate access minutes for a consistent sample of companies in each month of the base period as well as for each month of the test period. NECA used the model's twelve month access minute totals for the base period and the test period to arrive at an Access Minute Growth Ratio.

The Access Minute Growth Ratio was calculated by dividing the test period value by the base period value, as follows:

$$\textit{Access Minute Growth Ratio} = \frac{\textit{Annual Modeled Access Minutes 7/04 - 6/05}}{\textit{Annual Modeled Access Minutes 7/02 - 6/03}}$$

$$= \frac{4{,}688{,}558{,}186}{4{,}788{,}245{,}583}$$

$$= 0.9792$$

NECA used the Access Minute Growth Ratio to project access minutes data for its stratified random sample of companies. Using settlement data for each sample study area, NECA calculated the monthly average access minutes for the base period.[8] The base period monthly average access minutes value of each study area was multiplied by the Access Minute Growth Ratio to determine its test period monthly average access minutes. NECA used test period access minutes of each average schedule sample study area to evaluate allocation models, as described in Section VI, and to derive several Traffic Sensitive settlement formulas as described in Section VII.

D. 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. The use of a stratified approach was introduced in the 2000 Study in order to improve the accuracy of access line forecasts, after differences with respect to access line growth were observed among large and

[8] These data are displayed in Appendix D1.

small study areas.[9]

In the 2000 Study, NECA tested several stratification models containing various breakpoints and found that the most statistically significant differences in access line growth rates occurred when 1,000 and 7,500 access lines were used to group sample study areas. These tests were repeated during this study. These tests did not reveal any new breakpoints that improved the accuracy of the growth ratio estimates. Therefore, NECA continues to use these two breakpoints in this study.

Stratified growth models were developed by fitting a regression model to historical monthly access line values of the average schedule study areas in each stratum. The three year historical time period from July 2000 through June 2003, including all adjustments made through July 2003 were used to develop the model. NECA found that the rate of growth in access lines reported for settlements each month by large companies (average schedule companies with more than 7,500 access lines) decreased significantly starting in April 2002. Medium and small average schedule companies started reporting significant decreases in June 2002 and July 2001 respectively. As a result, NECA added trend change indicators to the access line model structures to capture the impact of the reported decreases on the overall strata growth ratios. Then NECA derived the following models and access line growth rates, using the regression data displayed in Exhibit 5.5A, to estimate base period to test period growth for the average schedule population:

[9] *See* National Exchange Carrier Association, Inc., 2001 Modification of Average Schedules, December 28, 2000, Sec. V.D at p 18.

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

*Monthly Access Lines = 84,159 + (85.81 * Month Sequence)*
*+ (-131.87 * Trend Change Indicator)*

*Where Trend Change Indicator = 0, from July 2000 to June 2001*
*Trend Change Indicator = 1 for July 2001; 2 for August 2001, etc.*

$R^2$ *= 0.7143* *t-statistic for Intercept = 714.41* *F-statistic = 41.26*
*t-statistic for Month Sequence = 6.63*
*t-statistic for Indicator = -8.01*

*<u>If Access Lines are between 1,000 and 7,500</u>*

*Monthly Access Lines = 766,721 + (668.28 * Month Sequence)*
*+ (-1,729.66 * Trend Change Indicator)*

*Where Trend Change Indicator = 0, from July 2000 to May 2002*
*Trend Change Indicator = 1 for June 2002; 2 for July 2002, etc.*

$R^2$ *= 0.7840* *t-statistic for Intercept = 791.93* *F-statistic = 59.90*
*t-statistic for Month Sequence = 10.38*
*t-statistic for Indicator = -10.46*

*<u>If Access Lines are greater than 7,500</u>*

*Monthly Access Lines = 1,604,476 + (2,663.06 * Month Sequence)*
*+ (-5,349.49 * Trend Change Indicator)*

*Where Trend Change Indicator = 0, from July 2000 to March 2002*
*Trend Change Indicator = 1 for April 2002; 2 for May 2002; etc.*

$R^2$ *= 0.9065* *t-statistic for Intercept = 758.79* *F-statistic = 160.05*
*t-statistic for Month Sequence = 17.68*
*t-statistic for Indicator = -16.51*

**EXHIBIT 5.5A**

**DEMAND DATA USED IN TIME SERIES MODELS – COMMON LINE**

| DATE | Common Line Month Sequence | Access Lines By Line Size Group | | |
|---|---|---|---|---|
| | | Small | Medium | Large |
| 200007 | 1 | 85,025 | 765,094 | 1,593,009 |
| 200008 | 2 | 85,124 | 766,015 | 1,602,234 |
| 200009 | 3 | 85,306 | 768,030 | 1,607,023 |
| 200010 | 4 | 85,348 | 768,933 | 1,614,450 |
| 200011 | 5 | 85,233 | 768,889 | 1,620,066 |
| 200012 | 6 | 85,224 | 769,165 | 1,621,980 |
| 200101 | 7 | 85,279 | 769,642 | 1,626,111 |
| 200102 | 8 | 85,423 | 771,487 | 1,632,269 |
| 200103 | 9 | 85,567 | 774,320 | 1,635,800 |
| 200104 | 10 | 85,659 | 775,491 | 1,639,307 |
| 200105 | 11 | 86,287 | 777,629 | 1,641,617 |
| 200106 | 12 | 86,346 | 778,754 | 1,640,411 |
| 200107 | 13 | 86,472 | 779,039 | 1,640,471 |
| 200108 | 14 | 86,380 | 778,683 | 1,644,077 |
| 200109 | 15 | 86,382 | 779,259 | 1,648,320 |
| 200110 | 16 | 86,307 | 778,864 | 1,650,930 |
| 200111 | 17 | 86,080 | 778,064 | 1,649,850 |
| 200112 | 18 | 85,889 | 777,491 | 1,651,297 |
| 200201 | 19 | 85,787 | 777,767 | 1,652,950 |
| 200202 | 20 | 85,706 | 777,611 | 1,652,644 |
| 200203 | 21 | 85,736 | 778,606 | 1,656,077 |
| 200204 | 22 | 85,699 | 780,685 | 1,657,268 |
| 200205 | 23 | 85,994 | 781,358 | 1,655,763 |
| 200206 | 24 | 86,273 | 783,744 | 1,653,813 |
| 200207 | 25 | 86,165 | 778,254 | 1,640,166 |
| 200208 | 26 | 86,029 | 777,026 | 1,640,739 |
| 200209 | 27 | 85,834 | 782,835 | 1,642,817 |
| 200210 | 28 | 85,578 | 775,176 | 1,641,646 |
| 200211 | 29 | 85,376 | 773,861 | 1,637,772 |
| 200212 | 30 | 85,231 | 771,781 | 1,635,380 |
| 200301 | 31 | 85,327 | 771,167 | 1,632,575 |
| 200302 | 32 | 85,282 | 770,299 | 1,629,245 |
| 200303 | 33 | 85,051 | 770,544 | 1,628,470 |
| 200304 | 34 | 85,550 | 770,404 | 1,627,426 |
| 200305 | 35 | 85,406 | 772,794 | 1,624,689 |
| 200306 | 36 | 85,507 | 770,881 | 1,624,132 |

**EXHIBIT 5.5B**

**DEMAND DATA USED IN TIME SERIES MODELS – TRAFFIC SENSITIVE**

| DATE | Traffic Sensitive Month Sequence | Normal Route Circuit Miles | Long Route Circuit Miles | Switched Circuit Terminations | Intertoll Dial Circuits |
|---|---|---|---|---|---|
| 200007 | 1 | 3,578,561 | 583,488 | 118,832 | 17,379 |
| 200008 | 2 | 3,593,157 | 583,584 | 119,042 | 17,422 |
| 200009 | 3 | 3,592,365 | 585,225 | 117,816 | 17,504 |
| 200010 | 4 | 3,597,805 | 553,811 | 118,690 | 17,541 |
| 200011 | 5 | 3,589,177 | 554,867 | 117,606 | 17,480 |
| 200012 | 6 | 3,607,486 | 564,032 | 118,168 | 17,948 |
| 200101 | 7 | 3,613,698 | 554,567 | 117,263 | 17,860 |
| 200102 | 8 | 3,641,819 | 562,426 | 117,173 | 18,281 |
| 200103 | 9 | 3,667,101 | 566,303 | 116,519 | 18,395 |
| 200104 | 10 | 3,735,544 | 645,002 | 118,574 | 18,439 |
| 200105 | 11 | 3,742,850 | 653,410 | 118,350 | 18,448 |
| 200106 | 12 | 3,762,729 | 648,567 | 118,391 | 18,454 |
| 200107 | 13 | 3,718,169 | 653,227 | 116,379 | 19,532 |
| 200108 | 14 | 3,767,887 | 659,440 | 117,231 | 19,357 |
| 200109 | 15 | 3,772,531 | 655,463 | 117,522 | 19,535 |
| 200110 | 16 | 3,801,421 | 693,506 | 117,666 | 19,548 |
| 200111 | 17 | 3,815,435 | 759,653 | 118,087 | 19,317 |
| 200112 | 18 | 3,827,458 | 745,847 | 117,743 | 19,185 |
| 200201 | 19 | 3,915,854 | 754,056 | 119,233 | 18,968 |
| 200202 | 20 | 3,992,689 | 757,253 | 119,801 | 19,381 |
| 200203 | 21 | 4,099,117 | 761,935 | 120,644 | 20,324 |
| 200204 | 22 | 4,182,574 | 771,917 | 122,220 | 21,292 |
| 200205 | 23 | 4,189,299 | 773,910 | 122,588 | 21,895 |
| 200206 | 24 | 4,182,130 | 773,943 | 122,233 | 21,826 |
| 200207 | 25 | 4,187,835 | 777,036 | 122,844 | 22,948 |
| 200208 | 26 | 4,205,442 | 820,970 | 123,334 | 23,378 |
| 200209 | 27 | 4,270,707 | 819,432 | 124,007 | 23,353 |
| 200210 | 28 | 4,337,854 | 859,188 | 124,119 | 23,492 |
| 200211 | 29 | 4,368,929 | 847,307 | 124,415 | 23,509 |
| 200212 | 30 | 4,379,415 | 868,899 | 125,023 | 23,760 |
| 200301 | 31 | 4,514,596 | 869,404 | 127,323 | 23,870 |
| 200302 | 32 | 4,569,706 | 922,930 | 127,957 | 24,270 |
| 200303 | 33 | 4,555,337 | 916,396 | 127,401 | 24,460 |
| 200304 | 34 | 4,588,030 | 916,400 | 127,569 | 24,301 |
| 200305 | 35 | 4,618,575 | 937,067 | 127,535 | 24,398 |
| 200306 | 36 | 4,629,029 | 935,874 | 127,829 | 24,400 |

Using these access line regression models, the Stratified Access Line Growth Ratios were computed as follows:

*Average of Month Sequence Numbers in Test Period (July 2004 to June 2005) = 54.5*

*Average of Month Sequence Numbers in Base Period (July 2002 to June 2003) = 30.5*

*2 Year Access Line Growth Ratio For Study Areas With Less Then 1,000 Access Lines*

$$= \frac{\text{Access Line Modeled Avg. Month of 7/04 - 6/05}}{\text{Access Line Modeled Avg. Month of 7/02 - 6/03}}$$

$$= \frac{\text{83,231.09 Access Lines}}{\text{84,336.51 Access Lines}}$$

$$= 0.9869$$

*2 Year Access Line Growth Ratio For Study Areas With 1,000 to 7,500 Access Lines*

$$= \frac{\text{Access Line Modeled Avg. Month of 7/04 - 6/05}}{\text{Access Line Modeled Avg. Month of 7/02 - 6/03}}$$

$$= \frac{\text{748,658.21 Access Lines}}{\text{774,131.36 Access Lines}}$$

$$= 0.9671$$

*2 Year Access Line Growth Ratio For Companies With More Then 7,500 Access Lines*

$$= \frac{\text{Access Line Modeled Avg. Month of 7/04 - 6/05}}{\text{Access Line Modeled Avg. Month of 7/02 - 6/03}}$$

$$= \frac{\text{1,570,404.98 Access Lines}}{\text{1,634,879.20 Access Lines}}$$

$$= 0.9606$$

Next, base period average access lines were computed for each sample study area, using the August 2003 view of data reported to the NECA pool from July 2002 through June 2003.[10] The average number of monthly access lines over the base period was calculated for each sample study area. Each sample company was then assigned to a stratum, based on its access line size. Forecasted test period average access lines for each sample study area was computed by multiplying base period average access lines by the appropriate Stratified Access Line Growth Ratio.

E. Circuit Mile Forecasting

In the 2000 Study, NECA initiated a method of forecasting normal route and long route circuit miles separately, based on analysis which indicated that they have different growth trends. In this Study, NECA continues analyzing normal route and long route circuit mile growth independently. NECA uses a threshold of 100 average circuit miles per circuit to distinguish low cost routes from normal cost routes. NECA's analysis of networks of companies with normal and low cost routes showed that a threshold of 100 circuit miles per circuit correctly classified only companies with low cost in the long route group, while at lower threshold levels, some companies with normal costs are incorrectly classified as low cost companies. Therefore, NECA continues to use 100 as the long route threshold. The total number of monthly circuit miles reported for settlements were split into normal route and long route circuit miles as follows:

*If Circuit Miles are less than or equal to (100 x Interstate Circuits),*

*Then Normal Route Circuit Miles = Circuit Miles*

*And Long Route Circuit Miles = 0*

*If Circuit Miles are more than (100 x Interstate Circuits),*

[10] These data are displayed in Appendix D1.

*Then Normal Route Circuit Miles = 100 x Interstate Circuits*

*And Long Route Circuit Miles = Total Circuit Miles - Normal Route Circuit Miles*

1. Normal Route Circuit Mile Forecasting

The following variables were used in normal route circuit mile regression modeling:

- Normal Route Circuit Mile counts - Monthly amounts were calculated from the settlement data submitted by average schedule companies from July 2000 through June 2003, including all adjustments through July 2003 (*See* Exhibit 5.5B).
- Month Sequence number - A sequentially assigned number, measuring a time trend. Month Sequence 1 corresponds to July 2000 and Month Sequence 36 corresponds to June 2003.

The regression model for normal route circuit miles is as follows:

*Normal Route Circuit Miles = 3,388,148 + (33,392 x Month Sequence)*

$R^2$ = *0.9525* *t-statistic for Intercept = 124.88* *F-statistic = 681.93*
*t-statistic for Month Sequence = 26.11*

*Month Sequence 1 = July 2000*

The Normal Route Circuit Mile Growth Ratio was computed as follows:

*Average of Month Sequence Numbers from July 2004 to June 2005 Test Period = 54.5*

*Average of Month Sequence Numbers from July 2002 to June 2003 Base Period = 30.5*

*Normal Route Circuit Mile Growth Ratio*

$$= \frac{\text{Normal Route Circuit Miles Modeled Avg. Month of 7/04 - 6/05}}{\text{Normal Route Circuit Miles Modeled Avg. Month of 7/02 - 6/03}}$$

$$= \frac{\text{5,208,012 Normal Route Circuit Miles}}{\text{4,406,604 Normal Route Circuit Miles}}$$

$$= 1.1819$$

2. Long Route Circuit Mile Forecasting

The growth in long route circuit miles was calculated based on historical trend data from July 2000 to June 2003. The following variables were used in long route circuit mile regression modeling:

- Long Route Circuit Mile Counts - Monthly long route circuit miles were calculated from settlement data submitted by average schedule companies from July 2000 through June 2003, including all adjustments through July 2003. (*See* Exhibit 5.5B)

- Month Sequence number - A sequentially assigned number, measuring a time trend. Month Sequence 1 corresponds to July 2000 and Month Sequence 36 corresponds to June 2003.

The regression model for long route circuit miles is as follows:

*Long Route Circuit Miles = 498,043 + (12,277 x Month Sequence)*

$R^2$ *= .9650* *t-statistic for Intercept = 58.53* *F-statistic = 937.12*
*t-statistic for Month Sequence = 30.61*

*Month Sequence 1 = July 2000*

The Long Route Circuit Mile Growth Ratio was computed as follows:

Average of Month Sequence Numbers from July 2004 to June 2005 Test Period = 54.5

Average of Month Sequence Numbers from July 2002 to June 2003 Base Period = 30.5

*Long Route Circuit Mile Growth Ratio*

$$= \frac{\text{Long Route Circuit Miles Modeled Avg. Month of 7/04 - 6/05}}{\text{Long Route Circuit Miles Modeled Avg. Month of 7/02 - 6/03}}$$

$$= \frac{\text{1,167,139.5 Long Route Circuit Miles}}{\text{872,491.5 Long Route Circuit Miles}}$$

$$= 1.3377$$

Next, base period average normal and long route circuit miles were computed for each sample study area, using the August 2003 view of data reported to the NECA pool from July 2002 through June 2003.[11] The average number of monthly normal and long route circuit miles over the base period was calculated for each sample study area. Forecasted test period average normal and long route circuit miles for each sample study area were computed by multiplying base period average number of normal and long route circuit miles by the appropriate Circuit Mile Growth Ratio.

[11] These data are displayed in Appendix D1.

F. Circuit Termination Model

NECA forecasted circuit terminations of sample average schedule study areas using a Circuit Termination Growth Ratio. The ratio was developed by fitting a regression model to historical monthly circuit termination values of the average schedule population.

The following variables were used in circuit termination demand regression modeling.

- Circuit Termination counts - Monthly amounts reported for settlements by average schedule companies from July 2000 through June 2003, including all adjustments through July 2003. Exhibit 5.5B displays the circuit termination data.

- Month Sequence number - A sequentially assigned measure of a time trend. Month Sequence 1 corresponds to July 2000 and Month Sequence 36 corresponds to June 2003.

The regression model describing the historical growth trend of circuit terminations data of the average schedule population is as follows.

*Circuit Terminations = 115,018 + (325.02 x Month Sequence)*

$R^2 = .7934$ *t-statistic for Intercept = 190.57* *F-statistic = 130.54*
*t-statistic for Month Sequence = 11.43*

*Month Sequence 1 = July 2000*

A Circuit Termination Growth Ratio was computed as follows:

*Average of Month Sequence Numbers from July 2004 to June 2005 Test Period = 54.5*

*Average of Month Sequence Numbers from July 2002 to June 2003 Base Period = 30.5*

*Circuit Termination Growth Ratio*

$$= \frac{\text{Circuit Terminations Modeled Avg. Month of 7/04 - 6/05}}{\text{Circuit Terminations Modeled Avg. Month of 7/02 - 6/03}}$$

$$= \frac{\text{132,731.59 Circuit Terminations}}{\text{124,931.11 Circuit Terminations}}$$

$$= 1.0624$$

Next, NECA calculated a monthly average base period circuit termination value for each sample average schedule study area, using data reported to the NECA pool for the period from July 2002 through June 2003, including all adjustments through August 2003. NECA forecasted circuit terminations to the test period by multiplying each sample study area's base period value by the Circuit Termination Growth Ratio.

G. Intertoll Dial Circuit Forecasting

NECA forecasted Intertoll dial circuits of sample average schedule study areas using an Intertoll Dial Circuit Growth Ratio. The ratio was developed by fitting a regression model to historical monthly Intertoll dial circuit values of the average schedule population.

The following variables were used in Intertoll dial circuit demand regression modeling.

- Intertoll Dial Circuit counts - Monthly amounts reported for settlements by average schedule companies from July 2000 through June 2003, including all adjustments through July 2003. Exhibit 5.5B displays the Intertoll dial circuit data.

- Month Sequence number - A sequentially assigned measure of a time trend. Month Sequence 1 corresponds to July 2000 and Month Sequence 36 corresponds to June 2003.

- Trend Change Indicator - Analysis of the data from this period revealed that the growth in Intertoll Dial Circuits changed significantly after April 2002. To account for this change, NECA added a dummy variable to the regression model to ensure that the trend change did not unduly influence test period growth estimates.

The regression model describing the historical growth trend of Intertoll dial circuit data of the average schedule population is as follows:

*Intertoll Dial Circuits = 16,919 + (155.66 x Month Sequence)*
*+ (2,050.97 x Trend Change Indicator)*

*where Trend Change Indicator = 0, from July 2000 to April 2002*
*Trend Change Indicator = 1 for May 2002; 2 for June 2002, etc.*

$R^2 = 0.9782$ *t-statistic for Intercept = 106.23* *F-statistic = 739.81*
*t-statistic for Month Sequence = 13.22*
*t-statistic for Trend Change Indicator = 8.17*

*Month Sequence 1 = July 2000*

A Intertoll Dial Circuit Growth Ratio was computed as follows:

*Average of Month Sequence Numbers from July 2004 to June 2005 Test Period = 54.5*

*Average of Month Sequence Numbers from July 2002 to June 2003 Base Period = 30.5*

*Intertoll Dial Circuit Growth Ratio*

$$= \frac{\text{Intertoll Dial Circuits Modeled Avg. Month of 7/04 - 6/05}}{\text{Intertoll Dial Circuits Modeled Avg. Month of 7/02 - 6/03}}$$

$$= \frac{\text{25,401.88 Intertoll Dial Circuits}}{\text{21,666.12 Intertoll Dial Circuits}}$$

$$= 1.1724$$

Next, NECA calculated a monthly average base period Intertoll dial circuit value for each sample average schedule study area, using data reported to the NECA pool for the period from July 2002 through June 2003, including all adjustments through August 2003. NECA forecasted Intertoll dial circuits to the test period by multiplying each sample study area's base period value by the Intertoll Dial Circuit Growth Ratio.

## H. Special Access Revenue Forecasting

NECA has data to support projection of average schedule company costs at the total account level, but not at the access category level. Total account growth ratios have been historically stable in the six percent to ten percent range. In contrast, demand for Special Access services, as measured by the revenues reported monthly to NECA for settlements, has grown at rates as high as thirty percent annually in recent years. Since the 2000 Study, the use of Special Access revenue data from more recent time periods (especially from calendar year 1999 and later) produced forecasts that are substantially incompatible with forecasts of cost data, which are based on the historical accounting data collected from sample study areas.

To avoid a misalignment of the cost and demand data, in the 2000 Study NECA started to produce

a Special Access revenue forecast that was directly compatible with the cost forecast by: (1) using base period Special Access revenues from the same months as the accounting data; and (2) projecting revenue growth in parallel with cost growth. This method is continued in this Study.

1. Special Access Revenue Data

In this study, NECA used Special Access revenue data reported to settlements from January 2000 to December 2001, as described in Section III.E, as the base period data. Average schedule study area settlements for special access service provisioning are calculated amounts derived from settlement formulas, that assume achievement of the authorized rate of return. The revenue levels reported for settlements, however, reflect the pool's achieved rate of return. NECA adjusted the revenues reported monthly for settlements to the rate of return authorized by the FCC during that time period using the following formula:

$$\textit{Rate of Return Adjustment Factor} = \frac{\textit{Special Access Revenue Requirement At Authorized Rate of Return}}{\textit{Special Access Revenues At Achieved Rate of Return}}$$

The Rate of Return Adjustment Factors calculated are shown in Exhibit 5.6.

**EXHIBIT 5.6**

**SPECIAL ACCESS RATE OF RETURN ADJUSTMENT FACTOR DEVELOPMENT**

| Month | Special Access Revenues Requirement At Authorized Rate of Return | Special Access Revenues At Achieved Rate of Return | Rate of Return Adjustment Factor |
|---|---|---|---|
| 200001 | 11,074,437 | 9,584,574 | 1.1554 |
| 200002 | 11,079,834 | 9,660,344 | 1.1469 |
| 200003 | 11,202,904 | 9,852,950 | 1.1370 |
| 200004 | 11,356,818 | 9,983,260 | 1.1376 |
| 200005 | 11,347,084 | 10,114,522 | 1.1219 |
| 200006 | 11,548,371 | 10,626,103 | 1.0868 |
| 200007 | 11,537,835 | 10,748,785 | 1.0734 |
| 200008 | 12,258,826 | 11,714,620 | 1.0465 |
| 200009 | 12,460,681 | 12,277,523 | 1.0149 |
| 200010 | 12,869,472 | 12,741,569 | 1.0100 |
| 200011 | 12,970,004 | 13,117,031 | 0.9888 |
| 200012 | 13,076,104 | 13,550,627 | 0.9650 |
| 200101 | 15,711,262 | 13,993,850 | 1.1227 |
| 200102 | 15,656,442 | 14,133,962 | 1.1077 |
| 200103 | 15,836,096 | 14,686,243 | 1.0783 |
| 200104 | 16,174,065 | 15,215,723 | 1.0630 |
| 200105 | 16,286,721 | 15,715,426 | 1.0364 |
| 200106 | 16,398,732 | 16,073,830 | 1.0202 |
| 200107 | 16,490,882 | 16,743,115 | 0.9849 |
| 200108 | 16,756,689 | 17,054,038 | 0.9826 |
| 200109 | 16,672,197 | 17,385,128 | 0.9590 |
| 200110 | 17,070,481 | 17,481,962 | 0.9765 |
| 200111 | 17,263,387 | 18,105,061 | 0.9535 |
| 200112 | 17,426,147 | 18,599,258 | 0.9369 |
| 200201 | 19,866,463 | 19,941,970 | 0.9962 |
| 200202 | 19,907,426 | 20,436,620 | 0.9741 |
| 200203 | 20,125,992 | 21,001,216 | 0.9583 |
| 200204 | 20,308,974 | 21,189,729 | 0.9584 |
| 200205 | 20,479,350 | 21,790,892 | 0.9398 |
| 200206 | 20,471,013 | 21,416,611 | 0.9558 |
| 200207 | 21,582,994 | 20,907,469 | 1.0323 |
| 200208 | 21,708,169 | 21,289,328 | 1.0197 |
| 200209 | 21,662,096 | 21,382,589 | 1.0131 |
| 200210 | 22,030,891 | 21,927,447 | 1.0047 |
| 200211 | 22,180,188 | 22,219,176 | 0.9982 |
| 200212 | 22,275,477 | 21,870,888 | 1.0185 |
| 200301 | 22,059,235 | 22,817,252 | 0.9668 |
| 200302 | 22,266,500 | 23,087,188 | 0.9645 |
| 200303 | 22,411,939 | 23,832,400 | 0.9404 |
| 200304 | 22,338,065 | 24,283,475 | 0.9199 |
| 200305 | 22,488,758 | 24,969,674 | 0.9006 |
| 200306 | 22,599,259 | 25,426,130 | 0.8888 |
| 200307 | 22,701,261 | 25,949,770 | 0.8748 |

2. Forecast of Special Access Revenues

To ensure consistency between the cost and demand data underlying the development of Special Access settlement formulas, NECA projected Special Access revenues to test period values using the same method used to project historical revenue requirements. The annual revenue requirement growth ratios by stratum (displayed on Exhibit 5.2) were converted into Multi-year Growth Ratios by Stratum by multiplying annual growth ratios by either three and one-half or four and one-half to capture the elapsed time between the 2001 and 2000 accounting periods and the test period, as described in Section V.B.8.

The forecasted test period average Special Access revenues for each sample study area was computed as follows:

*Sample Study Area Test Period Special Access Revenues*

= *Sample Study Area Base Period Special Access Revenues*
x *Rate of Return Adjustment Factor*
x *Multi-year Stratum Revenue Requirement Growth Ratio*

This method of forecasting Special Access revenues reduces the annual variation in estimated demand growth, while improving the accuracy of the Special Access settlement formula by assuring alignment of underlying cost and demand data.

# 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, as well as the allocation of transport cost to subcategories of Line Haul and Intertoll Dial switching. 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, Year 2000 demand, and the test period unseparated accounts and demand forecasts, described in Section V.

This section also describes the calculation of another set of modeled central office revenue requirements for high traffic volume study areas. For this effort NECA used the High Traffic Volume Period unseparated cost data collected from the high traffic volume study areas as described in Section III.F.

In order to comply with the MAG Order, issued on November 8, 2001, NECA performed additional allocations to ensure that the test period settlement formulas accurately reflect the new allocation rules.[1] The methods used to complete these adjustments are discussed in Section VII.M.

## 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 4.3. Traditionally, NECA had used test period average schedule

[1] MAG Order at App. A, ¶¶ 20, 21 and 22.

demand data, described in Section V, to evaluate these models. In an order released May 22, 2001, however, the FCC imposed an interim separations freeze effective July 1, 2001 for rate-of-return carriers.[2] Consequently, beginning with the 2002 average schedule study, NECA used calendar year 2000 average schedule demand data with the separations models developed from sample cost company 2001 cost studies.

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 or subaccount to the corresponding total unseparated, uncategorized cost. The fraction was multiplied by the sample study area's test period account value to calculate the interstate value of the account or category during the test period. One of the three methods, described in the following subsections, was used to compute the interstate percentage of each account or category.

1. Direct Separations Calculations - Average Separations Fraction

An average separations fraction was used for each account or category for which Exhibit 4.3 shows an average ratio model. Exhibit 6.1 shows an example using the Category 2 Central Office Equipment (COE) separations model.

[2] Jurisdictional Separations and Referral to the Federal-State Joint Board, CC Docket No. 80-286, Report and Order, 16 RCC Rcd 11382 (2001).

**EXHIBIT 6.1**

**DIRECT SEPARATION OF AVERAGE SCHEDULE ACCOUNTS BY AN AVERAGE FRACTION**

**EXAMPLE: SEPARATION OF COE CATEGORY 2**

| | | |
|---|---|---|
| A. | Average Schedule COE Account Balance | $100,000 |
| B. | Average Separations Fraction (from Exhibit 4.3) | 0.019661 |
| C. | Interstate Category 2 COE (Line A x Line B) | $1,966 |

2. Direct Separations Calculations - Regression Model Separations Fraction

A regression model was used for each account or category for which Exhibit 4.3 shows a model of the form:

$$P = B \times X$$

*or*

$$P = A + ( B \times X )$$

*or*

$$P = A + ( B \times X ) + ( C \times Y )$$

*or*

$$P = A + (B \times X) + (C \times Y) + (D \times Z)$$

Calculation of interstate amounts based on regression models, was completed in three steps.

- First, a separations fraction was developed for each sample study area, by evaluating the separations model with the study area's specific values of independent variables. Exhibit 6.2 shows an example using the COE Category 4.2 separations model. In this example, the independent variable, X, equals the sample

study area's adjusted Special Access revenues divided by its access lines (Exhibit 6.2, Steps B and C).

- Second, a range test was performed on the calculated separations fraction to assure its reasonableness. Separations fractions were compared to the related minimum and maximum fraction values (shown in Exhibit 4.3) obtained from the sample cost companies. If the fraction was outside the range, the fraction was set equal to the range limit minimum or maximum. This step ensures that the interstate allocations of the average schedule sample do not exceed the interstate cost allocations of the sample cost companies. The upper and lower limits of the COE Category 4.2 separations model shown in Exhibit 4.3 were 0.000269 and 0.411544, respectively. The separations fraction calculated in Exhibit 6.2 (0.053503) is within the range limit, and therefore no adjustment was necessary.

- Finally, each study area's interstate cost was computed using its separations fraction (Exhibit 6.2, Step D).

**EXHIBIT 6.2**

**DIRECT SEPARATION OF AVERAGE SCHEDULE ACCOUNTS BY A REGRESSION MODEL**
**EXAMPLE: SEPARATION OF COE CATEGORY 4.2**

| | | |
|---|---|---|
| A. | Study Area COE Account Balance | $100,000 |
| B. | Adjusted Special Access Revenues/ Access Lines | 1.171929 |
| C. | Interstate Percentage (Using Formula from Exhibit 4.3) (0.047334 + 0.005264 x Line B) | 0.053503 |
| D. | Interstate Category 4.2 COE Investment (Line A x Line C) | $ 5,350 |

3. Indirect Separations Calculations

For some of the accounts and categories shown in Exhibit 4.3, a separations fraction was developed using the interstate fraction of another account as an independent variable. In these cases, the independent variable fraction was first calculated for each study area, and then used in the model to determine the separation fraction of the dependent account. Exhibit 6.3 shows an example of this method for separating Cable and Wire Facilities (C&WF) Expense.

**EXHIBIT 6.3**

**INDIRECT SEPARATION OF AVERAGE SCHEDULE ACCOUNTS**
**ILLUSTRATIVE EXAMPLE: SEPARATION OF C&WF EXPENSE**

| | | | |
|---|---|---|---|
| A. | Average Schedule C&WF Expense Account Balance | | $100,000 |
| B. | C&WF Investment Separations Fraction<br>(Composite of all C&WF investment results for this study area) | | 0.282940 |
| C. | C&WF Expense Separations Fraction<br>(Line B) | 0.282940 | |
| D. | Interstate C&WF Expense (Line A x Line C) | | $28,294 |

Exhibit 6.4 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, which were explained in Section II.H. Individual study area accounts separated by these methods were next allocated to access categories as described in Section VI.C.

## EXHIBIT 6.4
## WEIGHTED CATEGORIZATION AND INTERSTATE SEPARATIONS RESULT

| Account | Weighted Total Cost | Average Interstate Proportion | Weighted Separated Cost |
|---|---|---|---|
| Telecommunications Plant In Service | $6,457,369,301 | 33.1318% | $2,139,445,111 |
| General Support Facilities | $924,464,197 | 33.2691% | $307,561,344 |
| Central Office Equipment | $2,421,915,554 | 39.3516% | $953,062,887 |
| - - COE Cat 1 | | 0.0055% | $134,327 |
| - - COE Cat 2 | | 0.8027% | $19,441,801 |
| - - COE Cat 3 | | 22.3927% | $542,333,211 |
| - - COE Cat 4.11 + 4.12 | | 1.6021% | $38,801,509 |
| - - COE Cat 4.13 | | 8.1001% | $196,177,582 |
| - - COE Cat 4.2 | | 5.2462% | $127,058,307 |
| - - COE Cat 4.3 | | 1.2022% | $29,116,150 |
| Cable & Wire Facilities | $3,089,795,156 | 28.2940% | $874,227,110 |
| - - C&WF Cat 1.1 | | 0.0000% | $0 |
| - - C&WF Cat 1.2 | | 0.7170% | $22,154,186 |
| - - C&WF Cat 1.3 | | 21.8176% | $674,117,851 |
| - - C&WF Cat 2 | | 1.4863% | $45,924,344 |
| - - C&WF Cat 3 | | 3.2667% | $100,932,830 |
| - - C&WF Cat 4 | | 1.0065% | $31,097,899 |
| Tangibles | $6,582,004 | 33.1258% | $2,180,343 |
| Intangibles | $14,612,390 | 16.5163% | $2,413,426 |
| Materials And Supplies | $71,426,740 | 28.5031% | $20,358,843 |
| Rural Telephone Bank Stock | $16,461,759 | 34.7743% | $5,724,467 |
| Other Telecommunications Plant | $241,880,327 | 33.2486% | $80,421,862 |
| Other Non-Current Assets | $5,970,620 | 31.6008% | $1,886,766 |
| Cash Working Capital | $39,304,983 | 33.0220% | $12,979,296 |
| Accumulated Depreciation | $3,760,115,503 | 33.8029% | $1,271,029,467 |
| Accumulated Amortization | $23,056,822 | 37.1759% | $8,571,587 |
| Net Deferred Operating FIT | $177,300,091 | 33.6841% | $59,721,940 |
| Network Support Expense | $6,234,475 | 33.3762% | $2,080,829 |
| General Support Expense | $64,182,040 | 33.1701% | $21,289,230 |
| COE Expense | $87,472,770 | 40.4768% | $35,406,161 |
| C&WF Expense | $123,434,089 | 28.2965% | $34,927,553 |
| Other Property & Plant Expense | $2,293,357 | 33.7138% | $773,178 |
| Network Operations Expense | $82,811,180 | 32.9956% | $27,324,011 |
| Depreciation & Amortization Expense | $425,229,124 | 35.6819% | $151,729,640 |
| Marketing Expense | $22,289,586 | 30.7848% | $6,861,812 |
| Services Expense | $167,351,231 | 29.9071% | $50,049,960 |
| Executive & Planning Expense | $84,660,276 | 32.3796% | $27,412,696 |
| General & Administration Expense | $174,395,674 | 35.6326% | $62,141,674 |
| Charitable Contributions | $1,529,612 | 33.1761% | $507,465 |
| Interest & Related Items | $63,693,596 | 33.5939% | $21,397,156 |
| Patronage Dividends | $95,012,300 | 33.7675% | $32,083,302 |
| Interest On Customer Deposits | $422,452 | 33.8514% | $143,006 |
| Other Long Term Liabilities | $76,795,891 | 31.3765% | $24,095,873 |
| Federal Income Taxes | $67,665,586 | 31.1975% | $21,109,960 |
| Investment Tax Credits | $1,009,179 | 33.1235% | $334,275 |
| Other Operating Taxes | $69,518,471 | 34.3587% | $23,885,661 |
| Allowance For Funds Used During Construction | $5,120,714 | 25.2703% | $1,294,018 |
| Expenses & Other Taxes | $1,311,824,336 | 33.8866% | $444,532,876 |
| Average Net Investment | $2,795,145,423 | 32.1056% | $897,397,476 |
| Revenue Requirement | $1,688,823,068 | 33.4734% | $565,306,034 |

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 4.5, 4.6 and 4.7
- Study area demand variables forecasted to the test period
- Direct and indirect allocation methods, as per Part 69 of the Commission's rules.

Access category allocations for each account or category were then completed using one of the three methods described below.

- Method 1 - Selected categories of investment were directly assigned to access categories. These assignments are summarized in Exhibit 6.5.

**EXHIBIT 6.5**
**INTERSTATE INVESTMENT DIRECTLY ASSIGNED TO ACCESS CATEGORIES**

| Investment Category | Access Category |
|---|---|
| COE Category 3 | Central Office |
| COE Category 4.3 | Transport |
| C&WF Category 1.2 | Special Access |
| C&WF Category 1.3 | Common Line |

- Method 2 - 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, COE Category 1, COE Category 2, combined 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 4.5, 4.6 and 4.7.

- Method 3 - Proportionate assignments of some accounts were made depending on the assignment of other accounts, as displayed in Exhibit 6.6.

**EXHIBIT 6.6**

**PROPORTIONATE ALLOCATION OF ACCOUNTS TO ACCESS CATEGORIES**

| Account | Allocation Basis |
|---|---|
| General Support Facilities | Combined COE and C&WF Investment[3] |
| Tangibles | Combined COE and C&WF Investment |
| Intangibles | Combined COE and C&WF Investment |
| Materials and Supplies | Telecommunications Plant in Service |
| Rural Telephone Bank Stock | 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 | Big Three Expenses |
| General Support Expense | General Support Facilities |
| Combined 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 |
| Patronage Dividends | Average Net Investment |
| Interest on Customer Deposits | Net Telecommunications Plant |
| Other Long Term Liabilities | Big Three Expenses |
| Federal Investment Tax Credit | Telecommunications Plant in Service |
| Other Operating Taxes[4] | General Support Facilities |
| Allow. for Funds Used During Construction | Telecommunications Plant in Service |

The access allocation results are displayed in Exhibit 6.7. Average allocation percentages

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

[4] Includes Operating Other Taxes + Operating State and Local Income Taxes.

corresponding to these results appear in Exhibit 6.8.

D. Allocation of Transport Costs to Subcategories

In order to develop more accurate settlement formulas for the three transport elements (Line Haul Distance Sensitive, Line Haul Non-Distance Sensitive and Intertoll Dial Switching), a further allocation of transport costs was performed. The transport portions of account data were allocated to these elements using two methods:

1. Selected separated categories of transport COE and C&WF were directly assigned to transport elements. These assignments are displayed in Exhibit 6.9.

2. All other accounts were allocated to transport elements in proportion to accounts or groups of accounts designated by Part 69 rules. These allocation methods are displayed in Exhibit 6.10.

**EXHIBIT 6.7**

**WEIGHTED ACCESS CATEGORY ALLOCATION RESULTS**

| Account | Interstate | Common Line | Central Office | Transport | Special Access |
|---|---|---|---|---|---|
| Telecommunications Plant In Service | $2,113,691,358 | $975,796,354 | $617,242,443 | $296,656,519 | $223,933,919 |
| General Support Facilities | $306,907,715 | $140,423,968 | $91,856,119 | $42,830,346 | $31,790,944 |
| Central Office Equipment | $933,072,993 | $180,793,334 | $523,774,400 | $140,544,313 | $87,905,713 |
| - - COE Cat 1 | $155,736 | $0 | $103,079 | $0 | $0 |
| - - COE Cat 2 | $19,959,585 | $0 | $0 | $19,957,011 | $0 |
| - - COE Cat 3 | $523,671,321 | $0 | $523,671,321 | $0 | $0 |
| - - COE Cat 4.11 + 4.12 | $37,485,855 | $0 | $0 | $2,748,043 | $34,737,811 |
| - - COE Cat 4.13 | $189,525,729 | $180,793,334 | $0 | $0 | $8,732,395 |
| - - COE Cat 4.2 | $132,645,285 | $0 | $0 | $88,209,778 | $44,435,507 |
| - - COE Cat 4.3 | $29,629,482 | $0 | $0 | $29,629,482 | $0 |
| Cable & Wire Facilities | $869,020,519 | $652,613,435 | $0 | $112,627,829 | $103,779,256 |
| - - C&WF Cat 1.1 | $0 | $0 | $0 | $0 | $0 |
| - - C&WF Cat 1.2 | $23,541,767 | $0 | $0 | $0 | $23,541,767 |
| - - C&WF Cat 1.3 | $652,613,435 | $652,613,435 | $0 | $0 | $0 |
| - - C&WF Cat 2 | $48,415,283 | $0 | $0 | $4,716,370 | $43,698,913 |
| - - C&WF Cat 3 | $112,766,824 | $0 | $0 | $76,228,248 | $36,538,576 |
| - - C&WF Cat 4 | $31,683,211 | $0 | $0 | $31,683,211 | $0 |
| Tangibles | $2,279,766 | $997,718 | $719,850 | $381,743 | $180,450 |
| Intangibles | $2,410,363 | $967,899 | $892,074 | $272,287 | $277,556 |
| Materials And Supplies | $21,999,837 | $9,978,840 | $6,158,286 | $3,214,029 | $2,648,411 |
| Rural Telephone Bank Stock | $5,620,335 | $2,532,065 | $1,798,048 | $757,308 | $532,908 |
| Other Telecommunications Plant | $71,483,597 | $32,010,678 | $21,516,394 | $10,065,276 | $7,890,968 |
| Other Non-Current Assets | $1,614,486 | $563,047 | $436,399 | $246,253 | $110,688 |
| Cash Working Capital | $12,726,201 | $5,070,342 | $3,509,591 | $1,688,443 | $1,183,927 |
| Accumulated Depreciation | $1,266,736,974 | $571,331,913 | $386,036,001 | $173,106,885 | $133,411,980 |
| Accumulated Amortization | $8,660,075 | $3,432,317 | $2,791,698 | $1,052,655 | $1,385,802 |
| Net Deferred Operating FIT | $55,948,127 | $26,255,729 | $18,095,974 | $3,834,466 | $5,383,646 |
| Network Support Expense | $2,025,612 | $933,944 | $579,052 | $295,122 | $217,487 |
| General Support Expense | $20,921,422 | $9,502,357 | $6,232,379 | $2,971,703 | $2,214,328 |
| COE Expense | $34,038,055 | $6,400,794 | $19,695,598 | $4,925,453 | $3,014,432 |
| C&WF Expense | $34,277,891 | $25,207,605 | $0 | $5,171,963 | $3,821,878 |
| Other Property & Plant Expense | $719,315 | $309,596 | $206,059 | $122,628 | $81,030 |
| Network Operations Expense | $27,936,114 | $12,819,900 | $7,932,744 | $3,978,217 | $3,204,324 |
| Depreciation & Amortization Expense | $150,349,781 | $57,982,816 | $55,761,409 | $20,275,960 | $15,949,965 |
| Marketing Expense | $6,769,512 | $3,024,114 | $1,992,254 | $960,995 | $791,921 |
| Services Expense | $47,993,036 | $10,438,293 | $11,126,849 | $4,435,364 | $2,925,134 |
| Executive & Planning Expense | $27,185,420 | $9,798,336 | $7,763,050 | $3,561,644 | $2,245,494 |
| General & Administration Expense | $62,263,689 | $24,368,103 | $16,579,631 | $8,266,643 | $5,485,771 |
| Charitable Contributions | $470,252 | $177,749 | $127,933 | $60,691 | $42,529 |
| Interest & Related Items | $20,570,562 | $9,244,924 | $6,130,491 | $3,000,514 | $2,194,460 |
| Patronage Dividends | $30,769,120 | $13,618,590 | $8,504,638 | $4,958,904 | $3,786,594 |
| Interest On Customer Deposits | $137,480 | $63,769 | $38,189 | $21,413 | $15,058 |
| Other Long Term Liabilities | $22,792,374 | $8,797,696 | $5,974,154 | $3,027,411 | $2,252,187 |
| Federal Income Taxes | $23,335,123 | $11,427,202 | $6,163,932 | $3,468,474 | $2,530,933 |
| Investment Tax Credits | $325,427 | $151,295 | $94,504 | $45,567 | $34,053 |
| Other Operating Taxes | $23,098,277 | $10,693,722 | $6,755,441 | $3,206,495 | $2,441,864 |
| Allowance For Funds Used During Construct. | $938,004 | $421,241 | $273,573 | $121,619 | $121,570 |
| Expenses & Other Taxes | $438,185,857 | $171,657,330 | $134,752,399 | $58,232,878 | $42,436,158 |
| Average Net Investment | $872,998,265 | $416,133,671 | $237,763,334 | $130,403,914 | $93,867,206 |
| Revenue Requirement | $558,795,281 | $229,478,328 | $167,391,133 | $76,250,172 | $55,405,582 |

**EXHIBIT 6.8**

**WEIGHTED AVERAGE ACCESS CATEGORY ALLOCATION FACTORS**

| Account | Common Line | Central Office | Transport | Special Access |
|---|---|---|---|---|
| Telecommunications Plant In Service | 46.1655% | 29.2021% | 14.0350% | 10.5944% |
| General Support Facilities | 45.7545% | 29.9296% | 13.9554% | 10.3585% |
| Central Office Equipment | 19.3761% | 56.1343% | 15.0625% | 9.4211% |
| - - COE Cat 1 | 0.0000% | 66.1881% | 0.0000% | 0.0000% |
| - - COE Cat 2 | 0.0000% | 0.0000% | 99.9871% | 0.0000% |
| - - COE Cat 3 | 0.0000% | 100.0000% | 0.0000% | 0.0000% |
| - - COE Cat 4.11 + 4.12 | 0.0000% | 0.0000% | 7.3309% | 92.6691% |
| - - COE Cat 4.13 | 95.3925% | 0.0000% | 0.0000% | 4.6075% |
| - - COE Cat 4.2 | 0.0000% | 0.0000% | 66.5005% | 33.4995% |
| - - COE Cat 4.3 | 0.0000% | 0.0000% | 100.0000% | 0.0000% |
| Cable & Wire Facilities | 75.0976% | 0.0000% | 12.9603% | 11.9421% |
| - - C&WF Cat 1.1 | 0.0000% | 0.0000% | 0.0000% | 0.0000% |
| - - C&WF Cat 1.2 | 0.0000% | 0.0000% | 0.0000% | 100.0000% |
| - - C&WF Cat 1.3 | 100.0000% | 0.0000% | 0.0000% | 0.0000% |
| - - C&WF Cat 2 | 0.0000% | 0.0000% | 9.7415% | 90.2585% |
| - - C&WF Cat 3 | 0.0000% | 0.0000% | 67.5981% | 32.4019% |
| - - C&WF Cat 4 | 0.0000% | 0.0000% | 100.0000% | 0.0000% |
| Tangibles | 43.7641% | 31.5756% | 16.7448% | 7.9153% |
| Intangibles | 40.1557% | 37.0100% | 11.2965% | 11.5151% |
| Materials And Supplies | 45.3587% | 27.9924% | 14.6093% | 12.0383% |
| Rural Telephone Bank Stock | 45.0518% | 31.9918% | 13.4744% | 9.4818% |
| Other Telecommunications Plant | 44.7805% | 30.0998% | 14.0805% | 11.0389% |
| Other Non-Current Assets | 34.8747% | 27.0302% | 15.2527% | 6.8559% |
| Cash Working Capital | 39.8418% | 27.5777% | 13.2675% | 9.3031% |
| Accumulated Depreciation | 45.1026% | 30.4748% | 13.6656% | 10.5319% |
| Accumulated Amortization | 39.6338% | 32.2364% | 12.1553% | 16.0022% |
| Net Deferred Operating FIT | 46.9287% | 32.3442% | 6.8536% | 9.6226% |
| Network Support Expense | 46.1068% | 28.5865% | 14.5695% | 10.7369% |
| General Support Expense | 45.4193% | 29.7895% | 14.2041% | 10.5840% |
| COE Expense | 18.8048% | 57.8635% | 14.4704% | 8.8561% |
| C&WF Expense | 73.5390% | 0.0000% | 15.0883% | 11.1497% |
| Other Property & Plant Expense | 43.0404% | 28.6466% | 17.0479% | 11.2649% |
| Network Operations Expense | 45.8901% | 28.3960% | 14.2404% | 11.4702% |
| Depreciation & Amortization Expense | 38.5653% | 37.0878% | 13.4859% | 10.6086% |
| Marketing Expense | 44.6725% | 29.4298% | 14.1959% | 11.6983% |
| Services Expense | 21.7496% | 23.1843% | 9.2417% | 6.0949% |
| Executive & Planning Expense | 36.0426% | 28.5559% | 13.1013% | 8.2599% |
| General & Administration Expense | 39.1369% | 26.6281% | 13.2768% | 8.8105% |
| Charitable Contributions | 37.7987% | 27.2051% | 12.9060% | 9.0440% |
| Interest & Related Items | 44.9425% | 29.8023% | 14.5864% | 10.6680% |
| Patronage Dividends | 44.2606% | 27.6402% | 16.1165% | 12.3065% |
| Interest On Customer Deposits | 46.3840% | 27.7780% | 15.5756% | 10.9532% |
| Other Long Term Liabilities | 38.5993% | 26.2112% | 13.2826% | 9.8813% |
| Federal Income Taxes | 48.9700% | 26.4148% | 14.8637% | 10.8460% |
| Investment Tax Credits | 46.4913% | 29.0401% | 14.0022% | 10.4641% |
| Other Operating Taxes | 46.2966% | 29.2465% | 13.8820% | 10.5716% |
| Allowance For Funds Used During Construction | 44.9083% | 29.1654% | 12.9658% | 12.9605% |
| Expenses & Other Taxes | 39.1745% | 30.7523% | 13.2895% | 9.6845% |
| Average Net Investment | 47.6672% | 27.2353% | 14.9375% | 10.7523% |
| Revenue Requirement | 41.0666% | 29.9557% | 13.6455% | 9.9152% |

**EXHIBIT 6.9**

**DIRECT ASSIGNMENT OF COE AND C&WF TO TRANSPORT ELEMENTS**

| Category | Transport Element |
|---|---|
| COE Category 2 | Intertoll Switching |
| COE Category 4.11 & 4.12 | Line Haul Non-Distance Sensitive |
| COE Category 4.2 | Line Haul Non-Distance Sensitive |
| COE Category 4.3 | Line Haul Non-Distance Sensitive |
| C&WF Category 2 | Line Haul Distance Sensitive |
| C&WF Category 3 | Line Haul Distance Sensitive |
| C&WF Category 4 | Line Haul Distance Sensitive |

E. Calculation of Cash Working Capital

Total company, interstate, access category and Transport element amounts of Cash Working Capital were calculated according to the simplified formula prescribed in a Commission Order.[5] This formula is displayed below. Amounts calculated by these methods are displayed in Exhibits 6.4 and 6.7.

*Cash Working Capital = 0.041096 x Total Amount for Allowances*

*Where, Total Amount for Allowances*

*= Total Operating Expenses + Operating Taxes + Interest & Related Items*
*+ Charitable Contributions + Interest on Customer Deposits*
*+ Allowance for Funds Used During Construction*
*- Depreciation & Amortization Expense*

[5] *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).

**EXHIBIT 6.10**

**INDIRECT ALLOCATION OF ACCOUNTS TO TRANSPORT ELEMENTS**

| Account | Indirect Allocation Basis |
|---|---|
| General Support Facilities | COE + C&WF |
| Tangibles | COE + C&WF |
| Intangibles | COE + C&WF |
| Materials and Supplies | COE + C&WF |
| Rural Telephone Bank Stock | COE + C&WF |
| Other Telecommunications Plant | COE + C&WF |
| Other Non-Current Assets | COE + C&WF |
| Cash Working Capital | COE + C&WF |
| Accumulated Depreciation | COE + C&WF |
| Accumulated Amortization | COE + C&WF |
| Net Deferred Income Taxes | COE + C&WF |
| Network Support Expense | COE + C&WF |
| General Support Expense | COE + C&WF |
| Central Office Equipment Expense | COE |
| Cable & Wire Facilities Expense | C&WF |
| Other Property Plant & Equipment Expense | COE + C&WF |
| Network Operations Expense | COE + C&WF |
| Depreciation & Amortization Expense | COE + C&WF |
| Marketing Expense | COE + C&WF |
| Service Expense | COE + C&WF |
| Executive & Planning Expense | Big Three Expenses |
| General & Administrative Expense | Big Three Expenses |
| Contributions | Big Three Expenses |
| Interest & Related Items | COE + C&WF |
| Patronage Dividends | Average Net Investment |
| Interest on Customer Deposits | COE + C&WF |
| Other Long Term Liabilities | COE + C&WF |
| Federal Income Tax | COE + C&WF |
| Federal Investment Tax Credits | Total Plant in Service |
| Other Operating Taxes | COE + C&WF |
| Allowance For Funds Used During Construction | Total Plant in Service |

F. Calculation of Interstate Access Category Revenue Requirements

Revenue requirements were computed for each access category and Transport element for sample study areas in accordance with the Commission's Part 65 rules. To ensure that data from a consistent set of sample average schedule study areas underlie test period settlement formula development and to maintain compatibility between test period cost and demand data forecasts, certain sample study areas were excluded from this analysis. The study areas excluded were involved in merger activity, had acquired access lines or exchanges from a cost company, or had elected to withdraw from NECA's traffic sensitive pool. Revenue requirements were calculated for each access category and for the Transport subcategories using the following formulas:

*Total Investment = Central Office Equipment + Cable and Wire Facilities*
*+ General Support Facilities + Other Telecommunication Plant + Tangibles*
*+ Intangibles + Materials and Supplies + Rural Telephone Bank Stock*

*Average Net Investment = Total Investment + Other Non-Current Assets*
*+ Cash Working Capital - Accumulated Depreciation & Amortization*
*- Net Deferred Income Taxes – Other Long Term Liabilities*

*Return = Average Net Investment x 0.1125*

*FIT Taxable Income = Return - Interest and Related Items*
*- Federal Investment Tax Credit - Patronage Dividends*
*+ Allowance For Funds Used During Construction - State Income Tax*

*Net Federal Income Tax*[6] *= [FIT Taxable Income x 0.329039 / (1 - 0.329039* [7]*)]*
*- Federal Investment Tax Credit*
*Total Expenses and Other Taxes = Network Support Expense*

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6 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.

7 Federal Income Tax is calculated using the average Effective Tax Rate developed using sample cost study data, as described in Section IV.G.

*+ Central Office Equipment Expense + Cable & Wire Facilities Expense*
*+ General Support Facilities Expense + Other Property Plant & Equipment Expense*
*+ Network Operations Expense + Depreciation & Amortization Expense*
*+ Marketing Expense + Services Expense + Executive & Planning Expense*
*+ General & Administrative Expense + Charitable Contributions*
*+ Other Operating Taxes + Interest on Customer Deposits*

*Revenue Requirement = Total Expenses and Other Taxes + Return*
*+ Federal Income Tax - Allowance for Funds Used During Construction*

*Monthly Revenue Requirement = Revenue Requirement / 12*

Next, the following adjustments, described in Sections VI.G through VI.I were made to the revenue requirements:

- Carrier Access Billing System (CABS) Adjustment
- Signaling System 7 (SS7) Adjustment
- Leased Transport Facilities Adjustment

G. Carrier Access Billing System (CABS) Adjustment

NECA uses a special study of cost company data to add CABS costs to the Central Office Settlement formula, as described in Section VII.E.1. Consequently, to avoid double recovery of these costs, NECA removed CABS costs, already present in the average schedule revenue requirements.

The CABS costs, used in this study, were determined from the CABS formula filed in 1998[8] (used for settlements in the first half of 2000) and the CABS formula developed in 1999[9] (used for settlements in the second half of 2000). The 2003 Study CABS costs were the average monthly payments calculated pursuant to these formulas, using test period access minutes, defined in Section V.C, and exchange counts, defined in Section III.E. The CABS Adjustment Factor was then computed as follows:

*CABS Adjustment Factor*

$$= 1 - \frac{S(\text{Sample Weight x 2001 Monthly CABS Costs})}{S(\text{Sample Weight x Total Monthly TS Revenue Requirements})}$$

$$= 1 - 0.075774$$

$$= 0.924226$$

Where the summations are over all average schedule study areas.

The Central Office, Transport and Special Access revenue requirements were adjusted by this fraction to produce the final revenue requirements used to derive the formulas described in Section VII.

## H. Signaling System 7 (SS7) Adjustment

NECA uses a special study of SS7 costs to determine a separate settlement formula for SS7. Therefore, NECA removed SS7 costs from Traffic Sensitive revenue requirements to avoid double recovery. Using 2001 settlement data, corresponding to 2001 accounts which are the basis of this study, NECA calculated the test period Traffic Sensitive revenue requirement adjustment ratio as:

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8 National Exchange Carrier Association, Inc., 1999 Proposed Modifications to the Interstate Average Schedule Formulas, Dec. 31, 1998 (December 1998 Filing).

$$\text{SS7 Adjustment Factor} = 1 - \frac{S(\text{SS7 Settlements})}{S(\text{TS Settlements})}$$

$$= 1 - 0.032473$$

$$= 0.967527$$

Where the summations are over all average schedule study areas over all months of 2000. All Traffic Sensitive test period revenue requirement values for each average schedule sample study area were multiplied by this ratio to remove SS7 costs.

## I. Leased Transport Facilities Adjustment

In accordance with FCC rules, leased C&WF costs associated with line haul circuit mile equipment are accounted for in the C&WF expense account, which in Part 69 is apportioned among the Common Line, Transport and Special Access categories. NECA's average schedule methods, however, calculate settlements for leased circuit miles using the Distance Sensitive Line Haul Formula. To correctly align the leased circuit miles with the lease expense costs in settlement formulas, NECA assigned all line haul C&WF lease expense to the distance sensitive Transport revenue requirement.

Using preliminary allocations of C&WF expense to the access elements, NECA first estimated the total long route revenue requirement and the amount in each access category. NECA then moved the proportionate amount of C&WF expense associated with long routes from the Common Line and Special Access categories to the transport element. This adjustment, which was applied only to study areas with long route circuit miles, resulted in a $21,554 shift of CWF expense from Common Line and Special Access to transport.

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[9] Ibid.

## J. Central Office Revenue Requirements for High Traffic Volume Study Areas

To support analyses of settlement rates for high traffic volumes, NECA separately calculated central office revenue requirements for high traffic volume study areas. These calculations were completed using the high traffic volume accounting and demand, described in Section III.F. These costs and demand were separated using methods described in Section VI.B and VI.C. Revenue requirement values developed in this section were used to support development of settlement formulas, including coefficients for high traffic volumes, as described in Section VII.

# VII. SETTLEMENT FORMULA DEVELOPMENT

## A. Introduction

This section describes 2003 Study development methods for the following average schedule settlement formulas:

- Common Line Access Line
- Universal Service Support Contribution Reimbursement
- Central Office
- Intertoll Dial Switching
- Line Haul Distance Sensitive
- Line Haul Non-Distance Sensitive
- Special Access
- Signaling System 7 (SS7)
- Rate of Return Factors
- Equal Access Implementation

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

Each year NECA analyzes 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

For each formula that uses sample data from average schedule study areas, outlier analysis was performed. Most settlement formulas are developed either by linear regression or ratio estimates, which use outlier accommodation methods described in Section IV.C. The Common Line Access Line and Non-Distance Sensitive formulas are non-linear models which require an additional step to develop the DFFITS statistic required by the outlier accommodation method.

## C. Common Line Access Line Formula

Common Line formulas include the Common Line Access Line formula (described here in Section VII.C), the Common Line Universal Service Contribution formula (Section VII.D), the Common Line Line Port and Common Line Transport formulas (Section VII.M), and the Common Line Rate of Return Factor formula (Section VII.K).

The Common Line Access 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 to access lines per exchange. Access lines used in the development of this formula were projected to the test period as described in Section V. Derivation of the Common Line revenue requirement is explained in Section VI.F.

The Common Line Access Line settlement formula was developed using the same line and curve structure underlying the current formula. This formula recognizes relationships between relative cost and lines per exchange for all companies. The formula has four parts: a sloping line for small study

areas with relatively low average access lines per exchange; a downward sloping curve for midrange values of access lines per exchange between 556 and 10,000 lines per exchange; a transitional sloping line connecting the midrange curve to the curve for larger study areas with lines per exchange between 10,000 and 15,000; and another downward sloping curve for lines per exchange greater than or equal to 15,000.

The Common Line Access Line formula relates common line cost per line (CPL) to the study area's access lines per exchange (LPE). This model has the following parameters:

- Three lines per exchange breakpoints which are the small company lines per exchange limit ($K_1$), the midrange lines per exchange limit ($K_2$), and the large company lines per exchange limit ($K_3$). The latter two limits were determined by graphical analysis to be 10,000 and 15,000 respectively. The small company limit was resolved by regression methods.

- A slope ($b_1$) and intercept ($a_1$) of the small company line, both of which are solved by regression methods.

- A slope ($b_2$) and intercept ($a_2$) of the midrange curve, of which the slope is resolved by regression methods, while the intercept is resolved by a constraint that requires that the small company line meet the midrange curve at $K_1$.

- A High Lines per Exchange Multiplier (M) for the large company curve, which is resolved by regression methods.

- The intercept and slope of the transitional line, both of which are resolved by constraints that the transitional line meet the midrange and large company curves at $K_2$ and $K_3$ respectively.

First, NECA analyzed graphically the Common Line Access Line revenue requirements of study areas with higher lines per exchange. Study areas with lines per exchange below 10,000 had relatively higher revenue requirements per line. Study areas with lines per exchange greater than 15,000 had relatively lower revenue requirements per line. There was no conclusive trend of revenue requirement per line for study areas between 10,000 and 15,000 lines per exchange. Therefore, NECA continues the use of 10,000 and 15,000 lines per exchange as the limits $K_2$ and $K_3$ respectively.

Second, a regression solution was developed to determine the value of $K_1$. This model was structured as one sloping line meeting a downward sloping curve at a small company breakpoint. The best-fitting small company breakpoint derived by this method was 556 lines per exchange.

The large company curve is proportionately reduced from the midrange curve using the High Lines Per Exchange Multiplier M. This multiplier accounts for the lower cost per line of the large lines per exchange study areas, producing a better model fit.

The best-fitting combination of parameters $a_1$, $b_1$, $b_2$, and M were solved using a weighted non-linear regression program, derived as follows:

For companies with LPE < 556,

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

For companies with 556 <= LPE < 10,000,

$$CPL_i = a_2 + b_2 / LPE_i$$

For companies with 10,000 <= LPE < 15,000,

$$CPL_i = P_i \times (a_2 + b_2 / 10{,}000) + (1 - P_i) \times M \times (a_2 + b_2 / 15{,}000)$$

$$P_i = \frac{15{,}000 - LPE_i}{15{,}000 - 10{,}000}$$

For companies with 15,000 <= LPE,

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

The following indicator variables are needed to program this model.

$d_{1i} = 1$ *if* $LPE_i < 556$; *otherwise* $d_{1i} = 0$.
$d_{2i} = 1$ *if* $556 <= LPE_i < 10{,}000$; *otherwise* $d_{2i} = 0$.
$d_{3i} = 1$ *if* $10{,}000 <= LPE_i < 15{,}000$; *otherwise* $d_{3i} = 0$.
$d_{4i} = 1$ *if* $15{,}000 <= LPE_i$ ; *otherwise* $d_{4i} = 0$.

Then the model is written as:

$$CPL_i = d_{1i} (a_1 + b_1 \times LPE_i) + d_{2i} (a_2 + b_2 / LPE_i) + d_{4i} \times M \times (a_2 + b_2 / LPE_i)$$
$$+ P_i \times d_{3i} \times (a_2 + b_2 / 10{,}000) + (1 - P_i) \times d_{3i} \times M \times (a_2 + b_2 / 15{,}000)$$

This model has the linear constraint that:

$$a_1 + b_1 \times 556 = a_2 + b_2 / 556$$

Consequently,

$$a_2 = a_1 + (b_1 \times 556) - (b_2 / 556)$$

Therefore, regression model parameters are reduced to $a_1$, $b_1$, $b_2$, and M.

Collecting model terms as factors of parameters yields the following model expression:

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

where,

$$A1_i = d_{1i} + d_{2i} + d_{3i} \times P_i$$
$$A2_i = d_{3i} \times (1 - P_i) + d_{4i}$$

$$B1_i = d_{1i} \times LPE_i + 556 \times (d_2 + d_{3i} \times P_i)$$
$$B2_i = 556 \times [d_{3i} \times (1 - P_i) + d_{4i}]$$

$$C1_i = (-\frac{1}{556}) \times (d_{2i} + d_{3i} \times P_i) + \frac{d_{2i}}{LPE_i} + \frac{P_i \times d_{3i}}{10{,}000}$$

$$C2_i = (-\frac{1}{556}) \times [d_{3i} \times (1 - P_i) + d_{4i}] + \frac{d_{3i} \times (1 - P_i)}{15{,}000} + \frac{d_{4i}}{LPE_i}$$

Using the variables $CPL_i$, $A1_i$, $A2_i$, $B1_i$, $B2_i$, $C1_i$, and $C2_i$, the program NLIN (NonLINear regression)[1] solves for parameters $a_1$, $b_1$, $b_2$, and M that best fit the data.

The resulting line and curve model produces a stable, continuous settlement formula and had an *R-Square* statistic of 0.25, a *t-statistic* of 16.00 for $a_1$, a *t-statistic* of 3.42 for $b_1$, a *t-statistic* of 2.74 for $b_2$, and a *t-statistic* of 5.42 for M. The proposed formula is shown in Section VIII.

[1] SAS Institute Inc., *SAS/STAT® User's Guide, Version 6*, 1,135 (4th ed. SAS Institute Inc., 1990).

D. 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. Under section 54.706 of the Commission's rules, all communications companies, including average schedule companies, are required to contribute to the universal service funds.[2]

The Universal Service Order[3] directs carriers to assign all contributions to federal universal service programs to the interstate jurisdiction, and prescribes that the appropriate contribution costs (based on revenues from regulated services) borne by ECs not subject to federal price caps be assigned to their common line revenue requirement. Accordingly, cost companies will assign these costs to the interstate jurisdiction in their cost separations studies, and will recover these costs from end user charges.[4]

In the December 1997 Filing,[5] NECA proposed that the same principles apply to average schedule companies and filed a common line universal service contribution settlement formula 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

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2 Under section 54.708 of the Commission's rules, there is an exemption for companies whose contribution would be *de minimus*.

3 Federal-State Joint Board on Universal Service, CC Docket No. 96-45, *Report and Order*, 12 FCC Rcd 8776 (1997).

4 MAG Order at ¶ 177.

5 National Exchange Carrier Association, Inc. Proposed Modifications to the 1998-99 Interstate Average Schedule Formulas, AAD 98-20, *Order*, 13 FCC Rcd 17351 (1998).

rules. The Commission approved this method in a 1998 order,[6] and in each subsequent year.

The rules regarding Universal Service Contributions have changed from year to year. Consequently, NECA does not have a history consistent with next year's contributions from which to develop an accurate formula based on demand or revenue variables. Therefore, NECA proposes to continue the current structure, which compensates for actual universal service contributions made by carriers.

E. Central Office (CO) Formula

The Central Office (CO) formula is designed to compensate average schedule companies for the local switching costs of interstate access calls, and for the cost of interstate carrier access billing systems (CABS). The cost of providing these functions has been found to depend on total switched interstate access minutes, access lines, number of exchanges served, and relative access minutes per access line.

The proposed structure is identical to that of the current CO formula and includes a basic settlement per minute and per exchange, an access line factor, and a settlement per study area for the component of CABS billing cost which is independent of the count of exchanges and access minutes. The basic formula consists of an exchange component, three per minute components corresponding to three tiers of minutes per line, and a high volume access line multiplier. The multiplier produces a better relationship between access line size and the cost of serving study areas with high volumes of minutes per line.

In previous studies, NECA analyzed detailed engineering data to determine switching equipment requirements to serve high traffic volumes. The proposed formula structure continues to reflect the findings of these analyses.

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[6] *June 1998 Order.*

The CO formula has the following parameters:

- A coefficient of the exchange variable (b) and of the normal volume minute variable ($a_1$)

- A breakpoint in the access line factor model (K) where the sloping line for companies with smaller access line counts meets the horizontal line for study areas with larger access line counts. This breakpoint was chosen to be 10,000, which is the upper limit of the group that has the largest DEM weight according to Commission rules.[7]

- The intercept of the large company access line factor line (w), which, by design, is equal to 1.0

- Slope (v) and intercept (u) of the small company access line factor (ALF) component. The slope is resolved by regression, while the intercept is determined by the constraint that the small company ALF line and the large company ALF line meet at K. Thus, $u = 1 - 10{,}000v$.

- The high volume access line multiplier (M) which was resolved iteratively, as the one which fit the high volume data best
- Coefficients of high volume minutes ($a_2$ and $a_3$) which were resolved by ratio calculations.

- Coefficient (d) of exchange counts, (e) of normal volume access minutes, and an intercept (c) of the CABS cost model. These coefficients were determined using cost company data.

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[7] 47 C.F.R. § 36.125(f).

1. Formula Based on Carrier Access Billing System (CABS) Costs in Cost Studies

Each average schedule company incurs monthly costs to render access bills to interexchange carriers. The Carrier Access Billing System (CABS) cost components of the CO settlement formula are designed to compensate average schedule companies for the interstate portion of these costs. Development of the CABS formula consisted of calculating cost study CABS revenue requirements, followed by regression modeling. This analysis used sample cost company exchange counts and 2001 cost studies.

Average schedule companies do not separately account for CABS costs. Rather, according to Class B accounting practices, these costs are included with many other costs in Account 6620, Services Expenses. Consequently, a focused analysis of CABS costs incurred by average schedule companies would not be practical.

On the other hand, according to separations methods prescribed in section 36.381 of the Commission's rules, CABS cost data were reported explicitly in cost studies. These data provided a suitable basis for analysis of average schedule CABS costs. Factors that determine CABS costs include the number of interexchange carriers billed, the number of exchanges served, the number of separate Special Access services and service orders billed, and the complexity of meet point arrangements. NECA's review of CABS documents supplied by sample average schedule and cost companies indicated similar distributions of these factors in the two groups. Consequently, NECA concluded that CABS costs from sample cost study areas would adequately represent average schedule CABS costs.

The CABS revenue requirement was calculated in two steps. First, 2001 sample cost study

accounts were forecasted to the test period using the stratified composite account growth rates derived in Section V.B.5. These accounts are displayed in Appendix B1. Second, each sample cost study area's projected interstate CABS revenue requirement was determined using the method shown in Exhibit 7.1.

NECA developed a model using the number of exchanges and the number of normal volume switched access minutes as the independent variables. The proposed CABS formula resulting from the regression model follows. This formula provides coefficients *c*, *d*, and *e* of the CO formula.

*CABS Cost =*

*3,001.03 + (213.89 x Number of Exchanges) + (0.000776 x Number of Minutes)*

| | | | |
|---|---|---|---|
| $R^2$ = 0.14 | *t-statistic (Exchanges)* = 2.85 | | *F-statistic = 17.26* |
| | *t-statistic (Minutes)* = 3.30 | | |
| | *t-statistic (Intercept)* = 5.92 | | |

**EXHIBIT 7.1**

**ILLUSTRATIVE CALCULATION OF CABS REVENUE REQUIREMENT USING WEIGHTED SUMMED AMOUNTS FROM COST SEPARATIONS STUDIES (IN THOUSANDS)**

| | | |
|---|---|---|
| | **Services Expense Category 2 (Revenue Accounting)** | |
| A. | Unseparated CABS Expense | $34,872 |
| B. | Interstate CABS Expense | $17,552 |
| | **Interstate Indirect Costs Calculation** | |
| | Depreciation & Amortization Expense | $286,772 |
| | Tax Expense | $33,651 |
| | General & Administrative Expense | $128,591 |
| | Executive & Planning Expense | $48,493 |
| C. | Total Interstate Indirect Costs | $497,507 |
| | **Unseparated Indirect Costs Calculation** | |
| | Depreciation & Amortization Expense | $786,704 |
| | Tax Expense | $95,127 |
| | General & Administrative Expense | $343,747 |
| | Executive & Planning Expense | $144,466 |
| D. | Total Unseparated Indirect Costs | $1,370,044 |
| E. | Total Unseparated Expenses | $2,551,208 |
| F. | Unseparated Expense Less Unseparated Indirect Costs (Line E - Line D) | $1,181,164 |
| G. | CABS Indirect Costs Fraction (Line A/Line F) | 0.029523 |
| H. | Interstate CABS Indirect Costs (Line G x Line C) | $14,688 |
| I. | Total Interstate CABS Cost (Line B + Line H) | $32,240 |

2. Studies of Average Schedule Company Data

NECA also conducted the following studies of average schedule data, described in Sections VII.E.2.a through VII.E.2.d, to determine CO settlement formula coefficients. In particular, these studies support the continued use of a rate per exchange, a rate for access minutes in the normal traffic volume range, lower rates for access minutes in high traffic volume ranges, and an access line factor. CO revenue requirements of average schedule study areas, described in Sections VI.F through VI.H, were used to develop such settlement rates to fit those data most accurately.

The following methods were used to update settlement rates in the current formula structure in order to refine rates for high traffic volumes.

a. Preliminary Access Line Factor Formula

A baseline cost per minute was computed to equal the average monthly CO revenue requirement per minute among average schedule study areas having more than 10,000 access lines.

$$Baseline\,Cost\ Per\ Minute =$$

$$\frac{\sum\ (Sample\,Weight\ x\ Monthly\,Central\,Office\,Revenue\,Requirement\ x\,Variance\,Weight)}{\sum\ (Sample\,Weight\ x\ Access\ Minutes\,x\,Variance\,Weight)}$$

where the summations are taken over sample study areas with more than 10,000 access lines. This calculation produced a baseline cost per minute equal to 0.023163. This baseline cost per minute was used to determine the access line factor ratio for each

study area as described below.

For each sample study area, an access line factor ratio was computed as follows:

$$Access\ Line\ Factor\ Ratio_i = \frac{Central\ Office\ Revenue\ Requirement\ Per\ Minute_i}{Baseline\ Cost\ Per\ Minute}$$

where *i* corresponds to the *ith* sample average schedule study area.

NECA used standard constrained linear regression methods to develop a model that related the Access Line Factor Ratio to access lines. Outliers were identified and accommodated as described in Section IV.C. This Preliminary Access Line Factor Model had the following structure:

$$\begin{aligned}
&For\ Study\ Areas\ with\ Access\ Lines\ Less\ Than\ 10{,}000: \\
&\qquad Access\ Line\ Factor = 1.954907 - 0.0000954907 \times Access\ Lines \\
&For\ Study\ Areas\ with\ Access\ Lines\ Greater\ Than\ or\ Equal\ to\ 10{,}000: \\
&\qquad Access\ Line\ Factor = 1.0 \\
&R^2 = 0.58 \quad F\text{-}statistic = 233.664 \quad t - statistic\ (Access\ Lines) = -15.29
\end{aligned}$$

An adjustment to the coefficients of this model is shown later in Section VII.E.2.d, which produces coefficients *u* and *v* of the central office formula.

b. <u>Calculation of Initial Central Office Formula</u>

This year, NECA used an improved method of calculating the central office formula coefficients. Data from all sample study areas and study areas with high traffic volumes were used to calculate all coefficients. Coefficients were solved for simultaneously using constrained regression methods based on predefined band boundaries $K_1$ and $K_2$. The method was iterated to test various band boundaries.

This analysis uses central office revenue requirements and demand data. Revenue requirements for sample study areas are developed in Section IV.F. Demand data for sample study areas are described in Section III.E. Revenue requirements for high traffic volume study areas are described in Section VI.J. Compilation of demand data for high traffic study areas is described in Section III.F. High traffic volume revenue requirements and corresponding demand were used for high traffic volume study areas that were also in the sample. The constrained regression method and results are described in detail below.

Using the Preliminary Access Line Factor Model in Section VII.E.2.a, NECA calculated a Model Access Line Factor value for each sample average schedule study area. Monthly central office revenue requirement was divided by the Preliminary Access Line Factor Model value for each study area.

Each study area is assigned to a band. Study areas in Band 1 are those with normal traffic volumes only. Band 2 includes study areas with traffic volumes exceeding $K_1$, but less than $K_2$. Band 3 includes study areas with traffic volumes exceeding $K_2$.

A Basic Cost Per Minute was then calculated for each band.

$$Basic\ Cost\ per\ Minute_j = \frac{\sum Monthly\ Central\ Office\ Revenue\ Requirement\ Per\ Minute_i}{\sum Model\ Access\ Line\ Factor_i}$$

Where *i* corresponds to the *ith* study area and *j* corresponds to the *jth* band.

c. <u>Development of the Initial Central Office Formula</u>

The High Volume Access Line Multiplier helps produce settlements for high traffic volumes with equivalent accuracy between all access line size ranges. NECA's tests show that without the High Volume Access Line Multiplier, average schedule study areas with high traffic volumes and low access line counts would tend to receive settlements slightly below their modeled revenue requirements, while study areas with high traffic volumes and higher access line counts would tend to receive settlements above their revenue requirements. The High Volume Access Line Multiplier corrects this condition by causing the effective settlement rate to decrease as access lines increase. NECA continued to use the following structure for the High Volume Access Line Multiplier, as it had in prior Filings since 1995.

*If Access Minutes per line* > $K_1$ *then*

*High Volume Access Line Multiplier = M / (Access Lines)*

*Else*

*High Volume Access Line Multiplier = 1.0*

The coefficient of the High Volume Access Line Multiplier was chosen by an iterative method described in the following section.

The iterative method repeats the calculation of model parameters once for each of many possible combinations of model parameter values. The accuracy of fit of the model to the data is evaluated for each of these iterations. The set of coefficients of all parameters tested that produced the most accurate model was chosen.

NECA defined the parameters for each iteration as follows. Trial values were chosen for each of the two high volume minutes per line thresholds, and for the numerator of the High Volume Access Line Multiplier (HVALM).

For each iteration, NECA tested for consistency with the logical criteria and for the fit of the resulting CO settlement formula to the CO revenue requirements of the full set of high traffic volume study areas. NECA identified iterations that met the constraints described and fit the data most accurately.

The steps of this iterative process are detailed in Exhibit 7.2.

The following constraints on the band average cost per minute are imposed on the regression model:

$$R1 = a_1 + b * H_1$$

$$R2 = a_1 * MeanE_2 + a_2 * MeanF_2 + b * MeanH_2$$

$$R3 = a_1 * MeanE_3 + a_2 * MeanF_3 + a_3 * MeanG_3 + b * MeanH_3$$

**EXHIBIT 7.2**
**ITERATIVE PROCESS FOR DETERMINING**
**INITIAL CENTRAL OFFICE FORMULA COEFFICIENTS**

1. Choose a numerator for the High Volume Access Line Multiplier, between 400 and 800.
2. Choose a lower limit ($K_2$) for the highest high traffic volume tier (Band 3).
3. Choose a lower limit ($K_1$) for the middle high traffic volume tier (Band 2), between 280 and $K_2$.

4. For each study area, calculate:
   E = Minutes per line in Band 1
   F = Minutes per line in Band 2
   G = Minutes per line in Band 3

5. Calculate R1, R2 and R3 = Average cost per minute in each band

6. Calculate $MeanE_j = \frac{\Sigma\text{ (Sample Weight * E * Lines)}}{\Sigma\text{ (Sample Weight * Minutes)}}$ over Band j for j = 2,3

   Calculate $MeanF_j = \frac{\text{S (Sample Weight * F * Lines)}}{\text{S (Sample Weight * Minutes)}}$ over Band j for j = 2,3

   Calculate $MeanG_j = \frac{\text{S (Sample Weight * G * Lines)}}{\text{S (Sample Weight * Minutes)}}$ over Band j for j = 3

   Calculate $MeanH_j = \frac{\text{S (Sample Weight * Exchanges)}}{\text{S (Sample Weight * Minutes)}}$ over Band j for j = 1,2,3

7. Run constrained regression and validate results

NECA used a regression solution for the coefficients that met all of these constraints.

The simultaneous solution to this regression model is:

$a_1 = 0.021996$

$b = 398.184922$

Coefficients $a_2$ and $a_3$ were solved for by substitution:

$$a_2 = (R2 - (a_1 * MeanE_2) - (b * MeanH_2))/MeanF_2$$

$$= 0.001114$$

$$a_3 = (R3 - (a_1 * MeanE_3) - (R2 - a_1 * MeanE_2 - b * MeanH_2) * (MeanF_3/MeanF_2) - b * MeanH_3)/MeanG_3$$

$$= 0.000861$$

NECA chose the iteration which produced the best fit and met all the constraints. Several other combinations either did not meet constraints, or did not fit the data as well. The resulting coefficients are shown in Section VIII.

This initial CO formula has been shown neither to disadvantage nor to favor high traffic volume study areas. It produces settlements approximately equal to their Central Office revenue requirement in the aggregate. This initial CO formula has an overall *R-Square* statistic of 0.96, a t-statistic for $a_1$ and b of 47.51 and 5.71 respectively, and an F-statistic of 1839.72.

d. <u>Folding CABS Cost into the Initial Central Office Formula</u>

Coefficients of the Cost Company CABS cost formula, derived in Section VII.E.1, and the Initial CO formula were then combined. This task was performed algebraically, as follows, ensuring that the combined formula produced settlements equal to total settlements from the separate formulas.

$$CABS\ Cost\ Formula = d \times E + e \times Min + c$$

*Initial Central Office Formula (Prior to Folding-in CABS)*

$$= (\text{Initial CO Cost}) \times (\text{Preliminary Access Line Factor Model})$$

$$= (a_1 \times Min + b \times E) \times [(u_o + v_o \times L) \times I + (1 - I)]$$

where:

| | | |
|---|---|---|
| E | = | Number of Exchanges |
| L | = | Number of Access Lines |
| Min | = | Number of Monthly Normal Volume Access Minutes |
| I | = | 1, if Access Lines < 10,000 |
| | = | 0, if Access Lines > 10,000 |

*Final Central Office Formula (After Folding-in CABS)*

$$= (\text{Adjusted Initial CO Cost}) \times (\text{Final Access Line Factor}) + \text{CABS Study Area Factor}$$

$$= [(a_1 + e) \times Min + (b + d) \times E)] \times [(u + v \times L) \times I + (1 - I)] + c$$

where:

u and v are constrained by the relation: $u = 1 - 10{,}000v$

NECA calculated coefficients u and v such that:

$$\sum (\text{Central Office Formula Prior to Folding in CABS} + \text{CABS Cost Formula}) = \sum (\text{Central Office Formula After Folding in CABS}),$$

where the summation is over the 446 average schedule study areas in the Traffic Sensitive Pool with normal volume minutes only. Data of these study areas, together with twenty study areas with high volume minutes, and twenty-three study areas not in the Traffic Sensitive Pool, are shown in Appendix E.

Solving this equation for the Final Access Line Factor Coefficients yielded the following values: u = 1.877255 and v = -0.0000877255.

Coefficients of the Preliminary CO formula and Final CO formula are given in Exhibit 7.3.

**EXHIBIT 7.3**

**CENTRAL OFFICE FORMULA COEFFICIENTS**

| | **Preliminary (Before Combining CABS)** | **Final (After Combining CABS)** |
|---|---|---|
| **Per Access Minute** | 0.021996 | 0.022772 |
| **Per Exchange** | 398.18 | 612.07 |
| **Access Line Factor Intercept** | 1.954907 | 1.877255 |
| **Access Line Factor Per-Line Coefficient** | -0.0000954907 | -0.0000877255 |
| **Per Study Area** | 0.0 | 3,001.03 |

The CO formula derived in subsections *a* through *c* provides an unbiased method of calculating settlements for the total population of average schedule study areas with normal traffic volumes. The resulting central office formula is shown in Section VIII.

F. Intertoll Dial Switching Formula

This formula compensates average schedule companies for the cost of tandem switching of interstate

access calls. The cost of tandem switching depends primarily on the capacity required to handle interstate usage. The current and the proposed formulas have identical structures, and use the count of Intertoll Dial (ITD) circuits[8] as a measure of tandem capacity. Costs used in this formula were the ITD transport monthly revenue requirements developed in Section VI.D and VI.F. The intertoll circuit counts used in this formula were monthly intertoll circuits projected to the test period as described in Section V.G.

The proposed formula was derived as follows:

$$Cost\ per\ Prorated\ Intertoll\ Trunk = \frac{\sum (Sample\ Weight\ x\ Intertoll\ Switching\ Cost\ x\ Outlier\ Weight)}{\sum (Sample\ Weight\ x\ Intertoll\ Circuits\ x\ Outlier\ Weight)}$$

Outlier Weights were derived using the ratio outlier method described in Section IV.C.2. The resulting formula is displayed in Section VIII.

G. Line Haul Distance Sensitive Formula

ECs provide Cable & Wire Facilities that transport interstate calls from the EC's Central Office to the interexchange carrier's point of connection. The Line Haul Distance Sensitive formula is designed to compensate average schedule companies for the use of these facilities.

Interstate costs of providing this function depend on the length of routes, the circuit count of cable facilities on the routes, and relative interstate usage of the routes.

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8 Total circuits on the incoming network side of the tandem are prorated among offices subtending the tandem. Only circuits prorated to stand-alone, subtending end offices are eligible for Intertoll settlements. Usage of circuits prorated to other offices is categorized as local switching and, consequently, is included in compensation determined by the Central Office formula.

Current and proposed formulas have an identical structure, which pays an amount per normal circuit mile, an amount per long route circuit mile, and an amount per access minute. The access minute variable reflects capacity required on the routes and relative interstate usage. Access minutes, normal route circuit miles, and long route circuit miles were projected to the test period as described in Section V.C and V.E. Line Haul Distance Sensitive Revenue Requirement was developed as described in Section VI.D and VI.F.

The Interstate Circuit Mile variable combines route miles, circuit counts and relative interstate usage into a single measure of cost. NECA divides the circuit mile variable into normal route circuit miles and long route circuit miles using the threshold of 100 circuit miles per circuit, as described in Section V.E. This calculation reflects the proportionately lower cost incurred by average schedule companies with long, low cost routes. By sharing capacity on networks with very high capacity, these companies achieve significant cost economies, resulting in costs well below average.

Study areas were divided into two groups: those with only normal route circuit miles, and those with both normal route and long route circuit miles.

The Line Haul Distance Sensitive settlement formula depends on four parameters:

- Coefficients of access minutes (b) and of normal route circuit miles ($a_1$), derived by regression;
- A long route threshold (K) derived by network analysis;
- A coefficient of long route circuit miles ($a_2$) calculated using coefficient $a_1$ and the Long Route Relative Cost Ratio.

To quantify the cost differential between normal and long routes, NECA developed the Long Route Relative Cost Ratio by the following three steps.

First, data from study areas with only normal route circuit miles were used in a linear regression model to determine a preliminary cost per normal route circuit mile. The dependent variable in the regression model was Distance Sensitive Revenue Requirement per Interstate Circuit Mile. The independent variable was Access Minutes per Interstate Circuit Mile. Outliers were accommodated as described in Section IV.C. The following model was derived:

$$\begin{aligned} &\textit{Distance Sensitive Revenue Requirement Per Circuit Mile} = \\ &\qquad 0.485675 + (0.001760 \text{ x } \textit{Access Minutes per Interstate Circuit Mile}) \end{aligned}$$

The regression model had an *R-Square* statistic of 0.57, and *F-statistic* value of 153.68. The *t-statistics* for the intercept and the coefficient of Access Minutes per Interstate Circuit Mile were 5.66 and 12.40, respectively. The intercept coefficient of 0.485675 represents the incremental cost per normal route circuit mile.

Second, NECA obtained cost data from the network companies used by most average schedule companies to determine the line haul cost of circuits provided over long route facilities. Lease data included the monthly amount paid by the average schedule company, the number of circuits provided under contract, and route mile information. Circuit miles were calculated as the number of circuits acquired under contract, multiplied by the route miles associated with the routing of those circuits.

The monthly cost per circuit mile for these facilities was the monthly amount paid divided by the total number of circuit miles. Monthly cost and circuit mile data for fifty-nine average schedule study areas that use long route facilities are displayed in Appendix I. The overall line haul average lease cost per circuit mile for long route facilities was developed as follows:

$$\textit{Average Cost per Long Route Circuit Mile} = \frac{\textit{å (Study Area Monthly Cost for Long Route Facilities)}}{\textit{å (Study Area Circuit Miles for Long Route Facilities)}}$$

$$= \frac{\$104{,}183}{2{,}385{,}488} = \$0.0437$$

Finally, the Long Route Relative Cost Ratio (LRRCR) of 0.089978 was developed by dividing the long route cost of 0.0437 by the preliminary normal route cost of 0.485675. NECA therefore estimated the ratio of long route cost to normal route cost to be 0.089978.

Next, the LRRCR was used to create an Equivalent Circuit Mile variable, representing the composite of both normal route and long route circuit miles.

*Equivalent Circuit Miles = Normal Route Circuit Miles + (LRRCR x Long Route Circuit Miles)*

The Equivalent Circuit Miles variable was used in a linear regression model developed using all study areas. The dependent variable in the regression model was Distance Sensitive Revenue Requirement per Interstate Circuit Mile. The independent variables of the model were access minutes per interstate circuit mile and Equivalent Circuit Miles per interstate circuit mile. Outliers were accommodated as described in Section IV.C. The following model was derived:

$$\begin{aligned}&\textit{Distance Sensitive Revenue Requirement Per Circuit Mile} = \\ &\quad (0.493290 \times \textit{Equivalent Circuit Miles per Interstate Circuit Mile}) \\ &\quad + (0.001736 \times \textit{Access Minutes per Interstate Circuit Mile})\end{aligned}$$

The regression model had an *R-Square* statistic of 0.80, and *F-statistic* value of 291.64. The *t-statistics* for access minutes per interstate circuit mile and the coefficient of Relative Circuit Miles were 13.86 and 7.08, respectively.

Finally, a settlement rate for long route circuit miles was developed by multiplying the settlement rate for normal route circuit miles by the LRRCR.

$$\begin{aligned}\textit{Long Route Circuit Mile Rate} &= \textit{Normal Route Circuit Mile Rate} \times \textit{LRRCR} \\ &= 0.493290 \times 0.089978 \\ &= 0.044385\end{aligned}$$

The resulting combined distance sensitive formula is displayed in Section VIII.

H. <u>Line Haul Non-Distance Sensitive Formula</u>

This formula compensates companies for interstate transport costs incurred to terminate switched access interexchange trunk facilities on end office switches and on tandem switches. These costs depend on the number of circuits provided and on the type of termination equipment used. The proposed formula has a structure identical to the current formula structure, which was first adopted in July 1997, and pays an amount per interstate switched circuit termination that depends on the study area ratio of circuit terminations per exchange. NECA proposes to continue this structure.

NECA analyzed Line Haul Non-Distance Sensitive revenue requirement per termination. Costs used in the proposed formula were the Non-Distance Sensitive (NDS) Transport monthly revenue requirements developed in Section VI.D and VI.F. Switched interstate circuit terminations were projected to the test period as described in Section V.F.

In prior years NECA has filed a Non-Distance Sensitive Line Haul model that included a terminations per exchange breakpoint. There continues to be a significant difference between average relative revenue requirement per termination for study areas with terminations per exchange greater than the breakpoint as compared to those with terminations per exchange less than the breakpoint. For this reason, NECA continues to propose a Non-Distance Sensitive Line Haul model that includes a terminations per exchange breakpoint.

NECA determined the best-fitting breakpoint through regression analysis. The best-fitting breakpoint occurred at 161 terminations per exchange. The breakpoint of 161 terminations per exchange also ensured settlements produced by this formula increase monotonically as circuit terminations increase.

A regression model of revenue requirement per termination was fit to the terminations per exchange data. This method computed a two-part formula: part one, a sloping line for relatively low terminations per exchange, and part two, a horizontal line for higher terminations per exchange. These lines were constrained to intersect at 161 terminations per exchange. The parameters of the model were the intercept and slope of the line for study areas with terminations per exchange less than 161, and the intercept of the line for study areas with terminations per exchange greater than 161. The latter parameter was derived by the constraint that the two lines meet at 161 terminations per exchange. The resulting formula, shown in Section VIII, had an *R-Square* statistic of 0.09, a *t-statistic* of 24.89 and 8.25 for the intercept of the first segment and for the coefficient of the second segment, respectively.

## I. Special Access Formula

The Special Access formula compensates average schedule companies for the cost of providing dedicated Special Access facilities, including local channel 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 costs of each company.

In prior years, the special access formula has used a retention ratio variable that is the ratio of a study area's special access revenue requirement to its special access revenues. The proposed formula continues to use such a retention ratio variable to produce an accurate settlement rate. The proposed formula also continues to use a size factor, first introduced in the 2000 Study, to better target settlements to individual study areas.

NECA examined both cost and average schedule data to determine that a relationship exists between retention ratios and revenues per exchange. The revenue per exchange size factor is developed using cost company data and is dependent upon Adjusted Special Access Revenues per Exchange. The formula is made up of this cost company size factor equation and an average schedule Basic Retention Ratio.

### 1. Development of Cost Company Size Factor

#### a. Calculation of Cost Company Revenue Requirements

NECA retrieved the components needed to calculate cost company revenue requirements from NECA's settlement system, using the average month of the October

2003 view of 2001 data and the authorized rate of return.

b. Development of Revenues per Exchange

NECA retrieved access lines and special access revenues from the October 2003 view of 2001 settlements data for use in the calculation of the cost company size factor from cost study areas that reported special access revenues. Special access revenues were adjusted to the authorized rate of return using the methods discussed in Section V.H.1, to produce Adjusted Special Access Revenues. Revenues per exchange were calculated as Adjusted Special Access Revenues divided by exchanges.

c. Select Cost Companies Representative of Average Schedule Companies

To ensure that the size factor developed by cost company data is representative of average schedule companies, NECA only used cost companies that were similar to average schedule companies in the calculation of the size factor. First, NECA developed a retention ratio for each cost study area by dividing Special Access Revenue Requirement by Adjusted Special Access Revenues. Second, NECA excluded those cost companies that had a retention ratio greater than 20 or had greater than 250,000 access lines.

d. Regression to Determine Cost Company Size Factor

NECA first graphed cost company special access revenues per exchange versus retention ratio and fit a model to the data. The model that fit the data best combines a downward sloping line meeting a horizontal line at $2,560 revenues per exchange.

Using this model, companies with revenues per exchange greater than or equal to $2,560 would receive settlements based on the retention ratio component of the special access formula only, while companies with less than $2,560 revenues per exchange would receive settlements based on both the retention ratio and the size factor component. The breakpoint of $2,560 was determined by fitting a non-linear regression model to the data.

Once the optimal breakpoint of $2,560 was determined, NECA developed a regression of retention ratio versus revenues per exchange. The regression was constrained to produce settlement results that increase monotonically as revenues per exchange increase.

Regression analysis produced the coefficient of the slope of the line for study areas with revenues per exchange between $0 and $2,560. This coefficient was used to derive the intercept of the sloping line and the level of the horizontal line of the model. All three coefficients were then divided by the intercept of the horizontal line, so that study areas with revenues per exchange greater than $2,560 have an average size factor of 1.0.

The resulting size factor model is shown below.

*If Revenues per Exchange < $2,560 then*

*Revenue Size Factor = 2.0 – 0.000391 x Revenues per Exchange*

*If Revenues per Exchange > = $2,560 then*

*Revenue Size Factor = 1.0*

This cost company size factor formula will be combined with an average retention ratio as discussed in the next section.

2. Development of Average Schedule Retention Ratio

a. Calculation of Average Retention Ratio

An Average Retention Ratio was calculated using average schedule special access revenue requirements developed in Section VI.F and forecast special access revenues developed in Section V.I. The retention ratio determines the proportion of tariff revenues that corresponds to the cost incurred by average schedule companies.

*Average Retention Ratio*

$$= \frac{S\ (\text{Sample Wgt x Monthly Special Access Revenue Requirement x Variance Wgt})}{S\ (\text{Sample Wgt x Monthly Special Access Revenues x Variance Wgt})}$$

$$= \frac{\$3{,}536{,}121}{\$3{,}987{,}097}$$

$$= 0.886891$$

b. Derivation of Basic Retention Ratio

NECA calculated the portion of special access revenues represented by the Revenue Size Factor Model. NECA obtained average schedule company special access revenues and exchanges from its settlement system for the October 2003 view of July 2003, consistent with the special access revenues data to be used in the study area priceout shown in Appendix E. These special access revenues were adjusted to

reflect the authorized rate of return using the method discussed in Section V.H.1, to produce Adjusted Special Access Revenues.

Second, NECA calculated each study area's ratio of Adjusted Special Access Revenues per exchange. NECA calculated a Revenue Size Factor for each average schedule study area, using its revenue per exchange value and the Size Factor model.

NECA calculated a Revenue Size Factor Portion of revenue requirement ratio. The calculation depends upon the Average Retention Ratio developed in Section VII.I.2.a.

*Revenue Size Factor Portion of revenue requirement =*

$$1 - \frac{S\ (\text{Average Retention Ratio x Adjusted Special Access Revenues})}{S\ (\text{Average Retention Ratio x Revenue Size Factor x Adj Sp Acc Revenues})}$$

$$= 1 - \frac{6{,}593{,}415}{6{,}907{,}296}$$

$$= 1 - 0.954558$$

$$= 0.045442$$

The Basic Retention Ratio of 0.846589 was calculated as the Average Retention Ratio reduced by the Revenue Size Factor Portion.

*Basic Retention Ratio*

*= Average Retention Ratio x (1 – Revenue Size Factor Portion)*

*= 0.886891 x (1 – 0.045442)*

*= 0.846589*

Finally, the proposed special access formula continues to employ a Tariff Rate Index

to reflect current tariff rates.

$$Tariff\ \ Rate\ Index = \frac{1}{1 + Special\ Access\ Relative\ Tariff\ \ Rate\ Change\ Since\ 12/2003}$$

Exhibit 7.4 displays NECA's method for calculating the Tariff Rate Index.[9] Each time NECA files new Special Access tariff rates, it will use data from that filing to calculate a new Tariff Rate Index according to the method displayed in Exhibit 7.4.

The resulting special access formula shifts settlements from larger study areas to smaller study areas, making a more accurate distribution of settlements to compensate for the costs associated with special access provisioning for companies of all sizes. This proposed formula is displayed in Section VIII.

[9] The Tariff Rate Index reflects all Special Access tariff 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. 988, filed June 16, 2003 (2003 Annual Access Tariff Filing). This includes rates for recurring charges, nonrecurring charges and optional features and functions.

**EXHIBIT 7.4**

**SPECIAL ACCESS TARIFF RATE INDEX CALCULATION METHOD**[10]

| | | |
|---|---|---|
| A. | Illustrative Traffic Sensitive Pool Test Period Special Access Revenues at December 31, 2002 Rates | $200,000,000 |
| B. | Illustrative Traffic Sensitive Pool Test Period Special Access Revenues Proposed in the NECA Tariff Filing | $199,000,000 |
| C. | Illustrative Average Schedule Company, Special Access Tariff Rate Index Effective July 1, 2003 [Line A/ Line B] | 1.005025 |

J. Signaling System 7 (SS7) Formulas

The Common Channel Signaling (CCS) network is a packet switched network that allows call control signals and database queries to be transported on dedicated lines separate from the voice network. The Signaling System 7 (SS7) protocol is a set of rules that governs the transmission of signaling information over the CCS network. The network is composed of nodes defined as Signal Point (SP), Service Switching Point (SSP), Consolidation Point (CP), Signal Transfer Point (STP) or Service Control Point (SCP). Telephone companies rarely install SP without SSP technology. Therefore, for simplicity the term SSP, as used herein, will refer either to an SP or SSP.

The SS7 formulas compensate companies for their costs based on counts of SSPs in service. There are two average settlement rates per SSP currently in effect, one rate for each SSP connected to the nationwide signaling network and another rate for each SSP not yet connected to the nationwide signaling network.

[10] 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.

1. Development of Settlement Formula for SSPs with Full Connectivity

The proposed settlement formula for an SSP with full connectivity includes three components that provide cost recovery for the company's capital investment in SSPs and CPs, provisioning of interconnecting data links, and access to the nationwide SS7 network. These are:

| | |
|---|---|
| Monthly investment cost: | the interstate return and loadings associated with the company's capital investment in SSPs and CPs. |
| Monthly CP data link cost: | the interstate portion of the cost of SS7 signaling links between the SSP and the CP. |
| Monthly A-link cost: | the interstate portion of charges for SS7 signal transport and access to STPs in the nationwide SS7 network. |

Development of these components is described in the following three sections. The formula calculation incorporating these components is described in Section VII.J.1.d. Supporting data are displayed in Appendix G.

a. Development of Monthly Investment Costs

NECA used investment data described in Section III.H, the monthly investment charge factor developed in this section, and separations factors to determine investment costs related to SS7.

Investment in SSPs and CPs was developed from data reported by the population of average schedule companies that receive SS7 settlements. For SSPs that were

reported with incomplete cost data, NECA used the average cost of other SSPs of the same model type. In a few cases, when the carrier did not identify the model type of SSP, NECA used the overall average cost.

NECA calculated an average monthly investment cost per SSP using data from fully connected and not yet fully connected SSPs. This average monthly investment cost per SSP was used to develop investment costs underlying the fully connected and not yet fully connected settlement rates.

These investment data are displayed in Column C of Appendix G as Capital Investment Cost. The Monthly Investment Cost (displayed as Column D in Appendix G) is the product of the study area capital investment cost and the monthly investment charge factor.

The monthly investment charge factor provides for the return on average net interstate investment, Federal and State Income taxes, interstate accumulated depreciation, interstate depreciation expense, and maintenance and corporate operations expenses. The monthly investment charge factor of 0.014620 was developed as shown in Exhibit 7.5.

In Exhibit 7.5, the average interstate depreciation reserve ratio of 0.414119 is the ratio of accumulated depreciation of SS7 equipment to total SS7 investment. This ratio is based on initial SS7 investment data reported by average schedule companies.

**EXHIBIT 7.5**

**DEVELOPMENT OF MONTHLY INVESTMENT CHARGE FACTOR**

| | | |
|---|---|---|
| A. | Illustrative SS7 Capital Investment | $100,000 |
| B. | Average Interstate Investment<br>(Line A x 0.472571) | $47,257 |
| C. | Average Interstate Depreciation Reserve<br>(Line B x 0.414119) | $19,570 |
| D. | Average Net Interstate Investment<br>(Line B – Line C) | $27,687 |
| E. | Return On Average Net Interstate Investment<br>(Line D x 0.1125) | $3,115 |
| F. | State & Local Income Tax @ 7.8%<br>(Line E x 0.084599) | $264 |
| G. | Federal Income Tax @ 32.9039%[11]<br>[(Line E – Line F) x 0.490400] | $1,398 |
| H. | Interstate Depreciation Expense<br>(Line B/8) | $5,907 |
| I. | Interstate Maintenance Expense<br>(Line B x 0.081676) | $3,860 |
| J. | Interstate Corporate Operations Expense<br>(Line B x 0.063483) | $3,000 |
| K. | Total Annual Interstate Cost<br>(Lines E + F + G + H + I + J) | $17,544 |
| L. | Total Monthly Interstate Cost<br>(Line K/12) | $1,462 |
| M. | Monthly Investment Charge Factor<br>(Line L/Line A) | 0.014620 |

[11] This factor is the average effective tax rate based on 2001 cost study data, as described in Section IV.G.

Since the eight-year depreciation life is the norm for digital switching equipment, NECA has calculated annual SS7 depreciation expense using an eight-year depreciation life for each SSP or CP. Accumulated depreciation is the sum of these expenses over the years each SSP or CP has been in service.

Companies that purchased SS7 equipment eight or more years ago would have fully depreciated their initial investment, and would have upgraded their equipment with new equipment of the same functionality. Since some new equipment tends to be less expensive than it was eight years ago, NECA updated this data.

NECA estimated replacement costs for fully depreciated switches by: (1) using information from switch vendors on upgrade and replacement costs by switch model and type; (2) supplementing vendor data with replacement cost data from a sample of average schedule study areas; (3) determining what switch models and types have most likely been replaced, and estimating replacement costs for these switches; and (4) applying replacement cost data to those switches in NECA's SS7 database. This method enabled replacement costs to be estimated without putting undue burden on companies by requesting complex SS7 equipment cost data from every study area.

Cost study factors (used on Lines B, I and J of Exhibit 7.5) were used to allocate SS7 costs to the interstate jurisdiction and to apply loadings for maintenance and corporate operations expenses. These factors were developed from weighted sample cost company cost studies as shown in Section IV.G.

To calculate the average investment of an SSP, NECA used the SSP cost data from both fully connected and not yet fully connected SSPs.

*Average Monthly Investment Cost per SSP*

$$= \frac{\textit{S (Monthly Investment Cost of all SSPs)}}{\textit{Total Number of SSPs}}$$

$$= \frac{367{,}447.96}{558}$$

$$= \$658.51$$

The investment cost associated with fully connected SSPs for each study area was then calculated as the number of fully connected SSPs multiplied by the Average Investment per SSP. Similarly, the investment cost associated with partially connected SSPs was calculated as the number of partially connected SSPs multiplied by the Average Investment per SSP. These adjusted investment amounts were used in the development of the fully and partially connected rates developed in Sections VII.J.1.d and VII.J.2.

b. Development of Monthly A-Link Costs

A-link pairs connect SSPs or CPs to a pair of STPs. A-links are configured with termination equipment at the SSP or CP and at a meet point, a cable facility connecting the terminations, and cable and ports connecting the meet point to the STPs. In this filing, NECA developed A-Link cost data representative of STP providers to whom average schedule companies are connected for SS7 signaling. Port costs, mileage costs and termination costs are based on tariff rates currently in effect, or on reported costs for providers under contract.

i. Provider Mileage Costs

Tariff and contract rates were used to develop monthly mileage costs as follows.

*Total Monthly Mileage Cost =*

*(NECA Mileage Rate)*

*x (Average Airline Miles from SSPs to the Meet Point)*

*+ A Mileage Cost Component Based on the Provider's Rate Structure and Average Airline Miles from the Meet Point to the STP*

Average Airline Miles from the SSP to the Meet Point was determined by using one of three methods, explained below.

The first method was used for most study areas. NECA analyzed its Line Haul database and retrieved all route data having a start and end location Common Language Location Identifier (CLLI, a trademark of Telcordia) code matching a CLLI code in the Tariff 4 database. The vertical and horizontal coordinates of the start and end location of each route were retrieved. The airline distance between the start and end location of each route was calculated. The weighted mean of all airline distances was calculated, weighted by interstate circuits. The resulting average weighted route mile distance between the SSP and Meet Point was 26.14 miles.

The second method NECA used to calculate SSP to Meet Point distance was used for one provider that reported an average distance of 56.6 miles from the SSP end office to the point of interface (meet point). This distance was used in developing mileage costs for SSPs served by that provider. In this case, no

remaining costs are incurred for distances from the meet point to the STP.

NECA used a third method to calculate SSP to Meet Point distance when the meet point was specified to have DDS capability. Average airline miles to DDS hubs in the same LATA (96.15 miles) were used as airline miles from the SSP to the meet point. Terminating costs were included at the SSP and DDS locations, both computed at the NECA tariff rate. No remaining costs are incurred from the meet point to the STP.

Average Airline Miles from the Meet Point to the STP (70.01 miles) is the difference between the average SSP to STP distance (96.15) and the average SSP to meet point distance (26.14 miles). Average mileage from the SSP to the STP was determined using the vertical and horizontal coordinates of STP and SSP locations.

Mileage costs for this component are based on the provider's rate structure as shown in Exhibit 7.6.

EXHIBIT 7.6

**DEVELOPMENT OF SS7 MONTHLY INTERSTATE A-LINK RATES (PER PAIR)**

| Provider | [A] Meet Point To STP Fixed Charge | [B] Meet Point To STP Per Mile Charge | [C] Termination Rate At Meet Point (Per Link) | [D] Port Cost (Per Pair) | [E(1)] Monthly A-Link Rate (Per Pair) | [F] (E x 0.472571(2)) Monthly Interstate A-link Cost |
|---|---|---|---|---|---|---|
| A | $0.00 | $3.50 | $0.00 | $1,800.00 | $2,579.59 | $1,219.04 |
| B | $0.00 | $0.00 | $155.00 | $674.10 | $1,273.62 | $601.88 |
| C | $0.00 | $1.11 | $14.27 | $760.00 | $1,233.48 | $582.91 |
| D | $25.60 | $0.26 | $0.00 | $930.00 | $1,307.13 | $617.71 |
| E | $30.25 | $0.99 | $86.00 | $828.20 | $1,488.84 | $703.58 |
| F | $33.00 | $0.15 | $50.00 | $858.10 | $1,334.62 | $630.70 |
| G | $25.20 | $0.90 | $64.40 | $748.00 | $1,342.74 | $634.54 |
| H | $100.16 | $0.91 | $0.00 | $1,000.00 | $1,617.26 | $764.27 |
| I | N/A | $2.69 | $118.96 | $454.00 | $1,601.77 | $756.95 |
| J | $66.44 | $2.50 | $0.00 | $859.94 | $1,632.39 | $771.42 |
| K | N/A | N/A | N/A | $2,000.00 | $2,000.00 | $945.14 |
| L | N/A | $3.96 | $115.99 | $910.00 | $2,626.46 | $1,241.19 |
| M | $120.00 | $2.33 | N/A | $1,598.00 | $2,453.77 | $1,159.58 |
| N | N/A | N/A | N/A | $2,020.00 | $2,950.00 | $1,394.08 |
| O | N/A | N/A | N/A | $750.00 | $1,039.52 | $491.25 |
| P | $20.81 | $0.77 | $44.09 | $880.00 | $880.00 | $415.86 |
| Q | $0.00 | $2.17 | $140.47 | $1,440.00 | $2,314.30 | $1,093.67 |
| R | $96.00 | $0.60 | $0.00 | $1,629.00 | $2,194.53 | $1,037.07 |
| S | $30.12 | $1.98 | $71.48 | $900.00 | $1,669.96 | $789.17 |

Channel Miles Termination Rate Per Termination CMT = $40.20(3)
Channel Miles Facility Rate Per Mile: CMF = $4.00(3)
Average SSP to HUB Distance = 96.15(4)
Average SSP to Meet Point Distance = 26.14(4)
Average Airline Mile From The Meet Point To The STP = 96.15 – 26.14 = 70.01

(1) Provider I: E = 2 x (CMT + CMF x 56.60) + D
Providers L & N: E= 2 x (CMT x 2 + CMF x 96.15) +D
Provider K & P: E = D (Transport costs are included in Port Cost)
All Other Providers: E = 2 x (CMT + CMF x 26.14 + A + 70.01 x B + C) + D

(2) Interstate COE Factor (See Exhibit IV.G)

(3) 2003 Annual Access Tariff Filing

(4) See Section VII.J.1.b.i

ii. Provider Termination Costs

Total termination costs are the sum of a termination charge at the NECA tariff rate ($40.20) for the link between the SSP and the meet point and another termination charge at the meet point. For each provider, termination cost was included at the NECA tariff rate of $40.20, one at the SSP and one at the meet point. See Exhibit 7.6, Column E and Note 1.

iii. Provider Monthly Interstate A-Link Costs

For each provider, monthly A-Link rates were multiplied by Interstate COE Factor (0.472571) to calculate Monthly Interstate A-Link Cost. *See* Exhibit 7.6, Column F.

iv. Average Schedule Company A-Link Costs

For each study area, the monthly interstate A-Link cost of its provider (corresponding row in Column F in Exhibit 7.6) was multiplied by the number of A-Link pairs to produce the monthly A-Link cost component shown in Column G of Appendix G (SS7 Costs with Full Connectivity).

c. Development of Monthly CP Data Link Costs

Consolidation Point switches are often used to consolidate links from a group of SSPs, to allow the group to be served by a single pair of A-Links. When Consolidation Point equipment is provided, CP Data Link cost is incurred by each of the SSPs.

A monthly average cost per CP data link was developed as shown in Exhibit 7.7. These calculations use NECA's Tariff rates for data channel miles ($4.00), and for

**EXHIBIT 7.7**

**MONTHLY CP DATA LINK RATE DEVELOPMENT**

| | | |
|---|---|---|
| A. | 24.14 Miles x $4.00 Per 56 Kbps CMF | $96.56 |
| B. | 2 Terminations x $40.20 Per 56 Kbps CMT | $80.40 |
| C. | Total (Line A + Line B) | $176.96 |
| D. | Average COE Factor (see Exhibit 4.8) | 0.472571 |
| E. | Monthly Average Cost Per CP Data Link (Line C x Line D) | $83.63 |

data channel terminations ($40.20). Average Length of Haul of 24.14 miles was calculated using the vertical and horizontal coordinates of SSP and CP locations. For each study area, monthly CP Data Link costs equal the product of the number of data links and the monthly average cost. Resulting CP Data Link Costs are shown in Column I of Appendix G (SS7 Costs with Full Connectivity).

d. Settlement Formula Calculation

The proposed settlement formula for a SSP with full connectivity is:

$$\text{Settlement for SSP With Full Connectivity} = \sum \frac{\text{Total Monthly Costs}}{\text{Number of SSPs}}$$

where the sum is taken over all SSPs that have full connectivity, and

$$\text{Total Monthly Costs} = \text{Monthly Investment Cost} + \text{Monthly A-Link Costs} + \text{Monthly CP Data Link Costs}$$

Appendix G shows the calculation, for each study area, of Monthly Investment Costs, Monthly A-Link Costs and Monthly CP Data Link Costs. Total Monthly Costs and the total number of SSPs from the study in Appendix G are used to calculate the proposed settlement rate.

$$\text{Settlement For SSP With Full Connectivity} = \frac{\text{Total Monthly Cost}}{\text{Total Count of SSPs}}$$

$$= \frac{\$640{,}609}{542}$$

$$= \$1{,}182$$

2. Development of Settlement Formula for SSPs Not Yet Fully Connected

The monthly settlement for those SSPs not yet connected to the nationwide signaling network was developed using a methodology that was similar to that previously described for the full connectivity scenario.

These companies incur SSP costs, and sometimes costs of CPs and CP data links, but do not incur A-Link Costs. The total costs of these companies are the total monthly SSP, CP and CP data link cost from average schedule companies that have installed SSP equipment, but are not

yet connected to the nationwide signaling network. Since currently the only SS7 network costs are SSP costs for SSPs without full connectivity, NECA is using the Average Monthly Investment Cost per SSP as the proposed formula. This proposed formula is displayed in Section VIII.

K. 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, currently 11.25%. The Rate of Return Factor measures the relative effect on revenue requirement caused by changes in the pool's achieved rate of return. Current and proposed formulas have identical structures.

These formulas, therefore, derive their structure from the revenue requirement calculation method, which has an expense component that is not sensitive to rate of return, and Return and Federal Income Tax Components that are sensitive to rate of return. The intercepts of the formulas correspond to the expense component, while the slopes correspond to the Return and Federal Income Tax components.

The development of the Rate of Return Factor adjustment formulas involved three steps. First, total sample revenue requirements were computed corresponding to each of several test rates of return. In each case, the methods described in Section VI.F were used to calculate revenue requirements. Second, a revenue requirement ratio was computed corresponding to each of these rates of return. Third, a regression model was developed relating the revenue requirement ratio to the rate of return.

The revenue requirement ratio equals the quotient of revenue requirement at a test rate of return

divided by the revenue requirement at the authorized rate of return. Exhibit 7.8 displays the ratios underlying the regression models.

The data in Exhibit 7.8 are interpreted as follows: if the Common Line Pool achieves a rate of return of 10.5 percent, then the revenues will be 98.1486 percent of the revenue requirement at the authorized rate of 11.25 percent. Similarly, an achieved rate of 12.5 percent corresponds to revenues that are 103.0886 percent of the revenue requirement at 11.25 percent.

The final step in the derivation of these formulas computed straight line regression models relating the revenue requirement ratios to the test rates of return. The revenue requirement models were constrained to equal 1.0 at the Rate of Return coordinate of 0.1125. These models fit the data perfectly, yielding the following formulas:

$$\textit{Common Line Factor} = 0.722777 + 2.464204 \times ROR \qquad R^2 = 1.00$$

$$\textit{Traffic Sensitive Factor} = 0.765003 + 2.088862 \times ROR \qquad R^2 = 1.00$$

EXHIBIT 7.8

**REVENUE REQUIREMENT RATIOS UNDERLYING ROR FORMULAS**

| Test Rate Of Return | Common Line Ratio | Traffic Sensitive Ratio |
|---|---|---|
| 0.0700 | 0.895826 | 0.911806 |
| 0.0725 | 0.901922 | 0.916963 |
| 0.0750 | 0.908028 | 0.922122 |
| 0.0775 | 0.914136 | 0.927288 |
| 0.0800 | 0.920244 | 0.932459 |
| 0.0825 | 0.926356 | 0.937630 |
| 0.0850 | 0.932468 | 0.942806 |
| 0.0875 | 0.938580 | 0.947984 |
| 0.0900 | 0.944693 | 0.953162 |
| 0.0925 | 0.950808 | 0.958342 |
| 0.0950 | 0.956928 | 0.963526 |
| 0.0975 | 0.963059 | 0.968716 |
| 0.1000 | 0.969192 | 0.973909 |
| 0.1025 | 0.975329 | 0.979106 |
| 0.1050 | 0.981486 | 0.984312 |
| 0.1075 | 0.987656 | 0.989539 |
| 0.1100 | 0.993828 | 0.994768 |
| 0.1125 | 1.000000 | 1.000000 |
| 0.1150 | 1.006173 | 1.005232 |
| 0.1175 | 1.012349 | 1.010467 |
| 0.1200 | 1.018527 | 1.015705 |
| 0.1225 | 1.024705 | 1.020950 |
| 0.1250 | 1.030886 | 1.026197 |
| 0.1275 | 1.037073 | 1.031445 |
| 0.1300 | 1.043261 | 1.036696 |
| 0.1325 | 1.049450 | 1.041949 |
| 0.1350 | 1.055641 | 1.047203 |
| 0.1375 | 1.061832 | 1.052458 |
| 0.1400 | 1.068024 | 1.057715 |
| 0.1425 | 1.074215 | 1.062972 |
| 0.1450 | 1.080408 | 1.068230 |
| 0.1475 | 1.086601 | 1.073490 |
| 0.1500 | 1.092794 | 1.078753 |
| 0.1525 | 1.098987 | 1.084016 |
| 0.1550 | 1.105181 | 1.089279 |

## L. Equal Access Settlements

Many average schedule companies incur costs for the provision of equal access to competing interexchange carriers. Part 36 rules include special methods of separating these costs to jurisdictions. These methods apply only in cases that meet the Part 36 prerequisites for equal access. Correspondingly, NECA provides an average schedule settlement formula that targets locations with equal access. The current and proposed formulas have identical structures. Equal access costs include initial expenses for customer presubscription balloting, education, some software expenses, and capitalized hardware and software costs.

Equal access costs are separated according to Part 36 rules on the basis of relative state and interstate equal access traffic. Settlements for interstate equal access costs are currently recovered by average schedule companies in two portions. The interstate portion of initial incremental equal access expenses are reported to the pool and recovered in the period incurred. The interstate portion of initial incremental investment is recovered using a monthly carrying charge factor of 0.0247, applied over an eight-year period.

Exhibit 7.9 displays the development of the monthly carrying charge factor (0.0247).

## M. Development of MAG Shift Factors

NECA further adjusted the formulas described in Sections VII.B through VII.L to account for allocation rules described in the MAG Order. NECA made adjustments to account for two changes: (1) Reallocation of Switching Line Port costs from the Central Office to the Common Line access category; and (2) Reallocation of Transport Interconnection Charge costs from Transport to Common Line.

**EXHIBIT 7.9**

**CALCULATION OF THE EQUAL ACCESS INVESTMENT**
**MONTHLY CARRYING CHARGE FACTOR**

| | | |
|---|---|---|
| A. | Illustrative Interstate Equal Access Investment | $10,000 |
| B. | Average Interstate Depreciation Reserve Over First Year (8 yr.)<br>[(Line A/8)/2] | $ 625 |
| C. | Average Net Interstate Investment<br>(Line A - Line B) | $ 9,375 |
| D. | Interstate Authorized Rate of Return | 11.25% |
| E. | Return on Average Net Interstate Investment<br>(Line C x Line D) | $ 1,055 |
| F. | Federal Income Tax @ 35%<br>(Line E x 0.538462) | $ 568 |
| G. | State Income Tax @ 7.8% (Line E x 0.084599) | $ 89 |
| H. | Interstate Depreciation Expense (8 yr.)<br>(Line A/8) | $ 1,250 |
| I. | Total Interstate Return, Taxes and Depreciation<br>(Lines E + F + G + H) | $ 2,962 |
| J. | Monthly Interstate Return, Taxes and Depreciation<br>(Line I/12) | $ 247 |
| K. | Monthly Interstate Carrying Charge Factor<br>(Line J/Line A) | 0.0247 |

NECA developed "shift factors" to move amounts from one access category to another. The

description of the development and use of each shift factor is described in the following sections.

1. Switching Line Ports

The MAG Order specifies that costs associated with Switching Line Ports be allocated to Common Line rather than to CO.[12] The MAG Order allows companies to use 30% as the amount of Local Switching revenue requirements, excluding local switching support amounts, to be reallocated.

a. Development of Line Port Shift Factor

Using the population of average schedule study areas, NECA retrieved total central office settlements from the 2003 Annual Access Tariff Filing. The line port component of settlements was calculated according to Commission rules as 30% of the difference between CO settlements and local switching support amounts. The Line Port Shift Factor was calculated as the line port component of settlements, divided by total central office settlements.

$$\textit{Line Port Shift Factor} = \frac{\textit{Line Port Component}}{\textit{Total Central Office Settlements}}$$

$$= \frac{\$38{,}919{,}803}{\$209{,}664{,}270}$$

$$= 0.185629$$

b. Application of Line Port Shift Factor

Each month, NECA will calculate the line port component of settlements for each average schedule study area by multiplying the Line Port Shift Factor by each study area's total central office settlements. This study area line port component will now be recovered through the common line pool. While this change did not impact Common Line Access Line or CO formula coefficients displayed in Section VIII of this Filing, Section VIII includes a Common Line Line Port Formula based on the central office formula. Similarly, Section VIII also includes a residual Traffic Sensitive Central Office Formula.

To calculate the settlement effects of proposed formulas (See Section VII.N), current Common Line Line Port settlements were calculated using the current Line Port Shift Factor of 0.178995, as documented in the 2003 Filing. Proposed Common Line Line Port settlements were calculated using the proposed factor of 0.185629. The Common Line Line Port settlement is included in the total common line settlement and the Traffic Sensitive CO settlement is included in the total traffic sensitive settlement for the development of Appendix E and exhibits 7.10, 7.11 and 7.12. For the average schedule population, this reallocation assigned $3,031,766 of the current central office settlement to the common line pool, and $2,840,479 of the proposed central office settlement to the common line pool.

2. Transport Interconnection Charge

As prescribed by the MAG Order, the Transport Interconnection Charge (TIC) was eliminated and the costs that were recovered through this rate element were reapportioned to all the other

[12] MAG Order at ¶ 90.

access elements.[13] For average schedule formula development, part of the transport revenue requirement was shifted to other access categories. The part of the transport revenue requirement that would have been shifted to other traffic sensitive revenue requirements was not calculated, since total common line and traffic sensitive settlements by study area would remain the same despite such a reallocation. However, the shift from the transport category to the common line category was calculated since this represents a shift from one pool to the other.

a. Development of Common Line TIC Shift Factors

From the 2003 Annual Access Tariff Filing, NECA used TIC revenues and total Transport settlements for each study area. Total Transport settlements include settlements produced by the Line Haul Distance Sensitive, Line Haul Non-Distance Sensitive, and Intertoll Switching formulas.

NECA allocated TIC revenues to the Common Line access category in proportion to the fraction of total settlements derived from Common Line. For this purpose, Common Line settlements excluded Universal Service Contribution (USC) amounts, and traffic sensitive settlements excluded local switching support and TIC revenues. The fraction of total settlements derived from the Common Line formula was multiplied by TIC revenues to produce Common Line TIC revenues. Finally, the sum of Common Line TIC revenues was divided by the sum of total Transport settlements for the population to produce the Common Line (CL) TIC Shift Factor.

$$\textit{CL TIC Revenues} = \frac{\textit{(CL Settlements Excluding USC)} \times \textit{TIC Revenues}}{\textit{Total Settlements (Excluding LSS and TIC Revenues)}}$$

[13] MAG Order at ¶ 98.

$$\textit{CL TIC Shift Factor} = \frac{\textit{SCL TIC Revenues}}{\textit{STransport Settlements}}$$

$$= \frac{\$23{,}946{,}097}{\$89{,}996{,}695}$$

$$= 0.266078$$

b. Application of TIC Shift Factors

Each month, NECA will calculate the amount of transport settlements to be allocated to Common Line using the CL TIC Shift Factor. For each study area, the total transport settlement will be multiplied by the CL TIC Shift Factor to produce the amount to now be recovered from the Common Line Pool. While this change does not impact Common Line or Transport formula coefficients displayed in Section VIII of this Filing, Section VIII includes a Common Line Transport Formula based on the transport formulas. Similarly, Section VIII also includes a residual Traffic Sensitive Transport Formula.

To calculate the settlement effects of proposed formulas (See Section VII.N below), current Common Line Transport settlements were calculated using the current CL TIC Shift Factor of 0.337068, as documented in the 2003 Filing. Proposed Common Line Transport settlements were calculated using the proposed factor of 0.266078. In developing Appendix E and exhibits 7.10, 7.11 and 7.12, the Common Line Transport settlement is included in the total common line settlement, and the Traffic Sensitive Transport settlement is included in the total Traffic Sensitive settlement. For the average schedule population, this reallocation assigned $2,423,068 of current transport settlements to the common line pool, and $1,634,975 of proposed

transport settlements to the common line pool.[14]

N. Impact of Proposed Formulas

This section analyzes settlement effects of the proposed formulas that carriers can expect to realize on the day of implementation. These effects take into account settlements based on formulas presented in sections VII.B through VII.L, along with the shift factors described in section VII.M.

Beginning July 2004, carriers can expect, on average, an overall settlement decrease of 1.42 percent as a result of the new formulas. This figure is based on a comparison of changes in settlements produced to become effective July 1, 2004 relative to those that became effective July 1, 2003, with demand held constant at the July 2003 level.

Changes in the formula levels result from the effects of cost and demand growth. The proposed formulas are expected to produce settlements during the test period that will match test period revenue requirements.

Impacts of these formula changes on individual average schedule companies will vary, depending on each company's size and demand characteristics. Overall, NECA projects that the majority of companies' settlements will decrease by ten percent or less. NECA estimates that approximately ten percent of the 489 average schedule study areas will experience an overall increase. Generally, this increase can be attributed to the increase in Common Line settlements not being offset by decreases in other (traffic sensitive) settlements. Also, because some companies are not in the traffic sensitive pool, NECA's calculations do not include their traffic sensitive settlements. Finally, NECA

[14] From average schedule study areas not in NECA's Traffic Sensitive Pool, NECA used line port and TIC shifts to common line according to the December 2001 view of their tariff data.

anticipates that eight study areas will experience a decrease in settlements greater than ten percent. This decrease is mainly attributable to the reduction in the high traffic volume coefficients.

Exhibit 7.10 summarizes the average change to each formula and the resulting fraction of total settlements from each proposed formula. Exhibit 7.11 summarizes the effects of these changes for average schedule companies by access line grouping.

Exhibit 7.12 summarizes settlements by formula. The values reflect the proposed formula changes and are based on demand levels taken from the October 2003 view of the July 2003 settlement month. Settlement effects for individual study areas are shown in Appendix E.

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These amounts are included in their common line settlements in Appendix E.

**EXHIBIT 7.10**

**SUMMARY OF PROPOSED FORMULA AVERAGE CHANGES**

| | Proposed Formula Change | Formula Percent Of Total |
|---|---|---|
| Common Line Basic | 8.39% | 44.89% |
| CL Universal Service | 0.00% | 2.67% |
| Central Office | -9.66% | 27.92% |
| CL Central Office | | 5.56% |
| TS Central Office | | 22.36% |
| Distance Sensitive | -15.90% | 5.75% |
| Non-Distance Sensitive | -10.42% | 4.68% |
| Intertoll Dial | -29.09% | 0.60% |
| Total Transport | | 11.30% |
| CL Transport | | 3.20% |
| TS Transport | | 8.09% |
| Special Access | 0.69% | 11.83% |
| Signaling System 7 | -12.13% | 1.35% |
| Equal Access | 0.00% | 0.04% |
| Overall CL Average | 3.14% | 56.32% |
| Overall TS Average | -6.75% | 43.68% |
| Overall Average | -1.42% | 100.00% |

## EXHIBIT 7.11

## SETTLEMENT EFFECTS OF PROPOSED AVERAGE SCHEDULES

| Access Line Size Group | Number Of ECs | % Change Common Line | % Change Traffic Sensitive | % Change Total | Per Line Change Total |
|---|---|---|---|---|---|
| <500 | 61 | -0.77% | -8.09% | -5.26% | -$2.68 |
| 501 - 1000 | 93 | 0.97% | -8.70% | -4.43% | -$1.51 |
| 1001 - 2500 | 156 | 1.94% | -6.87% | -2.72% | -$0.82 |
| 2501 - 5000 | 75 | 2.63% | -6.76% | -1.97% | -$0.52 |
| 5001 - 10000 | 56 | 2.42% | -6.61% | -1.65% | -$0.39 |
| 10001 - 20000 | 28 | 2.97% | -6.70% | -1.13% | -$0.23 |
| > 20000 | 20 | 4.29% | -6.41% | -0.31% | -$0.06 |
| TOTAL | 489 | 3.14% | -6.75% | -1.42% | -$0.32 |

**EXHIBIT 7.12**

**SETTLEMENTS BY MAJOR SETTLEMENT ELEMENT**

| | | |
|---|---|---|
| Common Line Basic | | $25,017,129 |
| CL Universal Service | | $1,487,297 |
| Central Office | | $15,556,975 |
| Central Office Line Port Shifts | | |
| CL Central Office | $3,095,554[15] | |
| TS Central Office | $12,461,421 | |
| Distance Sensitive Transport | | $3,202,714 |
| Non-Distance Sensitive Transport | | $2,605,608 |
| Intertoll Dial Transport | | $336,410 |
| CL Transport Not in TS Pool | | $150,863 |
| Total Transport | | $6,295,595 |
| TIC Reallocation Shifts | | |
| CL Transport | $1,785,841 | |
| TS Transport | $4,509,754 | |
| Special Access | | $6,593,415 |
| Signaling System 7 | | $752,181 |
| Equal Access | | $22,916 |
| Overall CL Total | | $31,385,821 |
| Overall TS Total | | $24,339,687 |
| Overall Total | | $55,725,508 |

[15] The Common Line Central Office settlement amount reflects the shift of Line Port costs to Common Line by companies not in the Traffic Sensitive Pool.

# VIII. CURRENT AND PROPOSED AVERAGE SCHEDULE SETTLEMENT FORMULAS

## A. COMMON LINE FORMULAS

### COMMON LINE ACCESS LINE FORMULA

**Current Formula**:

*Settlement = Common Line Access Lines x Settlement Per Common Line Access Line*

If Lines Per Exchange less than 513 then,
*Settlement per Line* = $15.853821 - ($0.009580 x Lines Per Exchange)

If Lines Per Exchange greater than or equal to 513 but less than 10,000 then,
*Settlement per Line* = $8.652836 + ($1,172.946518/ Lines Per Exchange)

If Lines Per Exchange greater than or equal to 10,000 but less than 15,000 then,
*Settlement per Line* = $11.359373 - ($0.000259 x Lines Per Exchange)

If Lines Per Exchange greater than or equal to 15,000 then,
*Settlement per Line* = 0.8562 x {$8.652836 + ($1,172.946518/Lines Per Exchange)}

**Proposed Formula**:

*Settlement = Common Line Access Lines x Settlement Per Common Line Access Line*

If Lines Per Exchange less than 556 then,
*Settlement per Line* = $16.088865 - ($0.007970 x Lines Per Exchange)

If Lines Per Exchange greater than or equal to 556 but less than 10,000 then,
*Settlement per Line* = $9.332844 + ($1,292.533587/ Lines Per Exchange)

If Lines Per Exchange greater than or equal to 10,000 but less than 15,000 then,
*Settlement per Line* = $11.479163 - ($0.000202 x Lines Per Exchange)

If Lines Per Exchange greater than or equal to 15,000 then,
*Settlement per Line* = 0.8975 x {$9.332844 + ($1,292.533587/Lines Per Exchange)}

## 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 Formula:**

Common Line Factor = 0.722393 + (2.467618 x ROR)

**Proposed Formula:**

Common Line Factor = 0.722777 + (2.464204 x ROR)

## UNIVERSAL SERVICE SUPPORT CONTRIBUTION FORMULA:

**Current Formula:**

Average Schedule Companies will receive a common line settlement reimbursement equal to the Average Schedule Company's contribution to the Federal Universal Service program assigned to the interstate common line access element according to Commission rules.

**Proposed Formula:**

Average Schedule Companies will receive a common line settlement reimbursement equal to the Average Schedule Company's contribution to the Federal Universal Service program assigned to the interstate common line access element according to Commission rules.

## COMMON LINE LINE PORT FORMULA:

**Current Formula:**

Common Line Line Port Formula= 0.178995 x Central Office formula

**Proposed Formula:**

Common Line Line Port Formula= 0.185629 x Central Office formula

## COMMON LINE TRANSPORT FORMULAS:

### Current Formula:

Common Line Transport Formula = 0.337068 x {Line Haul Distance Sensitive Formula
+ Line Haul Non-Distance Sensitive Formula
+ Intertoll Switching Formula}

### Proposed Formula:

Common Line Transport Formula = 0.266078 x {Line Haul Distance Sensitive Formula
+ Line Haul Non-Distance Sensitive Formula
+ Intertoll Switching Formula}

## CENTRAL OFFICE FORMULA

### Current Formula:

Settlement = (Basic Settlement x Access Line Factor) + $2,909.42

For Study Areas with Minutes Per Line Less Than or Equal to 350:
Basic Settlement = ($0.025078 x Access Minutes) + ($884.01 x Exchanges)

For Study Areas with Minutes Per Line Greater Than 350 but Less Than or Equal to 850:
Basic Settlement = ($0.025078 x 350 x Access Lines)
+ {$0.012800 x [Access Minutes - (350 x Access Lines)]}
x High Volume Access Line Multiplier + ($884.01 x Exchanges)

For Study Areas with Minutes Per Line Greater Than 850:
Basic Settlement = ($0.025078 x 350 x Access Lines)
+ {$0.012800 x (850 - 350) x Access Lines
+ $0.008040 x [Access Minutes - (850 x Access Lines)]} x High Volume Access Line Multiplier
+ ($884.01 x Exchanges)

Access Line Factor:

For study areas with common line access lines less than 10,000:
Access Line Factor = 1.805977 - (0.0000805977 x Common Line Access Lines)

For study areas with common line access lines greater than or equal to 10,000:
Access Line Factor = 1.0

High Volume Access Line Multiplier = (475/Common Line Access Lines)

**Proposed Formula:**

Settlement = (Basic Settlement x Access Line Factor) + $3,001.03

For Study Areas with Minutes Per Line Less Than or Equal to 330:
Basic Settlement = ($0.022772 x Access Minutes) + ($612.07 x Exchanges)

For Study Areas with Minutes Per Line Greater Than 330 but Less Than or Equal to 850:
Basic Settlement = ($0.022772 x 330 x Access Lines)
+ {$0.001114 x [Access Minutes - (330 x Access Lines)]}
x High Volume Access Line Multiplier + ($612.07 x Exchanges)

For Study Areas with Minutes Per Line Greater Than 850:
Basic Settlement = ($0.022772 x 330 x Access Lines)
+ {$0.001114 x (850 - 330) x Access Lines
+ $0.000861 x [Access Minutes - (850 x Access Lines)]} x High Volume Access Line Multiplier
+ ($612.07 x Exchanges)

Access Line Factor:

For study areas with common line access lines less than 10,000:
Access Line Factor = 1.877255 - (0.0000877255 x Common Line Access Lines)

For study areas with common line access lines greater than or equal to 10,000:
Access Line Factor = 1.0

High Volume Access Line Multiplier = (475/Common Line Access Lines)

**TRAFFIC SENSITIVE CENTRAL OFFICE FORMULA:**

**Current Formula:**

Traffic Sensitive Central Office = (1 – 0.178995) x Central Office Formula

**Proposed Formula:**

Traffic Sensitive Central Office = (1 – 0.185629) x Central Office Formula

**INTERTOLL SWITCHING FORMULA:**

**Current Formula:**

Settlement Per Intertoll Trunk = $18.77

**Proposed Formula:**

Settlement Per Intertoll Trunk = $13.31

**LINE HAUL DISTANCE SENSITIVE FORMULA:**

**Current Formula:**

For study areas with circuit miles greater than zero and circuit miles per circuit less than or equal to 100:

Settlement = ($0.511164 x Circuit Miles) + ($0.002850 x Access Minutes)

For study areas with circuit miles per circuit greater than 100:

Settlement = ($0.511164 x 100 x Circuits)
+ $0.044395 x (Circuit Miles - (100 x Circuits))
+ ($0.002850 x Access Minutes)

**Proposed Formula:**

For study areas with circuit miles greater than zero and circuit miles per circuit less than or equal to 100:

Settlement = ($0.493290 x Circuit Miles) + ($0.001736 x Access Minutes)

For study areas with circuit miles per circuit greater than 100:

Settlement = ($0.493290 x 100 x Circuits)
+ $0.044385 x (Circuit Miles - (100 x Circuits))
+ ($0.001736 x Access Minutes)

**LINE HAUL NON-DISTANCE SENSITIVE FORMULA:**

**Current Formula:**

For study areas with interstate circuit terminations per exchange less than 122:

Settlement Per Interstate Circuit Termination =
$32.98 - $0.111640 x Terminations Per Exchange

For study areas with interstate circuit terminations per exchange greater than or equal to 122:

Settlement Per Interstate Circuit Termination = $19.36

**Proposed Formula:**

For study areas with interstate circuit terminations per exchange less than 161:

Settlement Per Interstate Circuit Termination =
$28.98 - $0.076995 x Terminations Per Exchange

For study areas with interstate circuit terminations per exchange greater than or equal to 161:

Settlement Per Interstate Circuit Termination = $16.58

**TRAFFIC SENSITIVE TRANSPORT FORMULAS:**

**Current Formula:**

Traffic Sensitive Transport = (1 – 0.337068) x {Line Haul Distance Sensitive Formula
+ Line Haul Non-Distance Sensitive Formula
+ Intertoll Switching Formula}

**Proposed Formula:**

Traffic Sensitive Transport = (1 – 0.266078) x {Line Haul Distance Sensitive Formula
+ Line Haul Non-Distance Sensitive Formula
+ Intertoll Switching Formula}

**SPECIAL ACCESS FORMULA:**

**Current Formula:**

For study areas with Special Access Revenues per Exchange less than 2,435:
Settlement = [Special Access Revenues x $0.843811 x
(2.0 -0.000411 x Special Access Revenues per Exchange)] x Tariff Rate Index

For study areas with Special Access Revenues per Exchange greater than or equal to 2,435:
Settlement = Special Access Revenues x $0.843811 x Tariff Rate Index

Tariff Rate Index = 1/ (1+ Tariff Special Access Relative Rate Change Since 12/02)

**Proposed Formula:**

For study areas with Special Access Revenues per Exchange less than 2,560:
Settlement = [Special Access Revenues x $0.846589 x
(2.0 - 0.000391 x Special Access Revenues per Exchange)] x Tariff Rate Index

For study areas with Special Access Revenues per Exchange greater than or equal to 2,560:
Settlement = Special Access Revenues x $0.846589 x Tariff Rate Index

Tariff Rate Index = 1/ (1+ Tariff Special Access Relative Rate Change Since 12/03)

**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 Formula:**

Traffic Sensitive Factor = 0.752116 + (2.203413 x ROR)

**Proposed Formula:**

Traffic Sensitive Factor = 0.765003 + (2.088862 x ROR)

## EQUAL ACCESS IMPLEMENTATION FORMULA:

### Current Formula:

The interstate portion of initial incremental equal access expenses paid in the month in which they are incurred and 0.0247 x (the interstate portion of initial incremental equal access investment) per month for 96 months.

### Proposed Formula:

The interstate portion of initial incremental equal access expenses paid in the month in which they are incurred and 0.0247 x (the interstate portion of initial incremental equal access investment) per month for 96 months.

## SIGNALING SYSTEM 7 FORMULAS:

### Current Formula:

| | |
|---|---|
| Settlement = $1,346 | For each end office with SP or SSP equipment in service with full connectivity to the nationwide Signaling network. |
| Settlement = $716 | For each end office with SP or SSP equipment in service not yet having full connectivity to the nationwide Signaling network. |

### Proposed Formula:

| | |
|---|---|
| Settlement = $1,182 | For each end office with SP or SSP equipment in service with full connectivity to the nationwide Signaling network. |
| Settlement = $659 | For each end office with SP or SSP equipment in service not yet having full connectivity to the nationwide signaling network. |

## NETWORK ADMINISTRATION FORMULA:

### Current Formula:

The incremental interstate costs of inter-company charges for network administration, as approved by the Commission for recovery by cost companies.

### Proposed Formula:

The incremental interstate costs of inter-company charges for network administration, as approved by the Commission for recovery by cost companies.

# 2004 Modification of Average Schedules
## Glossary

| Term | Definition |
|---|---|
| Access Line | An end of period 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.). Inclusion of public pay telephone is effective April 1997. Prior to April 1997, public pay telephones are excluded from access line counts. For average schedule settlements reporting, beginning July 1, 2002, each BRI ISDN line counts as one access line and each PRI ISDN line counts as five access lines. |
| Access Line Factor | The component of the Traffic Sensitive Central Office Formula that compensates for the higher Local Switching Revenue Requirement per Minute, including DEM weighting, incurred by study areas with less than 10,000 access lines. It ensures that smaller study areas receive relatively higher settlements per minute and per exchange than larger companies. (See Section VII.E.2.a, b and d for formula.) |
| Access Minute | For average schedule companies, 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.<br><br>For cost companies, who did not report monthly traffic sensitive switched access minutes to NECA prior to July 2003, access minutes are derived from reported premium common line minutes. NECA derived a simple regression model from data reported by average schedule companies. Using this model, NECA then calculated traffic sensitive switched access minutes for each sample cost study area. (See Section III.E.1.d for calculation.) |
| Access Link (A-link) Pair | A communications path that connects a Signaling System 7 (SS7) switching office or Consolidation Point (CP) to its home Signaling Transfer Point (STP). A-links are always installed in pairs from an SS7 switching office or CP, with one to each "mated" STP. |
| Access Market Survey | A bi-annual survey, conducted by NECA, that studies the deployment of fiber optics, digital switching, Signaling System 7 (SS7), Integrated Services Digital Network (ISDN), Digital Subscriber Line (DSL) and other services by small telephone companies that participate in the NECA Traffic Sensitive pool. |
| Allocation Models | Statistically derived formulas used in NECA's average schedule studies to determine the interstate portion of a statistical sample of average schedule accounts assigned to access elements, as mandated by Part 69 of the Commission's rules. |
| Average Effective Tax Rate | The weighted average effective Federal Income tax rate from 2001 Sample Cost studies. |

# 2004 Modification of Average Schedules
## Glossary

| Term | Definition |
|---|---|
| Average Revenue Requirement Growth Ratio | The ratio of the sum of weighted 2001 unseparated revenue requirements to the sum of weighted 2000 unseparated revenue requirements using data from all average schedule study areas in the 2002 Sample. |
| Average Schedule Company Settlement Statements (AS3000) | The reports created by NECA that display an average schedule company's monthly net settlement computation, using estimates or adjustments provided by the company. Net settlement is the difference between gross settlement calculated using average schedule settlement formulas, and earned revenues, which include Access Charge revenues. The report also show distributions from Long Term Support (LTS) and Local Switching Support (LSS) funds. |
| Average Schedule USF Expense Adjustment | Amounts distributed to qualified average schedule companies pursuant to FCC rule Part 36.631 derived from the Universal Service Fund average schedule formula developed by NECA to estimate the loop costs of average schedule companies. Universal Service Administrative Company (USAC) transfers the Universal Service Support amounts by study area to NECA for distribution as part of the monthly settlement process. |
| Baseline Cost per Minute | The average monthly central office revenue requirement per minute among average schedule study areas having more than 10,000 access lines. This is used in developing the Access line Factor for each study area.<br><br>$$BaselineCost\ per\ Minute = \frac{\sum_{i=1}^{n}\left(SampleWeight_i \quad x \quad MonthlyCentralOffice\ RevenueRequirement_i\right)}{\sum_{i=1}^{n}\left(SampleWeight_i \quad x \quad Access\ Minutes_i\right)}$$<br><br>n = The number of average schedule study areas in the sample having more than 10,000 access lines. |
| Basic Cost per Minute | The Basic Cost per Minute for each minutes per line band (j) was used to develop the Initial Central Office formula.<br><br>For each band, the Basic Cost per Minute was calculated as:<br><br>$$Basic\ Cost\ per\ Minute_j = \frac{Central\ Office\ Revenue\ Requirement\ per\ Access\ Minute_j}{Model\ Access\ Line\ Factor_j}$$ |
| Carrier Access Billing System (CABS) Cost Model | The CABS model is developed by applying ordinary regression methods to the interstate CABS portion of service expenses reported in sample cost studies. Calculation for CABS Cost can be found in Section VII.E.1. |
| Common Line TIC Shift Factor | The fraction of transport settlements paid from the common line pool pursuant to the MAG Order. |

# 2004 Modification of Average Schedules
## Glossary

| Term | Definition |
|---|---|
| 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 the combined effects of prior period adjustments. In addition, these reports show distributions from the Universal Service Long Term Support and Local Switching Support Funds. |
| Cost Study Database | A database created by NECA that contains cost study account data separated to the interstate jurisdiction and allocated to access categories by NECA's Cost Study program for companies which settle with NECA based on individual cost. |
| Customer Database | A database, administered by NECA, that contains 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.). |
| Cutoff Point | A value used to distinguish an influential data point versus a non-influential data point. |
| Data Projections | The amounts calculated to represent a level of an account or demand variable of a sample study area, in a period usually the test period later than the historical period, from which the supporting data was taken. |
| 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 *ith* observation before/after deleting the *ith* observation. |
| Equivalent Circuit Miles | A composite of normal route and long route circuit miles used in the Line Haul Distance Sensitive regression model. Equivalent Circuit Miles is defined as normal route circuit miles added to the product of the Long Route Relative Cost Ratio and long route circuit miles. |
| 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. |
| High Lines Per Exchange Multiplier | A factor used in the Common Line formula that accounts for the lower cost per line of the large lines per exchange study areas. $High\ Lines\ Per\ Exchange\ Multiplier = 0.8975$ |
| High Traffic Volume Period | A high traffic volume period is the most recent calendar year, either 1999 or 2000 for the 2001 data collection, or 2000 or 2001 for the 2002 data collection, when the minutes of use per line per month of a sample average schedule company exceed 338. |

# 2004 Modification of Average Schedules
## Glossary

| Term | Definition |
|---|---|
| High Traffic Volume Threshold | A value of minutes per line which divides access minutes into groups for distinct settlement calculation methods. The High Volume Thresholds in the proposed Traffic Sensitive Central Office formula are at 330, and 850 minutes per line. |
| Initial Central Office Formula | The Traffic Sensitive Central Office Formula prior to the addition of CABS costs. |
| Interstate Circuit | One of the settlement variables in the distance sensitive line haul formula, obtained by a circuit count allocation method described in Section 7 of the Average Schedule Pool Administration Procedures. |
| Interstate Circuit Miles | The interstate allocation of the number of miles of circuits carrying interstate switched access traffic defined according to NECA's average schedule settlement procedures. |
| Interstate Switched Circuit Terminations | The interstate allocation of the number of terminations of circuits carrying interstate switched access traffic defined according to NECA's average schedule settlement procedures. |
| Line Haul Route | For Line Haul settlement purposes, a route is defined as the path that carries a switched line haul circuit from its origin switch to its destination switch or destination Point of Connection (POC). The origin and destination switch on a route must have switch ports assigned to circuits on the route. The destination POC must be the point of interconnection with an IC. An office that only provides a cross connect function for the circuit without hand-off to another carrier can not be the origin or destination of a route. Carriers may choose to separately identify routes to operator services facility locations for operator handled traffic for Line Haul settlements reporting. Examples of Line Haul route identification are: End Office to End Office, End Office to Tandem or POC, Remote to Host, Host to Tandem or POC, Intermediate Tandem to Access Tandem, Access Tandem to IXC Tandem or POC, Tandem to Operator Services Location. |
| Line Port Shift Factor | The fraction of central office settlements paid from the common line pool pursuant to the FCC's MAG order of November 8, 2001. |
| Local Switching Support Fraction | The ratio of average schedule local switching support to the central office settlement (excluding CABS costs). Eight fractions, depending on access line size and access minutes per line, are included in NECA's local switching support average schedule formula. |
| Local Switching Support Payment | The portion of the local switching settlement that is recovered through the new universal service fund effective January 1, 1998. The balance of the settlement is recovered through NECA's local switching access charges. Prior to January 1, 1998, the support amount was determined under the FCC's DEM weighing rules and recovered through access charges. |
| Long Route Circuit Miles | The difference between Interstate Circuit Miles and Normal Route Circuit Miles. |
| Long Route Relative Cost Ratio | A ratio of long route cost to normal route cost, where the numerator is determined using network company cost data, and the denominator is the Preliminary Normal Route Cost. |

# 2004 Modification of Average Schedules
## Glossary

| Term | Definition |
|---|---|
| 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. |
| Minutes per Line | A ratio computed to develop and administer the Traffic Sensitive Central Office Formula. $$Minutes\ per\ Line = \frac{Monthly\ Access\ Minutes}{Access\ Lines}$$ |
| Month Sequence | A variable sequentially assigned to each month of a time series, and is used as an independent variable in modeling demand. |
| Normal Route Circuit Miles | The Interstate Circuit Miles, used to carry interstate switched access traffic, up to but not exceeding 100 miles per Interstate Circuit. |
| Neyman Allocation | A method of allocating the sample size to each stratum that determines the size of the sample in each in proportion to strata standard deviation. |
| 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 2001 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. |
| Preliminary Normal Route Cost | The Line Haul Distance Sensitive cost per normal route circuit mile determined by regression based on companies without long routes only. This cost of $0.485675 does not yet take into account the data from study areas with both normal routes and long routes. It is used to develop the Long Route Relative Cost Ratio. |
| "Precision" or "Precision of Sample Estimates" | A measure of how close an estimate derived from sample data is expected to come to the value that would have been computed by examining the entire population of study areas. |
| 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. |
| Rate of Return Adjustment Factor | A monthly adjustment factor used to convert special access earned revenues from the achieved rate of return to the authorized rate of return. |

# 2004 Modification of Average Schedules
## Glossary

| Term | Definition |
|---|---|
| Relative Interstate DEM | The ratio of a study area's unweighted Interstate Dial Equipment Minutes (DEM) to its unweighted Total DEM Minutes. |
| Revenue Requirement | The amount recoverable from interstate tariff charges, providing for expenses, taxes and a return on investment at the authorized rate of return. |
| Route Miles | The sum of lengths of the facilities on a line haul route owned or leased by an exchange carrier for the transport of interstate switched access traffic measured from switching point to switching point, or from switching point to point of connection. |
| 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. |
| 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. |
| Settlement Analysis Workpaper | A report prepared annually by NECA that compares a study area's current and proposed settlements, assuming constant 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 Average Retention Ratio | An overall average special access retention ratio computed from average schedule sample data. |
| Special Access Basic Retention Ratio | A component of the special access average retention ratio not attributed to the Revenue Size Factor Model. |
| Special Access Revenues | The amount charged for all Traffic Sensitive Interstate Special Access rate elements. |
| Special Access Revenue Size Factor Model | A statistically derived model that determines a relationship between special access relative cost and company size. |
| 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 strata of the 2002 Sample. |
| Stratified Composite Growth Ratio | An account's annual growth ratio calculated by combining growth ratios from consecutive annual samples. |

# 2004 Modification of Average Schedules
## Glossary

| Term | Definition |
|---|---|
| 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 strata of the 2001 and 2002 Samples to the test period. |
| Test Period | A future time period when the average schedule formulas are proposed to be effective. The test period for the 2004 Modification of Average Schedules is July 1, 2004 through June 30, 2005. |
| TIC Shift Factor | The fraction of transport settlements paid from the common line pool pursuant to the FCC's MAG order of November 8, 2001. |
| Total Conversation Minutes | A factor developed as part of a cost separations study and used to determine the portion of some facility costs to be assigned to the interstate jurisdiction. |
| 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 proportionate share of 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 the actual paid *regulated* 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. |
| Universal Service Loop Cost Formula | A formula filed by NECA with the FCC each year as part of the annual Modification to the Average Schedules, used to calculate an unseparated loop cost for each average schedule company. An average schedule company receives USF compensation if its formula value exceeds 115% of the nationwide average cost per loop. The formula is included in NECA's October USF Data Submission. |
| Variance Weight | A multiplier, which is in inverse proportion to its contribution to total model variance, applied to influential points such that the impact of influential data on a regression model is minimized. |