Review of the Pacific Bell and Nevada Bell CPR Statistical Audit Plan

Ernst and Young has been retained by Southwestern Bell Telephone Company, Pacific Bell and Nevada Bell (the "SBC BOCs") to review the FCC's draft audit reports of the continuing property records of the BOCs on their behalf. E&Y was to identify significant errors and omissions from a statistical and processing standpoint, subject to the Nondisclosure Commitment dated July 20, 1998.

This report provides details of E&Y's findings in its analysis of the sampling plan used by the FCC for the Current Property Records (CPR) audit of Pacific Bell and Nevada Bell Telephone Companies – the Pacific Telesis group henceforth referred to as Pacific. Specifically, there is a discussion of four issues:

- an inappropriate choice of sample design;
- the incorrect calculation of margins of error;
- many sources of bias that affect the estimates; and
- the lack of a two-way audit.

After discussing each of the above issues, we provide a comparison of calculations we have made with those published in the FCC's draft report. We conclude that the FCC's estimates contain biases and are inaccurate. Given these deficiencies, we believe the amounts reported by the FCC as overstated investment are unsound and cannot be fairly relied upon. To set the tone for these discussions, we first provide some definitions and describe the notation that will be used in the equations that will follow.

Definitions and Notation

- The population of interest is the central office hardwire records of the current property record (CPR) database of Pacific as of June and July 1997.

  Denote the total number of such records in this population by M_0.

- We shall refer to a record in the CPR database as a line item.

- A central office location is denoted by the first eight characters of the Common Language Location Indicator (CLLI). We will henceforth refer to each central office location as a CLLI.

- For the audit, CLLIs are divided into L groups or strata.

- A line item belongs to one, and only one CLLI.

- For each $h = 1,\ldots,L$ of the CLLI strata, let

  N_h = the number of CLLIs in stratum h,

  n_h = the number of CLLIs selected for the audit in a sample from stratum h,

  M_h = the total number of line items across all CLLIs in stratum h,

  M'_h = the total number of line items in all CLLIs selected for the audit within stratum h, and

  m_h = the total number of line items selected for the audit in stratum h.

  Note that $$M_0 = \sum_{h=1}^{L} M_h .$$

- Within stratum h ($h = 1,\ldots,L$), let

  M_{hi} = the number of records in CLLI i ($i = 1,\ldots,N_h$) of stratum h, and

  36 = the number of FCC sampled line items in the selected CLLI of stratum h.

  Note that $$M_h = \sum_{i=1}^{N_h} M_{hi} ,$$

  $$M'_h = \sum_{i=1}^{n_h} M_{hi} \text{ , and}$$

  $$m_h = 36 \cdot n_h .$$

- Within CLLI i ($i = 1,\ldots,N_h$ when referring to the whole population, or $i = 1,\ldots,n_h$ when referring to the sample of locations for the audit) of stratum h ($h = 1,\ldots,L$), let

  y_{hij} denote the observed value for line item j ($j = 1,\ldots,M_{hi}$ for the population of line items, but $j = 1,\ldots,36$ for line items chosen for the audit) within CLLI i of stratum h. For example: if you are interested in the number of compliant line items, then y_{hij} is either 0 or 1 when a line item is either non-compliant or compliant; or if you are interested in the total in-place cost for line items that can't be located, then y_{hij} is the in-place cost of a line item that cannot be located, and zero otherwise.

Sample Design Considerations

A sample design is the plan for choosing items for a sample. According to the draft report, the CPR hardwire audit conducted by the FCC used a two-stage, stratified cluster design. This was accomplished via the following steps:

1. The total number of hardwire line items for the audit sample was determined to be 1082.
    - The methodology for determining this assumed a simple random sample would be taken at both stages.
    - The criterion for determining the sample size was a desire to have a margin of error for the proportion of compliant line items of at most 0.025.
    - It appears to have been implicitly assumed that the degrees of freedom of the estimator would be large enough to use normal distribution theory.
2. It was determined that auditors would try to find the property corresponding to 36 randomly chosen line items within each randomly selected central office location.
3. The number of central office locations needed for the audit was determined to be 30, the result of dividing 1082 by 36 and truncating to an integer.
4. The sampling frame was determined as follows.[1]
    - All line items were clustered within locations that were determined by eight character CLLI codes.
    - After removing non-hardwire records, line item counts were done for each CLLI.
    - CLLIs with fewer than 100 line items were discarded and the remaining CLLIs were considered to be central offices.
5. The CLLIs in the frame were divided into 11 strata based on the number of line items.
6. The sample size of 30 CLLIs was allocated across the strata proportionately to the total number of records in each stratum.[2] After adjusting the resulting number to be integers that added up to thirty, any stratum that was allocated fewer than two CLLI selections had its allocation increased to two.[3] This increased the total number of CLLIs in the sample to 34. In turn, this increased the total number of line items for the audit to $34 \cdot 36 = 1{,}224$.
7. Within each stratum, CLLIs were randomly selected according to the allocation plan in step 6.

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[1] This is not described in the draft report. This procedure was described by the FCC staff to SBC, and subsequently relayed to us.

[2] The draft report states that Neyman allocation was used. It does not state what was used as each stratum's variance, S^2_h. We suspect that the variance of the proportion of all compliant line items in the stratum was used with the proportion set at 0.5. If so, the variances are treated as being the same across all strata, and the allocation becomes proportionate to record counts. Our own calculations using proportionate record counts allocation produce results which are consistent with those published in the summary table on page 7 of the draft report's Appendix B.

[3] See footnote 17 of Appendix B in the FCC's July 20, 1998 draft report (concerning advice from Census Bureau staff), and discussions with SBC personnel, we believe that the increase to 2 locations in a stratum was done after many of the first 30 locations had been visited.

8. For each CLLI selected in step 7, thirty-six line items were randomly selected for the audit.[4]

While this sample design can be used to calculate estimates of many different population quantities, most estimates produced from it will not have very good precision. Major decisions for the design were based on the desire for a precise estimate of the proportion of compliant records. These included:

- determining the total number of line items for the audit;
- allocation of the total number of CLLIs across strata; and to some extent,
- the division of CLLIs into strata.

Even at that, the sample design does not produce the desired effect – a margin of error of at most 0.25 for the estimate of the proportion of compliant line items. This is due to the fact that the effect of clustering – sampling line items within a CLLI – was not taken into account at the design stage. Instead methods based on simple random sampling were used – even though the design is more complex than a simple random sample. For an account of how to design a complex sample so that a planned precision can be approximately achieved see Chapter 8 of Kish.[5]

Furthermore, if a precise estimate of the total in-place cost associated with non-locatable line items is desired, then the sample design should take this into account. Selecting CLLIs proportional to the total in-place cost of each CLLI, and stratification based on in-place cost are two concepts that may help reduce the variance of in-place cost related estimators. For more on audit sampling issues, see "Statistical Models and Analysis in Auditing."[6]

As a general rule, the precision of dollar value estimators is much more sensitive to design decisions than are proportion estimators. By this we mean that a design made for a precise dollar estimator will most likely produce a proportion estimate with acceptable precision. The reverse of this is seldom true. Additionally, more CLLIs need to be selected in order to use normal approximation theory. This issue will be discussed more fully in the next section.

Finally, if the FCC wanted to make conclusions about California and Nevada separately, then they are using the wrong approach. The FCC design does not support state-by-state estimation as presently structured.

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[4] From footnote 18 of the draft report Appendix B, we know that when the audit team arrived at the central office location, if it was determined that the property associated with a line item was "too hard-to-get-to," another line item was substituted. This line item was the one that preceded the randomly selected item in the CPR listing. This has the potential to introduce bias into estimates.

[5] Kish, L. (1965). *Survey Sampling*. John Wiley & Sons, New York.

[6] National Academy of Sciences, Panel on Nonstandard Mixtures of Distributions (1989). Statistical Models and Analysis in Auditing. *Statistical Science*, **4**, No. 1, pp. 2-33.

Instead of taking the FCC's approach, a state stratification should have been done. The whole CLLI sample size would then have been allocated according to a two-way stratification (by state and with the original strata). Just as with the single stratification, every stratum would need at least two CLLIs allocated to it. A minimum of two CLLIs are needed to calculate the variance. More than this minimum may be needed to obtain adequate precision for a particular state. Since this was not done, the FCC will not be able to produce precise estimates at the state level, even though they made sure that every state was represented in the sample. The sample that the FCC has drawn is not representative by state.

Margin of Error

The margin of error is a measure of the precision of an estimator. It is usually the plus/minus part of a confidence interval of the form:

$$\tilde{X} \pm t \cdot s(\tilde{X}),$$

where $\tilde{X}$ is an estimator of some population quantity X, e.g., the total number of compliant line items in the CPR, or the total in-place cost associated with missing property. The quantity $s(\tilde{X})$ is the standard error of the estimator, and t is a multiplying factor that is determined by the distribution of the standardized quantity

$$\frac{\tilde{X} - X}{s(\tilde{X})},$$

and the confidence that one wants to have in the estimate. Typically, t is a percentile of the standard normal distribution or Student's t distribution. Most basic statistics books have tables for finding these values. Statistical software and spreadsheet programs can also be used.

Following the discussion in Cochran,[7] if $\tilde{X}$ has a normal distribution with mean X, and $s(\tilde{X})$ is well determined, then t comes from the standard normal distribution. These are two very important assumptions, and if they are not true, other types of error bounds need to be calculated using more advanced techniques.

The more well known situation occurs when $\tilde{X}$ has a normal distribution, but the sample size is not large enough for $s(\tilde{X})$ to be well determined. In this case, the degrees of freedom need to be considered, and Student's t distribution is used to find the multiplying factor.

[7] See Cochran, W. G. (1967). *Sampling Techniques*, 3rd ed. Wiley, New York. Pp. 95 -96.

In a situation where stratification has been used, one needs to consider the degrees of freedom provided by each stratum. The distribution of $s(\tilde{X})$ is in general too complicated to simply compute the degrees of freedom for each stratum in the usual way – taking the CLLI sample size within the stratum minus one, i.e., $(n_h - 1)$ – and then add them up across all strata. An approximate method of assigning an effective number of degrees of freedom to $s(\tilde{X})$ has been worked out by Satterthwaite.[8]

Let $v(\tilde{X})$ be the total variance of the estimator, and $v_h(\tilde{X})$ the component of $v(\tilde{X})$ from stratum h. Then the effective degrees of freedom can be approximated as

$$n_e = \frac{\{v(\tilde{X})\}^2}{\sum_h \frac{\{v_h(\tilde{X})\}^2}{n_h - 1}}.$$

The value of n_e always lies between the smallest of the values $(n_h - 1)$ and their sum. For the audit described in the draft report, this value will lie between 1 and 23. Such values are too small for the normal distribution to be used.

Why is it that the central limit theorem does not apply when there is a relatively large total sample size of line items (1,224)? This is due to the two-stage design. The variance between CLLIs contributes much more towards total variance than the variances within CLLIs. Thus, the number of locations chosen plays an important role, and this number was chosen to be relatively small in the FCC sample design.

In the calculation section below, we show that the effective degrees of freedom is in the range 2 to 11, depending on the estimation method used and the scoring of the property records audited.

The draft report uses the multiplying factor 1.96, obtained from the standard normal distribution for a 95 percent two-sided confidence level. The table below shows the multiplying factor associated with different confidence levels from Student's t distribution with different degrees of freedom.

[8] Satterthwaite, F. E. (1946). An approximate distribution of estimates of variance components. *Biometrics*, 2, pp. 110-114.

Degrees of Freedom n_e	One Sided Confidence Bounds		Two Sided Confidence bounds	
	95%	99%	95%	99%
2	2.920	6.965	4.303	9.925
5	2.015	3.365	2.571	4.032
8	1.860	2.896	2.306	3.355
11	1.796	2.718	2.201	3.106

Notice that the multiplying factors for two-sided bounds at 95 percent confidence are larger than the value from the normal distribution – namely, 1.96. Thus, the reported margin of error for all estimates in the draft report needs to be increased.

The above analysis is only useful if the underlying distribution of the estimator is normally distributed. The estimator of the proportion of compliant records would certainly be normally distributed under this design – although this should be confirmed. On the other hand, normality might not hold true for estimators associated with dollar values. Very often the dollar values of a collection of items, such as the property records, are highly skewed, i.e., there is a relatively large number of small valued items, and a relatively small number of extremely large valued items. The distribution of an estimator based on a small sample size from such a population is usually skewed as well. Hence, it is not normal.

To learn more about the distribution of an estimator for dollar values, we conducted a simulation experiment that estimated the total in-place cost of the Pacific hardwire line item population under study. This was done as follows:

1. Define a frame of CLLIs for which the total number of line items, and the total in-place cost is known. The frame should be divided into 11 strata just like the frame the FCC used for sampling. We were unable to create a sampling frame that produced a summary table exactly the same as that given in Appendix B, page 7, of the draft report. For a summary of the frame we did use, and how it compares to the frame used by the FCC for the audits, see Table 1 at the end of this appendix. In our view the two are reasonably close.
2. Randomly select n_h out of the N_h CLLIs within each stratum, and record C_{hi}, the total in-place cost for selected CLLI i in stratum h.
3. Estimate the total in-place cost using

$$\hat{C}_R = \sum_{h=1}^{L} \frac{M_h}{M'_h} \sum_{i=1}^{n_h} C_{hi} \ .$$ [9]

[9] This estimator and the mean squared error equation that follows are equivalent, at the CLLI level, to the ones the FCC published in Appendix B of the draft audit report. See the next section for a full description of the estimator.

4. Estimate the mean squared error of $\hat{C}_R$ using

$$v(\hat{C}_R) = \sum_{h=1}^{L} \left(\frac{N_h^2(1-f_{1h})}{n_h} \cdot \frac{\sum_{i=1}^{n_h} M_{hi}^2 \left(\bar{c}_{hi} - \hat{\bar{\bar{C}}}_{Rh} \right)^2}{n_h - 1} \right), \text{ where}$$

$$\bar{c}_{hi} = \frac{1}{M_{hi}} C_{hi}$$

$$\hat{\bar{\bar{C}}}_{Rh} = \frac{1}{M'_h} \sum_{i=1}^{n_h} C_{hi}, \text{ and}$$

$$f_{1h} = \frac{n_h}{N_h}.$$

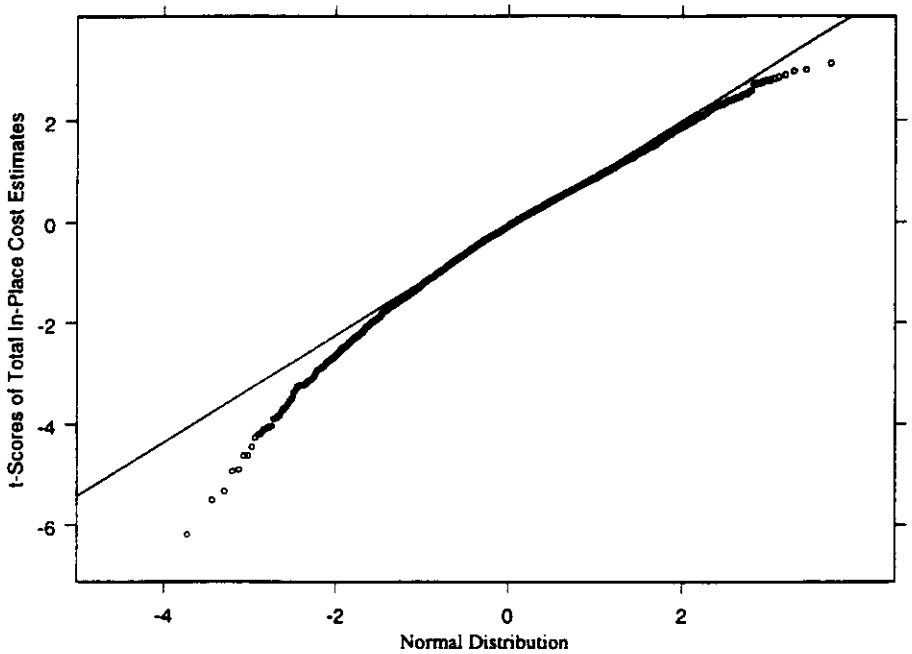
5. Calculate a t-score for the estimate, i.e., find the error in each estimate, $\hat{C}_R$ - C, where C is the known total in-place cost, and divide the error by $\sqrt{v(\hat{C}_R)}$.
6. Repeat steps 2 through 5 a large number of times. In our case we did 5,000 runs.

While this simulation does not perform an evaluation of the exact estimator the FCC used to estimate values the audit was interested in, it does provide information about how well the type of estimator that was used performs in estimating the in-place cost associated with non-locatable line items. This is because the simulation looks at estimates of a similar quantity, total in-place cost.

The simulation results give us an indication of how to proceed with determining a one-sided lower confidence bound by examining the distribution of the 5,000 realizations of the t-scores. We first compare the t-score distribution with a normal distribution via a normal q-q plot. This plot provides a powerful, visual comparison of the estimated quantiles of the t-scores with the same quantiles of a standard normal distribution. If the t-scores come from a normal (or nearly normal) distribution, then the resulting plot should look like a straight line. We follow Cleveland's[10] method of presentation where a reference line passing through upper and lower quartiles is "superposed" on the graph.

[10] Cleveland, W. S. (1993) *Visualizing Data*. Hobart Press, Summit, New Jersey.

Normal Q-Q Plot for t-Scores of $\hat{C}_R$



This plot tells us that the lower (left) tail of the distribution is much heavier than that of a normal distribution – much like Student's t distribution. However the upper (right) tail is slightly thinner than that of a normal distribution.

To find multipliers for the root mean squared error so that we can obtain one-sided lower confidence bounds, we can use the 1 percent or 5 percent quantiles of the t-score distribution. These are presented below.

Item	1%	5%
t-score	-3.177	-2.101

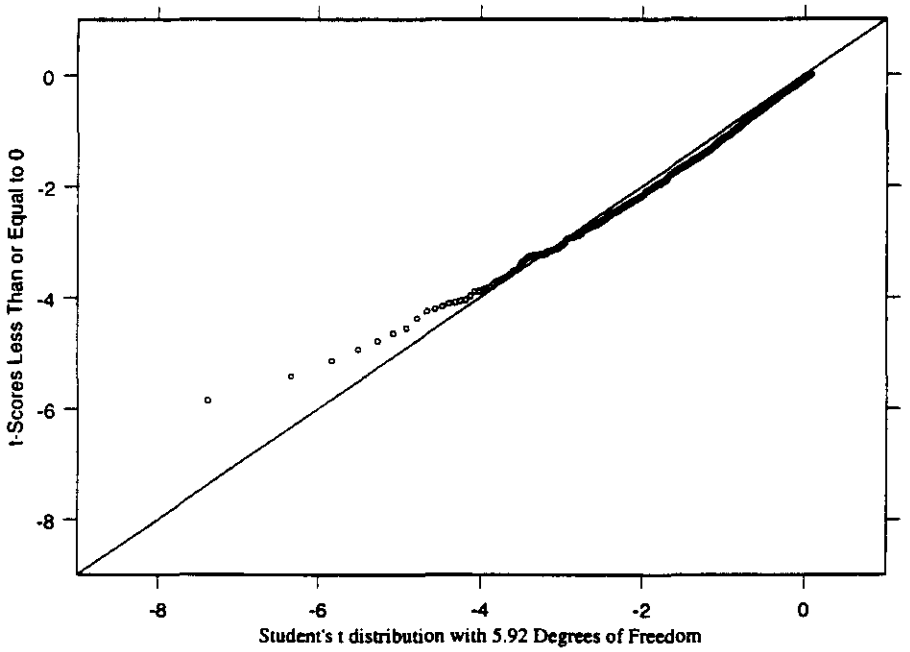
We can also use the results to answer the following questions.

1. Can Student's t distribution be used to find the multiplying factor for determining a lower confidence bound?
2. Is the Satterthwaite approximation for the effective degrees of freedom good?

To answer the first question, we proceeded by first identifying the degrees of freedom for a Student's t distribution that fit the lower tail of the t-score distribution. This was done by finding a least squares fit between the quantiles of the t-scores and a t distribution. We found that a t distribution with 5.92 degrees of freedom provides a least squares fit. To evaluate this fit, we compared the quantiles of the t-scores with those of a t distribution via the q-q plot shown below.

The fit does not appear to be very good, especially in the extreme region of the lower tail. Thus, we conclude that Student's t distribution is not adequate for finding the margin of error.

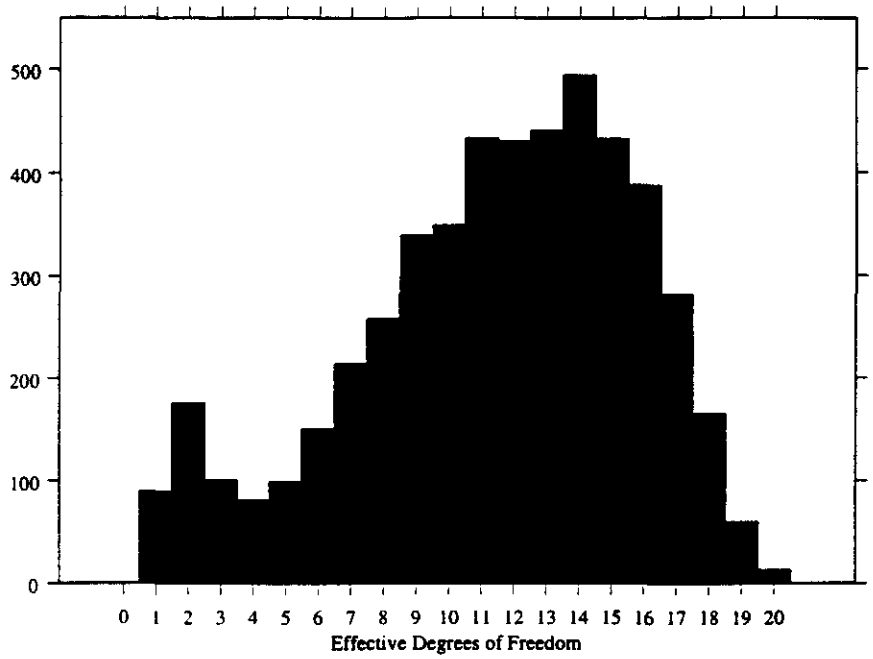
Student's t Q-Q Plot for t-Scores of $\hat{C}_R$



Even though it appears that the t distribution should not be used, it is still useful to examine the Satterthwaite approximation, since we will still rely on it for the margin of error associated with proportion estimates.

To determine how well the approximation performs, we calculated the effective degrees of freedom for each of the 5,000 realizations of $\hat{C}_R$. The distribution is very wide, and possibly bimodal (one mode around 2 the other around 14). The overall distribution has a mean of 11.4 with a standard deviation of 4.3. Thus, the Satterthwaite effective degrees varies quite a bit from sample to sample, and may not capture the true nature of the distribution that determines the multiplying factor for a margin of error.

Histogram of 5,000 Realizations of the Effective Degrees of Freedom



In light of the simulation results, we computed lower bounds for the FCC's biased estimates of dollar values using the appropriate quantile of the t-score distribution given above, e.g., a t value of -3.177 for the 99 percent lower bound. We do not know if this analysis is compatible with proportion estimation.

More advanced techniques such as balanced repeated replication, or the jackknife can also be used to determine error bounds in these more complex situations.[11] We will not go into these methods here, since we believe our point about the increase in the size of the margin of error has been made.

Once a correct approach is found for calculating error bounds, we would argue that a one-sided lower confidence bound should be used as the value assessed to be in error, e.g., the total in-place cost of non-locatable line items, or the proportion of non-compliant records. This is because only values smaller than the lower bound are, statistically speaking, significantly different from values above the lower bound The IRS uses such a rule for its audit findings.[12]

Also, if one is going to take a conservative approach, the confidence level for this bound should be set at 99 percent. This practice attempts to take into account the uncertainty

[11] See Cochran, chapter 11, sections 18 - 20. See also, Wolter, K. M. (1985). *Introduction to Variance Estimation*. Springer-Verlag, New York.

[12] The IRS uses a lower bound approach in their audit findings. In fact, the IRS calculates estimates in three ways. The method that produces the smallest margin of error is used, and the 95 percent lower bound of the method chosen is the amount assessed.

caused by various unquantifiable errors introduced into both the sampling and audit processes. In other words, as far as the FCC estimates of dollar values are concerned, use of a 99 percent lower bound of the proper confidence interval would be the prudent approach.

Given the errors discussed above and the biases to be discussed below, the amounts reported by the FCC as overstated investment are unsound and cannot be fairly relied upon. Our professional opinion is that the FCC's estimates are inaccurate.

Sources of Bias that Affect the Estimates

Several forms of bias are present in the estimates supplied in the draft report. These include:

- the use of a statistically biased estimator,
- bias caused by substituting CLLIs and line items for undesirable ones that turned up in the sample, and
- biases induced by weaknesses in audit controls.

The effect of each of these biases varies in its degree of severity. The total effect may be significant; it certainly brings up legitimate concerns for the accuracy of the audit results. We address each in turn below.

Estimator Bias

The estimator used by the FCC is statistically biased. The FCC estimator can be useful in many situations, since it may have a smaller mean squared error than the standard unbiased estimator. The formula for this FCC estimator of a total population value is given by

$$\hat{Y}_R = \sum_{h=1}^{L} \frac{M_h}{M'_h} \sum_{i=1}^{n_h} \frac{M_{hi}}{36} \sum_{j=1}^{36} y_{hij} = \sum_{h=1}^{L} \frac{M_h}{M'_h} \sum_{i=1}^{n_h} M_{hi} \bar{y}_{hi} = \sum_{h=1}^{L} \hat{Y}_{Rh}, \text{ where}$$

$$\hat{Y}_{Rh} = \frac{M_h}{M'_h} \sum_{i=1}^{n_h} M_{hi} \bar{y}_{hi}, \text{ and}$$

$$\bar{y}_{hi} = \frac{1}{36} \sum_{j=1}^{36} y_{hij}.$$

If y_{hij} is the in-place cost of an audited line item that was not located and zero otherwise, then $\hat{Y}_R$ is an estimator for the total in-place cost of non-locatable line items. On the other hand, if y_{hij} is one or zero depending on whether or not an audited line item is or is not compliant, then $\hat{Y}_R$ is an estimator for the total number of compliant line items in the

population. If this is divided by M_0 then we have an estimator for the proportion of compliant line items in the population.

In order to judge the precision of an estimator, statisticians usually look at the variance of the estimator, or its square root – the standard error of the estimator. For a biased estimate, the variance does not capture the precision of the estimator with respect to the true value of the population that is being estimated. The more appropriate measure is the mean squared error of the estimator, and its square root – referred to as the root mean squared error.

An approximate sample estimate for the mean squared error for this estimator is given by

$$v(\hat{Y}_R) = \sum_{h=1}^{L} \left(\frac{N_h^2(1-f_{1h})}{n_h} \cdot \frac{\sum_{i=1}^{n_h} M_{hi}^2 \left(\bar{y}_{hi} - \hat{\bar{\bar{Y}}}_{Rh} \right)^2}{n_h - 1} + \frac{N_h}{n_h} \sum_{i=1}^{n_h} \frac{M_{hi}^2 (1-f_{2hi}) s_{2hi}^2}{36} \right), \text{ where}$$

$$\hat{\bar{\bar{Y}}}_{Rh} = \frac{\hat{Y}_{Rh}}{M_h},$$

$$f_{1h} = \frac{n_h}{N_h}, \quad f_{2hi} = \frac{36}{M_{hi}} \text{ and}$$

$$s_{2hi}^2 = \frac{1}{35} \sum_{j=1}^{36} \left(y_{hij} - \bar{y}_{hi} \right)^2.$$

This approximation depends on how well the ratio $\frac{M_h}{M_h'}$ approximates the ratio $\frac{N_h}{n_h}$ for each $h = 1,\ldots,L$. This will depend on how much the M_{hi} vary within each stratum, and by how large n_h is for each stratum. If these ratio approximations are not good, then this formula produces a significantly biased estimate of the mean squared error. We can compare these numbers across all strata by looking at the total squared difference between the two. The square root of this total is the Euclidean distance between the two vectors, so this gives us a way to measure the closeness of the ratios across strata. The table below gives results.

Stratum h	$\frac{M_h}{M'_h}$	$\frac{N_h}{n_h}$	Squared Error
1	5.21	5.00	0.04
2	10.26	9.60	0.43
3	11.68	11.00	0.46
4	13.50	13.00	0.25
5	12.04	12.50	0.21
6	14.77	14.50	0.08
7	19.26	20.50	1.54
8	25.62	26.00	0.15
9	25.14	26.00	0.73
10	32.67	38.50	33.98
11	117.00	132.50	240.15
Total			278.02

Most of the total squared difference comes from stratum 11. So one should question the approximation for the mean squared error of the biased estimator, $v(\hat{Y}_R)$. However, this is not an extremely large total, so the overall approximation may not be all that bad.

To further evaluate the statistical bias, we can use the results of the simulation described in the previous section. For evaluating the bias of $\hat{C}_R$, we compared the average of the 5,000 realizations with the known value of the total in-place cost.

Item	Dollar Value
Total Hardwire In-place Cost[13]	4,752,507,577
Average value of $\hat{C}_R$	4,741,494,667
Standard Error of the Average of $\hat{C}_R$	4,713,143
Estimated Bias	-11,012,910
Bias as a Percentage of the Total	-0.23%

These results indicate that the bias of the estimator $\hat{C}_R$ may not be that bad. The mean value of the estimator is approximately two-tenths of a percent below the actual total hardwire investment.

To evaluate the estimator bias in the approximation of the mean squared error of $\hat{C}_R$, we first estimated the mean squared error in the following way:

1. For each of the 5,000 realizations of $\hat{C}_R$, subtract the true total in-place cost from the estimate.
2. Square each of these errors.

[13] This is the total hardwire investment in the frame used for the simulation.

3. Find the average of the 5,000 squared errors.

We then compared the result of this calculation with the average of the 5,000 values of $v(\hat{C}_R)$.

Item	Value Squared $ $\times 10^{15}$
Simulation Estimate of the Mean Squared Error	111.17
Standard Error of the Simulation Estimate	2.58
Average value of $v(\hat{C}_R)$	106.48
Standard Error of the Average of $v(\hat{C}_R)$	1.40
Estimated Bias	-4.68
Standard Error of the Estimated Bias	2.27
Bias as a Percentage of the Total	-4.21%

It appears that $v(\hat{C}_R)$ underestimates the mean squared error of $\hat{C}_R$ enough for there to be some concern. If one felt that this is significant, then an adjustment should be made to $v(\hat{C}_R)$. For instance, inflating the estimated mean squared error by 4.21 percent would provide a correction to the mean squared error. Looking a the distribution of the t-scores, as we did in our simulation experiment, and finding the appropriate quantiles to use for multiplying factors is another way to make an adjustment.

Substitution Biases

Aside from statistical calculation issues, there are other sources of bias. We are concerned about statements in the draft report that refer to the substitution of originally selected items. First, the draft report states on page 7 of Appendix B that

> "In some instances, the location initially selected was impractical to audit, ... In such cases, another location was randomly selected from that stratum."

If the FCC does not want to audit certain locations, their conclusions should be narrowed accordingly – in fact, just to the records in locations that the FCC was willing to audit.

Additionally, footnote 18 in Appendix B talks about substituting for "hard-to-get-to" line items by using the preceding line item in the population list. This changes the probability of selection for certain items, and if this is not accounted for, the result is a bias in the estimate.

Biases Induced by Weaknesses in Audit Controls

It appears that there were procedure weaknesses throughout the audit process. For example, the audit staff did not use the same team of auditors to inspect each location. When examining the proportion of items found by different audit teams, there are noticeable differences in the scoring of line items.

The FCC has twice changed the initial on-site audit scores. These changes were not based on additional information or revisits. They were made back in the office after supervisory review to compensate for inconsistencies in coding. Because of these repeated revisions, there is reason to suspect the accuracy of the entire scoring process.

The FCC may argue that the revisions improve consistency of coding and correct errors. The point is, if there are errors or inconsistencies, how can we be assured all errors and inconsistencies were identified and corrected? Also, were some of the last revisions a result of a policy change in the categorization of certain items previously scored as a "4"? If so, how can we be certain the coding is consistent when the coding criteria have changed long after the onsite FCC visits – many months after in fact?

The error introduced by incorrect scores is not accounted for in statistical estimates, variance equations, or confidence interval calculations. This is *non-sampling* error because it comes from a source other than the random selection of a sample. It is difficult to quantify non-sampling error. If we compare the estimates based on the current FCC scores, and Pacific's own scoring of line items in the audit, we see how much of a difference scoring changes can make – approximately $377 million dollars difference in the estimates. Table 5, at the end of this appendix, contains the estimates used for this comparison.

Lack of a Two-way Audit

The audit only investigated in one direction: sampling from the property records to see if a selected line-item can be located where the property record says it is. If the intent of the audit was to attempt any quantification of "missing" equipment, it would be necessary to conduct a two-way audit. A two-way audit would also include an inventory of randomly selected offices and a check to see if items found in the inventory can be tied back to the property records. The only way to determine "missing" equipment would be to take the results of the initial audit and net them against the results of the reverse direction audit. The failure to conduct the reverse audit here means that any quantification of "missing" investment systematically overstates the actual value and cannot be relied on.

In fact, Pacific has voluntarily undertaken the task of performing a complete inventory of all central offices (the SAVR project). Given the SAVR project, the FCC should have proceeded differently. They could have concurred with the companies in the

audit approach, checked its implementation, and then approved what SBC is doing. In this way, the FCC would know what property should be added or removed from the records.

While we could go into the mathematics of how to produce an estimate of missing property from the results of a two-way audit, we do not feel that it is warranted here. Pointing out the failure to even attempt the necessary two-way audit should be enough.

Calculations

The FCC provided Pacific with a list of 710 CLLI along with the record counts for each CLLI. Based on this list and the frame summary table on page 7 of the draft report's Appendix B, we were able to place each CLLI chosen for the audit into the strata defined by the FCC. Table 1 below summarizes this frame, and also shows a comparison with the best match (BM) frame that we used for the simulation described in the "Margin of Error" section.

Calculation Comparisons

Tables 2 and 3 show the results of calculations published in the draft report with our attempt to verify the numbers. Our calculations associated with the percentage of non-compliant records match quite well. Our results for the in-place cost of non-locatable items are not as good. The standard error calculation is reasonably close to the FCC's result, but the estimate itself is off by $29 million. At this time, we do not know the reason for this. The calculation method for both the proportion and the total dollars are essentially the same. It's possible that the in-place cost data contains errors, but we have not been able to find any.

Updated Results

We also present the results (in Tables 4 and 5) of calculating the estimates under four different scenarios:

1. using the biased estimator and its approximate mean squared error with the FCC's current scoring of audited line items (given in the draft report);
2. using an unbiased estimator and its variance with the FCC's current scoring of audited line items (given in the draft report);
3. using the biased estimator and its mean squared error with the Pacific's scoring of audited line items; and
4. using an unbiased estimator and its variance with the Pacific's scoring of audited line items.

The unbiased estimator is one that is based on weighting each value in the sample by the inverse of the probability of selection. As with the biased estimator, it can be used to estimate the proportion of compliant line items, or the total in-place cost of non-locatable line items. The formula for the estimator and its variance can be found in Cochran (1977).

One-sided lower (upper) bounds are given for the in-place cost (proportion) estimates. If, for example, the one-sided lower bound of the in-place cost of non-locatable line items was less than 100 million dollars, then one could not statistically conclude, at the appropriate confidence level, that the true value is actually more than 100 million dollars. Similarly, if the one-sided upper confidence bound is greater than 0.90, then one could not statistically conclude, at the appropriate confidence level, that the true value is actually less than 0.90 (90 percent).

To calculate one-sided confidence bounds for all proportion estimates and the unbiased in-place cost estimates, Student's t distribution was used with the effective degrees of freedom calculated using the Satterthwaite approximation. For the biased estimates of in-place cost, the multiplying factors determined by the simulation results in the "Margin of Error" section were used.

The one-sided lower 99 percent bounds for the in-place cost of non-locatable items under Pacific's scoring are below zero. When using FCC scores, the lower bounds are a small fraction (about 3.33 percent) of the Pacific's total hardwire investment.[14] At the 95 percent confidence level, the one-sided lower bounds are still only a small fraction of the total hardwire investment, especially when Pacific's scores of audited line items are used (about nine-tenths of a percent).

[14] This assumes that total hardwire investment is $5.082 billion, as stated in the table on page 4 of the draft audit report.

Table 1 - FCC vs. "Best Match" (BM) Sampling Frame Summary

Stratum h	Number of Records per Central Office Location in Stratum				Number of Central Office Locations in Stratum N_h		Number of Central Office Locations Selected for Audit n_h		Number of Records per Stratum M_h	
	High		Low							
	FCC	BM	FCC	BM	FCC	BM	FCC	BM	FCC	BM
1	6563	6666	2030	2022	40	41	8	8	120229	124516
2	1990	2002	1501	1510	48	47	5	5	81667	80998
3	1479	1478	1004	1007	55	56	5	5	68935	70464
4	995	1003	820	802	26	29	2	2	23395	26448
5	786	785	700	700	25	29	2	2	18297	21478
6	687	688	602	600	29	32	2	2	18674	20481
7	598	598	500	500	41	49	2	2	22572	26583
8	497	497	404	400	52	51	2	2	23209	22949
9	396	396	300	300	52	52	2	2	18003	17906
10	299	299	201	201	77	78	2	2	18851	18950
11	199	198	100	100	265	298	2	2	35803	40406
Total					710	762	34	34	449635	471179

Table 2 - Calculation Verification
Percentage of Compliant Records

Item	Estimate	Standard Error	Margin of Error[15]	Lower Confidence Bound[15]	Upper Confidence Bound[15]
FCC Published	80.63	1.76	3.45	77.18	84.08
Verification Results	80.23	1.72	3.36	76.86	83.59

Table 3 - Calculation Verification
Total In-Place Cost ($M) of Non-Locatable Line items

Item	Estimate	Standard Error	Margin of Error[15]	Lower Confidence Bound[15]	Upper Confidence Bound[15]
FCC Published	500.9	110.4	216.4	284.5	717.3
Verification Results	529.8	113.6	222.6	307.2	752.4

[15] The margin of error was determined using the 97.5th percentile of a standard normal distribution. This is the same methodology used in the draft report. While we do not feel that this is the correct thing to do, it was done here in order to make a comparison. The resulting error bounds give a 95 percent confidence interval.

Table 4 - Percent of Compliant Records

Scoring System	Estimator Type	Estimate	Standard Error	Effective Degrees of Freedom	One-Sided 95% Upper Bound	One-Sided 99% Upper Bound
FCC	Biased	80.23	1.72	4.43	83.88	86.65
	Unbiased	79.55	3.83	2.10	90.73	100.00[16]
Pacific	Biased	84.53	1.61	7.47	87.59	89.37
	Unbiased	83.77	3.69	2.27	94.54	100.00[17]

Table 5 - Total In-Place Cost ($M) of Non-Locatable Line items

Scoring System	Estimator Type	Estimate	Standard Error	Effective Degrees of Freedom	One-Sided 95% Lower Bound	One-Sided 99% Lower Bound
FCC	Biased	529.8	113.6	N/A	291.2	169.0
	Unbiased	513.6	122.3	11.05	293.9	181.2
Pacific	Biased	152.5	51.4	N/A	44.5	-10.9
	Unbiased	148.3	64.7	8.49	28.0	-39.0

[16] Value capped at 100.00%. Calculated value was 106.22%.
[17] Value capped at 100.00%. Calculated value was 109.47%.

Exhibit B

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July 14, 1999

B. Jeannie Fry
Director, Federal Regulatory
SBC Telecommunications Inc.
1401 I Street, NW, Suite 1100
Washington, DC 20005

Re: Federal Communications Commission COE Rescoring Methodology

Dear Ms. Fry:

Based on our review of each of the items submitted for rescore by Pacific Bell, Nevada Bell, and Southwestern Bell Telephone Company (collectively the "SBC LECs") and our review of the FCC's treatment of those submissions, we have the following observations which raise serious concerns regarding the FCC's methodology and conclusions:

1) **After the initial field visit, the FCC did not interact with the companies on a timely and frequent basis.** A critical element of auditing is timely and frequent interaction with representatives of the company being audited to attempt to address issues raised in the audit. This ensures the auditors have considered all relevant facts prior to the issuance of their report. It is our understanding that this interaction did not occur after the FCC auditors' field visits. The FCC did not initiate dialogue with the companies regarding the evidence provided in the rescore process. This lack of interaction inherently makes the rescore process more difficult. In addition, the failure to seek clarification of complex, technical information creates final scores that may be unreliable. Based on our own experience auditing SBC, we question the accuracy of complex technical judgments made concerning SBC's continuing property records without interaction with the companies.

2) **The FCC's criteria failed to make clear, in a timely manner, its criteria for scoring its observations.** The FCC did not publish the criteria used to determine if a submission would be considered adequate for rescoring until late in the process (on April 7, 1999) after all of the submissions had been made and the FCC's reports were made public. As such, the companies had no indication of what would or would not be considered a successful submission for rescore by the FCC at the time they were preparing their submissions. Consequently, documentation that could have led to a rescoring was not submitted by the SBC LECs. In addition, release of the rescoring criteria some two years after the performance of the audit field work makes it difficult, if not impractical, for the auditee to supplement prior information provided.

3) **The FCC did not apply its criteria for rescoring equipment considered "not found" consistently.** Exactly the same or similar explanations and documentation were submitted by the companies, but scored differently by the auditors without any explanation. In other words, the Commission staff seemed to accept one explanation yet reject the same explanation and information provided with respect to others under similar circumstances. The following examples highlight this point:

- **Identical items with exactly the same information submitted for rescoring were rescored differently by the FCC.** For example, two equipment frames were originally scored as "not found" in two different Pacific Bell offices. The equipment frame listed on the CPR listing for the Vista, California office was rescored to "item found". The equipment frame in the San Diego, California office was not changed from its "not found" score. In both situations, precisely the same written explanation and attachments were provided, yet there were two completely different final scores. Ernst & Young believes the evidence submitted was sufficient for both locations to have been rescored as found by the FCC.

- **The FCC did not consistently follow their own standards for rescoring.** The Rescoring Notice of April 7, 1999 (page 2) generally explains, under "Source Documentation," the type of documents and information that the FCC found acceptable. The Notice states that

  > "The auditors found such documents containing cost amounts, signatures, dates and other such evidence to be the most convincing of the facts relative to the installation and removal of equipment. Internally generated computer lists, on the other hand, were not considered adequate without additional support."

  However, in some instances internal documents resulted in a rescore, when in other instances the same documents and, additionally, third party documents supplementing the information were submitted; yet this information, even though more complete and reliable, did not result in a rescore to "found." For example in a Clint, Texas central office, the FCC auditors changed a score on a part on a distributing frame from "auditor unable to identify-unverified" to "found" based on internal documents submitted by Southwestern Bell Telephone Company (SWBT), Property Record Codes (PRCs) and a PICS/DCPR screen print. For a cross connect panel in the Houston, Texas central office, which was listed as "quantity problem-unverified", SWBT submitted not only the internal documents, but also vendor equipment specifications and a vendor equipment list to further substantiate existence of the part. This item was not rescored, even though the information was supplemented with third party documents. We believe the third party evidence submitted for the later item was valid, if not more valid, to warrant a rescore to "found" per the FCC rescore criteria, since third party documentation additionally provides independent verification.

4) **The rescoring standards used by the FCC were too narrow. Additionally, the FCC should have performed additional procedures to justify their findings and considered additional types of documentation to be sufficient for rescoring.** As noted in the above quoted language from the April 7, 1999 Rescoring Notice, the FCC considered source documents that contained cost amounts, such as invoices, to be the most convincing of the facts relative to the sampled equipment. Upon review of the items submitted for rescoring by the SBC LECs, Ernst & Young found that the SBC Telcos provided not merely internal documents (as discussed in the April 7, 1999 Public Notice) but documents generated by third parties, such as vendor invoices as well as vendors' mechanized order acknowledgments (MOAs). Because third party documents represent independent verification and are considered more reliable evidence than internal documents, these third party documents (e.g., MOAs) should have been considered sufficient evidence to warrant a reversal of the findings or, at a minimum, justified a return visit to the central offices for verification.

One example of the narrowness of the FCC's rescoring standards is demonstrated by the FCC's "not found" scoring on a battery rack in Pacific Bell's Fresno, California central office. The battery rack was scored as "not found" by the FCC because the voltage was incorrectly listed on the CPR. Since the CPR listed the battery rack as 24V and no 24V battery racks existed in the central office, the FCC assumed the battery rack did not exist. Pacific Bell submitted support indicating that the 24V battery strings were converted to 48V battery strings in 1994 using the existing battery racks and that the battery racks now hold the 48V batteries. As a result, the battery racks were simply mislabeled on the CPR and actually do exist. Based on our review of the documentation submitted, we believe this should have resulted in a rescore to "found" or if the FCC had any doubts after reviewing the documentation, they should have discussed the evidence with the company or returned to the field to confirm their conclusions. This is a further example of the FCC making judgmental decisions on complex technical issues without consultation with the companies' technical experts.

Another example of the narrowness of the FCC's rescore standards is demonstrated by the FCC's "not found" scoring of a remote test port in the Palo Alto, California central office. On the day of the FCC field visit, the remote test port was unable to be found because it was located in a separate room from the main switching equipment and Pacific Bell's engineers were not familiar with that piece of equipment. On the day after the audit, Pacific Bell located the equipment and notified the FCC auditors. However, the FCC auditors chose not to return to the location but instead directed the company to explain in its replies to the audit that the equipment had been located. Floor plans and vendor invoices were submitted by the Company, which, in our opinion, should have justified a rescore to "found", or at a minimum a return visit to the field. The FCC's rescore standards don't address what they did in situations like this where the equipment in question was located in a different location than where they were looking. These types of exceptions clearly necessitate a return visit to the field or further discussion with company personnel before making a final conclusion of "not found."

Additionally, for embedded items, Ernst & Young determined the FCC's rescore criteria to be too limited. Based upon our review of the documents submitted, equipment diagrams and/or schematics should have been sufficient evidence to warrant rescore of embedded items. Embedded items are parts that are integrated or exist within large central office equipment assemblies (and thus, are more difficult to verify). In fact, it seemed that any embedded items submitted for rescore which were originally scored "not found" had no possibility of being rescored to found. On the other hand, embedded items originally scored as "unverified" (rather than "not found") were rescored to "found," if the Company submitted documentation meeting the FCC's rescore criteria. The following is an example of where identical information was submitted for rescore in two instances but only one item was rescored to "found" by the FCC.

- The FCC auditor initially scored a digital monitoring part at the Santa Ana, California central office as "unverified" because the part was inside a cabinet. Subsequently, Pacific Bell submitted a vendor invoice, an equipment drawing and PICS/DCPR reports, to substantiate the existence of the part. The item was rescored to "item found". Similarly, a power module, located in a West Los Angeles, California central office, could not be pulled out to verify the part number since the power module was in use. However, this item was initially scored "not found". Pacific Bell submitted a vendor invoice, vendor diagram and similar PICS/DCPR reports. This item was not rescored to "found" based on the documentation submitted. Apparently, the different type of initial scoring influenced the final outcome, despite the same circumstances during the field visit and the submission of the same information after the field visit. We believe the evidence submitted was sufficient for both items in both locations to have been rescored to "found".

Thus, our review indicates that the FCC staff did not consider all documentation submitted by the companies as evidence of the existence of equipment considered "not found". At a minimum, the FCC should have performed additional procedures to ensure that their initial conclusions of "not found" were still appropriate after considering the evidence submitted by SBC. Examples of additional procedures that should have been applied under the circumstances include discussions with SBC employees, a return visit to the central office or a request for further documentation. In light of the evidence submitted by the SBC LECs that showed that items were found and the lack of any additional procedures to evaluate the evidence, the auditors did not have sufficient evidence to form a conclusion that these items were "not found."

5) **The FCC has purported that their audits of the CPR were conducted in accordance with Generally Accepted Government Auditing Standards (GAGAS). However, these audits should have been performed in accordance with GAAS which would require the auditor to consider all appropriate evidence in reaching a conclusion regarding the fair presentation of an account balance.**. GAGAS addresses the standards for performing an audit of government organizations, whereby the gifting and funding of the government entity is reviewed. In fact, this type of audit may be performed by government auditors or by external independent accounting firms. Thus, GAGAS is narrowly focused on how entities receiving government funding should be audited. GAGAS does not have all the appropriate standards that would need to be applied to opine on the fair presentation of account balances. In other words, GAGAS does not address how to perform audits regarding the fair presentation of financial statement information, which the FCC set out to perform in these audits. By contrast, Generally Accepted Auditing Standards (GAAS) address the procedures to be used by auditors in auditing and opining on the fair presentation of financial statement information. Since the FCC is recommending that the SBC LECs make a financial adjustment to their books and records, the FCC should have used GAAS in the performance of their audit. This represents a significant departure in application of auditing standards.

It has been, and continues to be, our professional opinion that the FCC's audit methodologies are biased, inaccurate and inconsistently applied, and as a result, its conclusion regarding the overstatement of investment is flawed to such an extent that any proposed financial adjustment is meaningless. Additionally, it would only be appropriate to suggest a financial statement adjustment if these audits were performed in accordance with GAAS, as opposed to GAGAS.

Sincerely,

John W. Putnam

John Putnam
Partner

Exhibit C

Statewide Asset Verification and Retirement (SAVR)

The Statewide Asset Verification and Retirement (SAVR) process provides for a physical asset verification and reconciliation of the hardwired property records in the Hardwired Detailed Continuing Property Record (HW/DCPR) system. SAVR is a "two-way" inventory of 100% of the hardwire central office assets and the inventory is performed by independent contractors with an in-depth knowledge of central office equipment.

BACKGROUND

As explained on a number of occasions to the FCC, SAVR was developed to ensure proper controls were in place to validate and monitor hardwired PICS/DCPR inventory records. PacificBell (Pacific) first disclosed information regarding the SAVR process on May 2, 1997 in its response to the FCC's first data request. During a formal presentation with the FCC audit staff, on October 30, 1997, the SBC LECs explained to the FCC that SAVR was developed in the third quarter of 1996 and implemented in Pacific in second quarter of 1997. Pacific completed the inventory of 100% of its central offices in March 1999.Following the completion of SAVR in California, in April 1999, the SAVR process was initiated in Nevada Bell. All 265 central offices at Nevada Bell are scheduled to be inventoried by December 31, 1999.

Southwestern Bell Telephone Company (SWBT) implemented SAVR in the third quarter of 1997. Since there are approximately 1700 central offices at SWBT, the programs established to manage the SAVR inventory process at SWBT are separate from those at Pacific. A program to inventory SWBT's 112 analog central offices was established and completed in 1998. This program focused on reconciling the "undetailed" investment in CPR040000. A separate program was established to inventory the digital central offices (with investment greater than $10 Million) and, as of June 1999, all of the offices with over $10 Million in investment (representing over 65% of the hardwire investment at SWBT) have been completed.

The SAVR process is an integral part of the controls and procedures in place to improve the integrity of the CPR records. The SBC LECs have repeatedly requested that the FCC review SAVR as part of its audit, however, to date the FCC has declined to review SAVR and ignored its results.

THE SAVR PROCESS

SAVR uses a separate database that allows personnel who are performing the inventory to view and correct asset records on-line during the on-site physical asset verification process. The independent contractors perform a physical asset verification of all hardwired central office equipment using a laptop computer loaded with the SAVR Access database.

At the start of each inventory, a copy of all property records for the central office from the HW/DCPR system is downloaded to a laptop computer. All hardwire equipment in the central office is inventoried and compared to the property record in the SAVR Access database. All equipment that is physically present in the central office and all equipment in the HW/DCPR database is noted as verified by the inventory contractors. In addition, discrepancies are also noted. For example, central office equipment found during the physical inventory to have a

quantity different from the quantity recorded in the HW/DCPR database, will be noted by the inventory contractors and updated by the Asset Managers. In addition, discrepancies in actual frame identification for equipment recorded in the database will be updated during the inventory process. Also, any working equipment found to be physically located in the central office, but which is not listed in the HW/DCPR database, will be documented by the inventory contractors. During the inventory process, if an item of equipment exists in the HW/DCPR database, which is not physically located in the central office, the inventory contractor will mark the property record as "not located" in the file located in the laptop.

Using a team of two individuals, a typical on-site SAVR audit of a digital office takes two working days not including travel time. A number of employees are also involved in providing support for the SAVR inventories. For example, to prepare for the inventories, it was necessary to develop the inventory program and procedures, to design a program for the laptops and to schedule the contractors. Asset Managers provide support by providing coordination and preparing and distributing various reports required by the audit, such as the "add" reports, the "retirement" reports and the "change" reports. Network engineers in the field provide support by reviewing these reports. At the end of the SAVR audit, a quality review of the results is also performed.

Upon completion of the inventory, the inventory contractors upload the SAVR Access database file to a main frame for processing by the SBC Telco Asset Managers, who are responsible for coordinating the reconciliation of the inventory with the HW/DCPR database. The Asset Managers pull reports detailing the proposed changes to the property records. These reports are forwarded to the responsible central office equipment engineers for their review, reconciliation, and acceptance. The equipment engineer or a qualified contractor will review all proposed changes from the physical inventory. After review by the equipment engineers, approved frame ID changes, quantity changes, and retirements are processed in the HW/DCPR system by the Asset Managers. Equipment identified during the inventory that is not currently in the HW/DCPR database will be aged and priced by the equipment engineer so that it can be added to the database by the local HW/DCPR groups.

As a final step in the SAVR reconciliation process, the "undetailed" investment will be detailed or retired and the "unallocated" investment will be allocated to installed equipment or retired. Thus, upon completion of the SAVR process, the HW/DCPR database will contain accurate property records for all central office equipment at the given location.

Exhibit D

Declaration of Marla Martin

Introduction

I am Director of Regulatory Accounting for Southwestern Bell Telephone Company (SWBT). I have responsibility for regulatory compliance in areas of accounting and finance for each of the five state jurisdictions of SWBT, as well as the federal jurisdiction. This includes financial reporting and development of revenue requirement. Additionally, I have responsibility for Part 64, non-regulated accounting.

I have been asked to consider the ratemaking implications of the audits of the continuing property records, primarily from a rate-of-return perspective, for purposes of the SBC LECs' comments on the FCC's Notice of Inquiry in CC Docket No. 99-117.

The SBC LECs do not agree with the FCC auditors' findings that large numbers of assets are missing and these findings would not have any ratemaking implications in any event. While the SBC LECs' records are not perfect, they are materially correct. The few, true "not found" conditions are most likely caused by delayed retirements. Delayed retirements result when assets are retired and removed from the field, but the related paperwork is not processed in a timely manner to remove the assets from our financial books and records. There are sufficient, effective internal controls to assure that network investment placed on the books represents assets actually purchased and installed in the network. Our external auditors attest to the strength of our controls in this area. Therefore, the FCC auditors can not have evidence to contend that the assets never existed, even if they had performed procedures to make such a contention. Such evidence does not exist. Rather, the "not found" condition is due to a failure to post retirements in a timely manner in the continuing property record.

Rate-making Implications

The appropriate question then is "What is the ratemaking impact and how would customer prices have changed if retirements had been made 'on time'?" The answer is that **there would have been no significant impacts on ratemaking or customer prices**. There are a number of reasons why this is true.

First, as described in the SBC LECs' Comments at great length, the audit report is flawed and its conclusions can not be relied upon. Quite simply, the SBC LECs are not missing $1.7B, or any smaller material portion, of their COE equipment and as a consequence there can be no ratemaking implications.

Second, when the FCC adopted price cap regulation, it largely severed the connection between the prices customers pay and the costs companies incur. Instead, price cap carriers began to determine customer prices using a formula in which new customer rates are equal to current rates adjusted by inflation, offset by productivity gains. Even before the elimination of the rate-of-return backstop mechanisms of price cap regulation, changes in company costs would not necessarily have much, if any, impact on customer prices.

Third, even if we presume the audit findings to be accurate **and** we were operating under Rate of Return (ROR) regulation **and** retirements should have been made but were not. **the ratemaking impact would have been negligible over time**. Although this may seem illogical. it occurs because the impact of a retirement on ratemaking is largely depreciation related and depreciation is an issue of timing. not amount. Under ROR regulation. a change in company costs. both capital costs (return on investment) and operating expenses. can change customer prices. Normal retirements may change company costs temporarily for any given year. but do not change total costs over time and thus produce no significant ratemaking impacts. This is due to several factors:

(1) **using group depreciation there is no impact on net investment from a normal retirement**. and consequently there is no impact on return and ultimately customer prices:

(2) **remaining life depreciation rates are self correcting** and as a result. depreciation rates change to reflect prior under or over depreciation: and

(3) **depreciation produces two separate but related impacts on revenue requirement which move in opposite directions.** If depreciation expense increases. then depreciation reserve increases and net investment. upon which return is calculated. decreases. and vice versa.

1. No impact on net investment using Group Depreciation Methods

Using group depreciation methods as prescribed by the FCC, assets are depreciated, not as individual units, but in groups of similar assets. A depreciation rate is applied to the whole group. This depreciation rate is designed to recover the unrecovered plant (plant less depreciation reserve) over the remaining life of the group.

No attempt is made to track depreciation by individual asset. (This reflects a practical approach to tracking millions of items of property.) Under this group concept, when an asset is retired it is considered to be fully depreciated, no matter what its age. The original capital cost is removed from the plant account and the same amount is removed from the accumulated depreciation reserve account. Therefore, there is no impact on the net investment balance (plant less depreciation reserve) from the retirement.

In the example below, Line 3 reflects the impact of a retirement on net plant under the Group Depreciation concept. If a retirement of an asset originally costing $100 is made (Column B), $100 is removed from both the gross plant (Line 1) and depreciation reserve (Line 2) balances. The resulting net Plant (Line 3) balance after the retirement is $625, the same as before the retirement. Thus, net plant is unaffected by a retirement and the return component (rate of return * net plant) of revenue requirement, which can affect customer prices, is also unaffected by a normal retirement.

GROUP DEPRECIATION AND RETIREMENTS

($100 Retirement 3 years after assets placed in service)

	A Before Retirement	B Retirement	C=A-B After Retirement
1. GROSS PLANT	$ 1,000	$ 100	$ 900
2. DEPRECIATION RESERVE	375	100	$ 275
3. NET PLANT (PLANT LESS RESERVE)	$ 625		$ 625

2. Self-correcting Nature of Remaining Life Depreciation

As explained above, retirements result in a reduction to both plant and depreciation reserve balances with no impact on net investment. However, retirements do reduce the depreciation reserve ratio (depreciation reserve/plant) which serves to increase the depreciation rate when it is recalculated.

The example below illustrates the self-correcting nature of depreciation rates following a retirement. Again, Column A represents the before or delayed retirement scenario and Column C equals the after or timely retirement scenario. Line 7 shows that after a retirement is made, the depreciation rate is higher (13.9%) than before the retirement is made (12.5%). This is due to the impact of the retirement on the reserve percentage (Line 6). After the retirement, the reserve percentage, calculated as reserve divided by plant ($275/$900=30.6%) is lower than the one calculated before the retirement ($375/$1,000=37.5%). A lower reserve ratio produces a higher depreciation rate. This is because the reserve ratio is used in the calculation of the depreciation rate (one minus reserve, divided by remaining life).

GROUP DEPRECIATION AND RETIREMENTS

($100 Retirement 3 years after assets placed in service)

	A Before Retirement	B Retirement	C=A-B After Retirement
1. GROSS PLANT	$ 1,000	$ 100	$ 900
2. DEPRECIATION RESERVE	375	100	$ 275
3. NET PLANT (PLANT LESS RESERVE)	$ 625		$ 625
4. ESTIMATED USEFUL LIFE (IN YEARS)	8		8
5. REMAINING LIFE DUE TO TIME PASSAGE (8 - 3) (Estimated useful life less time passage)	5		5
6. RESERVE PERCENTAGE (Depreciation Reserve/Plant)	37.5%		30.6%
7. DEPRECIATION RATE ((One minus Reserve Ratio)/Remaining Life)	12.5%		13.9%
8. DEPRECIATION EXPENSE (Depreciation Rate X Gross Plant)	$ 125		$ 125
9. RECOVERY OVER ACTUAL REMAINING LIFE (L5*L8)	$ 625		$ 625

Lines 8 and 9 further demonstrate the self-correcting impact of the recalculated depreciation rate following the retirement. The depreciation rate (Line 7) is applied to gross plant (line 1) to calculate depreciation expense. In the before scenario, a lower depreciation rate of 12.5% is applied to a higher gross plant amount $1000. In the after scenario, a higher depreciation rate of 13.9% is applied to a lower gross plant amount of $900. In both the before and after scenarios the

depreciation expense of $125 is exactly the same. Additionally, in both the "before" and "after" scenarios, total remaining cost to be recovered over the remaining life of the plant is the same ($625), because the annual expense is the same and the remaining life is constant[1] over both scenarios. In summary, both the delayed retirement, as well as the timely retirement scenario result in the same depreciation expense charge. The plant is fully recovered over the life of the plant and revenue requirement is the same over the life of the plant. Therefore, there is no impact on customer prices.

Additionally, if following a retirement, the group depreciation rate is not immediately recalculated, the current, lower depreciation rate continues to be applied to the reduced plant balance. The resulting annual depreciation expense will be lower compared to before the retirement, thus creating a temporary imbalance of cost recovery.

Subsequently, when a new depreciation rate is calculated and applied, a higher depreciation rate and higher depreciation expense will result and the cost recovery imbalance will be corrected over the remaining life of the plant. Therefore, absent an immediate recalculation of rates following a retirement, a temporary imbalance may exist. However, it is corrected at the next recalculation of rates so that over the life of the plant there is neither over nor under recovery of cost. If depreciation rates are never recalculated, the depreciation recognized over the remaining life of the asset is inadequate. Using the example above, only $112.5 of depreciation expense will be generated annually if the lower 12.5% rate is applied to the $900 of gross plant going forward. At that rate, only $562.5 of the $625 unrecovered plant will have been recovered over the remaining life of five years. This creates an imbalance of $62.5 at the end of the life of the plant, requiring additional time for full recovery.

3. Depreciation Impacts on Revenue Requirement

As described earlier, the addition or removal of an asset causes two interrelated changes in revenue requirement, both of which are a direct result of accounting for depreciation of the assets. These changes impact (1) depreciation expense, an **income statement** account and (2) depreciation reserve (accumulated depreciation), a **balance sheet** or contra asset account. Depreciation expense is an operating expense of the company and is a component of revenue requirement. Depreciation reserve is the account that accumulates the depreciation expenses recognized annually. Plant less depreciation reserve equals net plant (unrecovered plant). Net plant times rate of return determines the return component of revenue requirement. To the extent that depreciation expense is lower, which lowers revenue requirement, then accumulated depreciation reserve is also lower which increases net plant and hence **increases the return component** of revenue requirement. This serves to **mitigate the effect of a decrease in depreciation** and the effect on customer prices. Additionally, the review of depreciation reserve and its impact on net investment is what prevents asset groups from being "overdepreciated". In a simple example, if an asset's useful life is 5 years and at the end of 5 years the asset is retired from service, but not removed from our financial records, the following will be reflected in year-end financial results:

[1] It could be argued that additional retirements would support a shorter life which could increase the depreciation rate under a timely retirement scenario.

	Deprec. Expense	Gross Plant	Accum. Deprec.	Net Plant
Year1	$10	$50	$10	$40
Year2	$10	$50	$20	$30
Year3	$10	$50	$30	$20
Year4	$10	$50	$40	$10
Year5	$10	$50	$50	$0

When the depreciation reserve ratio (Accum. Deprec./Gross Plant) approaches one, the depreciation rate is closely monitored and turned off at the appropriate time. Second, if the rate is not turned off as shown below in year 6, even though depreciation expense includes $10 of "overdepreciation", Net Plant is negative $10 and will reduce the company's return. If as some would suggest, the SBC LECs have been over depreciating for a long period of time the net effect would be a large negative to company costs (and customer prices) because of the cumulative effect on net investment.

Year 6	$10	$50	$60	-$10

Consequently, it would clearly not be in the company's best interests to allow this to happen.

CONCLUSION

In conclusion, delayed retirements compared to retirements made "on time" may cause temporary annual variances in revenue requirement for a short period. However, depreciation and regulatory accounting processes produce the appropriate level of depreciation cost recognition over the entire life of the assets. Under either the delayed or the timely retirement scenario, this recognition of cost will not exceed the original cost of the asset group. Therefore as described above, over the life of assets, delaying retirements does not have a material impact on customer prices, even if we were still in a rate-of-return environment.

Submitted,

Marla Martin

Marla Martin
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September 8, 1999

CERTIFICATE OF SERVICE

I, Katie M. Turner, hereby certify that the foregoing "COMMENTS OF SWBT, PACIFIC BELL AND NEVADA BELL" in CC Docket No. 99-117 and ASD File No. 99-22 has been filed this 23rd day of September, 1999 to the Parties of Record.

Katie M. Turner

September 23, 1999

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