Before the
FEDERAL COMMUNICATIONS COMMISSION

Review of the Commission's Rules Regarding the Pricing of Unbundled Network Elements and the Resale of Service by Incumbent Local Exchange	)))))	WC Docket No. 03-173

REPLY DECLARATION

OF

LAWRENCE K. VANSTON

ON BEHALF OF SBC COMMUNICATIONS, INC.

January 30, 2004

REPLY DECLARATION OF LAWRENCE K. VANSTON

I. QUALIFICATIONS AND EXPERIENCE

1. My name is Lawrence K. Vanston. My business address is Technology Futures, Inc., 13740 Research Boulevard, Building C, Austin, Texas 78750-1859.

2. I am President of Technology Futures, Inc. (TFI). In this capacity, I direct TFI's telecommunications and forecasting research.

3. Established in 1978, TFI provides its clients with technology and market forecasts, as well as advice on strategic planning, market development, technology roadmaps, and technology management. It provides research and consulting to equipment suppliers, including Corning and Intel; telecommunications users, including Rice University and a major East Coast medical center; entrepreneurial startups and venture capital firms, including several based in Europe; and U.S. Government agencies, including the General Accounting Office and the Department of Defense. This work, along with our work for telecommunications carriers, provides TFI with a very broad perspective on the communications and information technology industries.

4. I hold a Ph.D. in Operations Research and Industrial Engineering from the University of Texas at Austin, where I also earned my Master of Science and Bachelor of Arts degrees. For four years, I was a Member of Technical Staff at Bell Labs and Bellcore in network planning. I have been with TFI since 1984, specializing in technology forecasting. I have 23 years of experience in technology forecasting for the telecommunications industry. A detailed resume of my qualifications and experience is attached to this declaration as Attachment 2.

5. As an expert on the impacts of new technologies and markets on the public telephone network, I have been asked to testify as an expert witness in over thirty jurisdictions. My views and the results of my research are regularly cited by general business and industry publications including the Wall Street Journal, Telephony, America's Network, Wired, Lightwave, Wireless Systems Design, and Communications News. The September 21, 1998 issue of The Wall Street Journal contained an in-depth interview entitled "Consultant's Call: Lawrence Vanston Makes Some Pretty Bold Predictions for the Future of Telecommunications. He Has Been Right Before."

II. OVERVIEW

6. The purpose of this reply declaration is to provide information supporting SBC's position that GAAP lives are more appropriate than FCC-prescribed lives for the calculation of UNE costs. In addition, several parties have taken positions that I believe are erroneous, namely:

- Richard B. Lee, on behalf of AT&T,[1/]
- Michael J. Majoros, on behalf of MCI,[2/]
- John C. Klick, on behalf of several CLECs, and[3/]
- Robert D. Willig on behalf of AT&T.[4/]

7. Specifically, I show why the GAAP lives that SBC uses for financial reporting are correct for UNE cost models, as discussed in SBC's Comments and Reply Comments. I will

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1/ Lee Decl. *passim.*

2/ Majoros Decl. *passim.*

3/ Klick Decl. at 43-55.

4/ Willig Decl. at 61-65.

also explain why the Commission should reject the CLECs' recommendation to use the Commission's outdated prescribed depreciation lives.

8. As a preliminary matter, I would like to point to a number of recent developments that support SBC's position regarding depreciation:

- The Commission issued its *Triennial Review Order* (*TRO*), which reiterates and emphasizes the requirement that the rate of depreciation must "reflect the actual decline in value that would be anticipated in the competitive market."[5/]
- The continued loss of access lines to wireless, cable telephony, and broadband, including Voice over Internet Protocol (VoIP) in particular — long forecast by TFI — is now widely recognized as a deepening problem for ILECs.
- Cable companies are continuing to roll out telephony, which will only increase this line loss. With subscription rates in the 30% range in the areas where cable telephony has been offered already, this development is likely to strand millions of incumbent access lines.
- The Commission's decision to require number portability accelerates the conversion from wireline to wireless for voice services, which is already well underway. About 5% of U.S. households have already abandoned their wireline phones and nearly one-half have expressed a willingness to do so.
- Technological developments are affecting the lives of existing network assets. For example, fiber technology is increasingly replacing copper. The major ILECs

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5/ Report and Order, *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability*, 18 FCC Rcd 16978, 17399 ¶ 689 (2003) (*TRO*).

are looking at the possibility of deploying Fiber in the Loop (FITL) equipment based on Passive Optical Network (PON) technology and have received bids from suppliers. Indeed, Verizon has already selected vendors and announced plans for a very significant rollout, consistent with TFI's forecasts.

- ILECs, as carriers of last resort, are expected to engineer their networks and invest enough in them to serve 100% of potential access lines, either on a wholesale or retail basis. But due to growing facilities-based competition, we know the percentage of ILEC-served access lines will continue to decline. We also know that access line losses will translate into lost revenue and will cause ILEC assets to produce less economic value.

9. All of these developments support the conclusions herein, namely:

- The facilities that comprise the circuit-switched, copper network modeled in TELRIC cost studies will increasingly lose value as new technology develops.
- Facilities-based competition from cable telephony, wireless, and broadband will strand much of the ILEC investment assumed by the TELRIC models.
- TELRIC depreciation must reflect these factors in assessing the value of ILEC assets.
- Financial lives, which are confirmed by TFI's forecasts and analysis, accomplish this.
- In contrast, outdated regulatory lives that are in some cases almost a decade old do not.

10. As the Indiana Utility Regulatory Commission just noted in approving SBC's use of financial reporting lives for UNE costing, "Technological advancement continues at a

rapid pace, leading to faster obsolescence of all types of telecommunications equipment. . . . We also note that the increase in competition faced by SBC Indiana, both intermodal and intramodal, compels use of shorter depreciation lives. . . . [W]e reject any claim that we are somehow bound to adopt regulatory lives, or even that they must be used as a starting point. Whatever the merit of such an argument may have been in 1996, it carries no weight in 2003."[6/]

III. DECLINES IN ASSET VALUES MUST BE INCLUDED IN THE DEPRECIATION LIVES USED IN TELRIC STUDIES, AND GAAP LIVES BEST ACCOUNT FOR SUCH DECLINES.

11. In the *TRO*, the Commission correctly called for the depreciation rates used in TELRIC studies to "reflect the actual decline in value that would be anticipated in the competitive market."[7/] This is the most logical approach too TELRIC, and GAAP lives best reflect the declines in asset values are expected to occur due to technological developments and competition.

12. I believe that of all the proposals made regarding the appropriate depreciation lives for use in TELRIC studies, GAAP lives most accurately account for the declining economic value of incumbent assets. Because GAAP lives are reviewed on an annual basis and are intended to produce the company's best forward-looking estimate of the time over which its assets will produce economic value, they are clearly superior to the FCC-prescribed lives proposed by the CLECs.

13. In the context of state UNE rate proceedings, I have regularly reviewed SBC's GAAP

6/ Order, In the Matter of the Commission Investigation and Generic Proceeding of Rates and Unbundled Network Elements and Collocation for Indiana Bell Telephone Company, Inc. d/b/a SBC Indiana Pursuant to the Telecommunications Act of 1996 and Related Indiana Statutes, Cause No. 42393 at 66 (Ind. Util. Reg. Comm'n Jan. 5, 2004).

7/ *TRO* at 17399 ¶ 689.

lives and compared them to analyses performed by TFI of industry asset lives, and I have concluded that SBC's GAAP lives are a fair, representative measure of the economic lives of the assets the company uses to provide UNEs. TFI's studies account for relevant trends and developments across the telecommunications industry as a whole, and we have concluded that appropriate UNE lives are equal to or shorter than SBC's GAAP lives. I therefore conclude that SBC's GAAP lives are *not* overly conservative or short; rather, the GAAP lives are fully supportable as an accurate measure of the expected effect that competition and technology will have the economic lives of SBC's assets.

IV. THE FCC-PRESCRIBED LIVES ARE OUT OF DATE.

14. The biggest problem with the FCC-prescribed ranges of depreciation lives is that because they were prescribed in the mid-1990s, they are hopelessly out of date today in 2004. Those lives do not reflect the expected decline in asset values from competitive risks as required by TELRIC, and do not account for the fact that we are now so much closer to the next major technology shift.

15. The FCC ranges were ordered for some accounts in June of 1994[8/] and for the rest in May of 1995. The ranges are based on a statistical analysis of prior prescribed lives.[9/] Because the FCC cycled through the companies over a three-year period, some of the lives were already several years old when they were adopted in 1994 and 1995. Thus, the

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8/ Second Report and Order, *Simplification of the Depreciation Prescription Process*, 9 FCC Rcd 3206 (1994).

9/ The FCC explicitly did not update the lives in these two orders, they simply established ranges based on existing lives. *See id.* at 3209 ¶ 25; Third Report and Order, *Simplification of the Depreciation Prescription Process*, 10 FCC Rcd 8442, 8447 ¶ 12 (1995).

ranges are based on prescribed lives that are about ten years old today.

16. To my knowledge, the only change in the FCC range has been to the digital switching minimum life, which was lowered from 16 years to 12 years during the last FCC review in 1999.[10/] Yet even the FCC has recognized that lives need to be re-examined every three years at a minimum: In the original 1993 depreciation simplification order, the FCC stated: "We are persuaded that a three year review is necessary to keep ranges in line with technological, demand, and competitive changes."[11/] Developments since 1993 indicate that such changes are occurring much faster than could have been anticipated in 1993. Thus, even the 1999 review is out of date.

V. THE FCC-PRESCRIBED LIVES DO NOT PROPERLY ACCOUNT FOR TECHNOLOGY CHANGE.

17. The FCC's assessment of technology obsolescence and replacement in its 1990s depreciation lives could not have anticipated the actual technological developments that have taken place since these lives were established. We are now more certain about possibilities for new technologies and services such as distribution fiber, packet switching, and high-bandwidth access. Further, we are now closer to the technological obsolescence of current generation assets, meaning that equipment placed recently will have a shorter expected life than equipment placed in the 1990s.

18. For the major network accounts, all of the FCC-prescribed lives are too long for use in

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10/ Report and Order in CC Docket No. 98-137 and Memorandum Opinion and Order in ASD 98-91, *1998 Biennial Review — Review of Depreciation Requirements for Incumbent Local Exchange Carriers*, 15 FCC Rcd 242, 247-48 ¶ 13 (1999).

11/ First Report and Order, *Simplification of the Depreciation Prescription Process*, 8 FCC Rcd 8052, 8058 ¶ 80 (1993).

TELRIC studies. For example, the minimum 25-year life for underground metallic cable (which is mostly feeder cable in conduit) is astoundingly long considering that metallic feeder cable is increasingly being replaced by fiber. The next generation of broadband services will require fiber feeder at minimum. The 25-year life is a throw-back to the time when underground cable was expected to have a long life due to its isolation from the elements and human activity. But today, technological obsolescence and competition — not physical mortality — drive depreciation of metallic cable. The extremely high underground metallic life is a clear indication that the FCC ranges are severely outdated.[12/]

VI. FCC PRESCRIBED LIVES DO NOT SUFFICIENTLY ACCOUNT FOR COMPETITION.

19. Competition will strand incumbent facilities such as switch and circuit line cards, as well as cable pairs, translating into a major decrease in the economic value of incumbent assets. There is no way that the FCC could have anticipated the competition that has developed in recent years, and its impact on the economic value of incumbents' assets, when it prescribed its depreciation ranges in the 1990s. In fact, the FCC noted in 1999 that competition was minimal and that any effects competition might have on depreciation lives were not immediate.[13/] But the competitive landscape has changed

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12/ The buried and underground non-metallic cable range of 25-30 years similarly is too long: that range might be reasonable if the only mortality forces were optical degradation and accidental cable damage. However, as recent TFI studies have documented, lives within this range are too long in light of technology obsolescence and competitive impacts. *See* L. K. Vanston & R. L. Hodges, "Transforming the Local Exchange Network: Review and Update," *Technology Futures* 83-101 (2003). The 20-year GAAP life for all the non-metallic cable accounts that SBC uses is more consistent with reality.

13/ Tenth Report and Order, *Federal-State Joint Board on Universal Service, and Forward-Looking Mechanism for High Cost Support for Non-Rural LECs*, 14 FCC Rcd 20156,

significantly since 1999. By June 2003, CLECs were serving almost 6.3 million lines using their own facilities.[14] That includes cable telephony providers, whose penetration rates in SBC's markets are in the 30% range.[15] And in 1999, the FCC could not have foreseen the possibility, which analysts now predict, that VoIP will cause the ILECs to suffer "20% to 30% consumer voice market share, as a result of the aggressive introduction of voice services by the cable industry over the next 5 to 7 years" and that "7% of access lines may be at risk by 2005."[16] Nor could the explosion in wireless have been predicted: consumers increasingly rely on their wireless phones, and wireless companies already have captured as much as 30% of what were previously wireline minutes.[17]

20. In 1999, the number of ILEC access lines was still increasing. However, since 2000, the number of ILEC narrowband access lines (*including* UNE and resale lines) has been declining. This figure peaked at 187.3 million in 2000, falling to 176.1 million by June 2003 (see Table 2). Note also that total wireline narrowband access lines, including both

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20345 ¶ 427 (1999).

14/ Federal Communications Commission, *Local Telephone Competition: Status as of June 30, 2003* (FCC Wireline Competition Bureau, Industry Analysis Division, rel. Dec. 2003), *available at* <http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/lcom1203.pdf> (Table 3).

15/ *See, e.g.*, James Granelli, *Expanding Cable Telephony Is New Kid on SBC's Block*, L.A. Times (Jan. 21, 2003) ("As of the end of September, Cox provided telephone service for 30% of the 304,000 households it has wired in 14 south Orange County cities, where nearly all the homes are hooked up. It has a similar share in the San Diego County communities it serves.")

16/ F. Governali, *Telecom Services: Quantifying the VoIP Threat, An Eye-Opening Exercise*, Goldman Sachs at 1 (Dec. 23, 2003).

17/ *See FCC Reports Wireless Sub Growth is Leveling, Mobile is on Rise*, Communications Daily, Vol. 23, Issue 124 (June 27, 2003).

CLEC and ILEC lines, peaked in 2000 as well, indicating the broad substitution by wireless and broadband that has occurred since.

Table 2
Narrowband Access Lines by Carrier Type (Millions)

		CLEC						
Month	Year	ILEC Retail	Facilities-Based	Resale & UNE	CLEC Total	ILEC Total*	Wireline Total	CLEC Pct
Dec	1999	181.3	2.7	5.5	8.2	186.8	189.5	4.3%
Jun	2000	179.8	4.0	7.5	11.6	187.3	191.3	6.0%
Dec	2000	177.6	5.2	9.7	14.9	187.3	192.5	7.7%
Jun	2001	174.9	5.8	11.5	17.3	186.4	192.1	9.0%
Dec	2001	172.0	6.1	13.6	19.7	185.6	191.7	10.3%
Jun	2002	167.5	6.2	15.4	21.6	182.9	189.1	11.4%
Dec	2002	162.7	6.4	18.4	24.8	181.1	187.5	13.2%
June	2003	155.9	6.3	20.6	26.9	176.5	182.8	14.7%

*Includes ILEC Retail and Resale & UNE.

Source: FCC, *Local Telephone Competition: Status as of June 30, 2003*, Tables 1 and 3.

21. Competition is expected to grow dramatically in the near future. Figure 1 illustrates the current TFI industry forecast for the impact on ILEC access lines of competition from cable telephony, wireless, and broadband.[18/] This shows that in a few years the decline that already has started likely will become very precipitous. Figure 2 shows that adding DSL customers to the ILEC access line count improves the situation, but since DSL has only a small share of the broadband market, there is still a significant overall loss in access lines.

[18/] L. K. Vanston, Forecasts of Access Line Competition in the Local Exchange (Technology Futures, 2003).

Figure 1
Narrowband Access Lines by Carrier Type

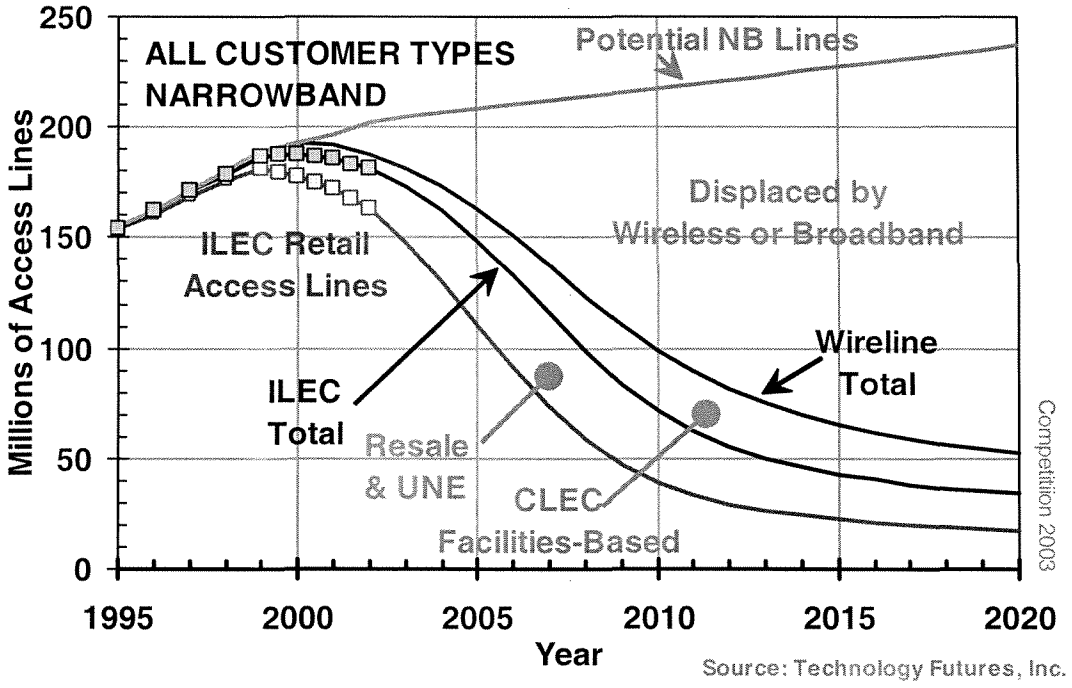
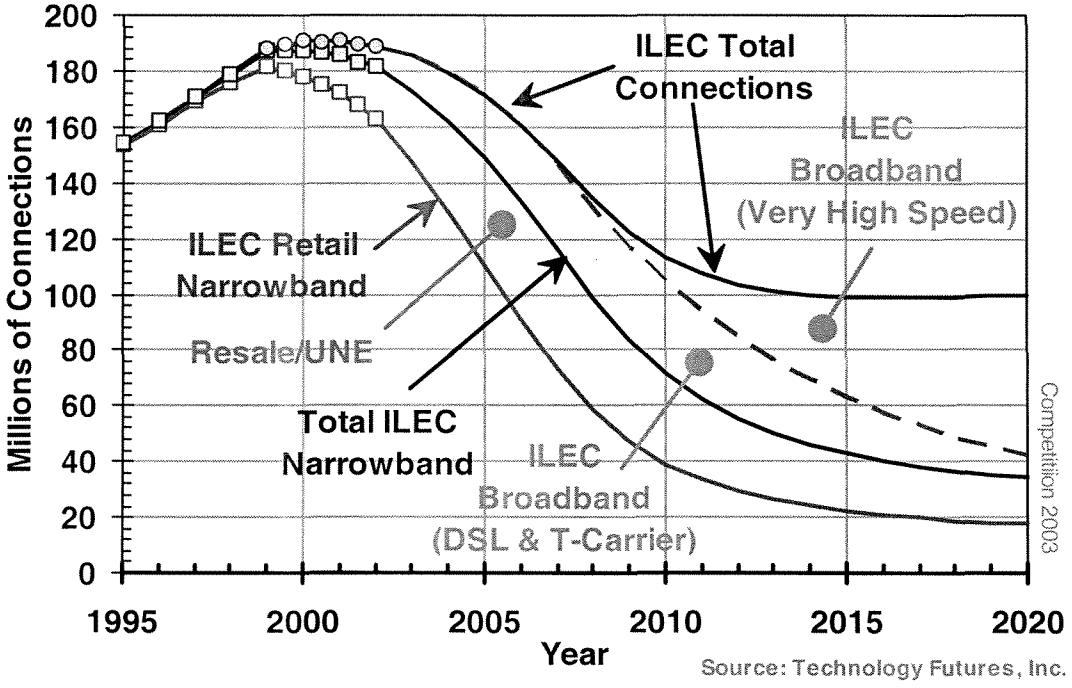


Figure 2
ILEC Narrowband Access Lines and Broadband Connections
(Includes Resale and UNE)



VII. THE DEPRECIATION RESERVE DOES NOT PROVE FCC-PRESCRIBED LIVES ARE ADEQUATE FOR CALCULATING TELRIC RATES.

22. Mr. Majoros and Mr. Lee erroneously claim that that current ILEC reserve levels prove that FCC-prescribed lives are adequate. *See* Majoros Decl. at 14-17; Lee Decl. at ¶¶ 15-19. The reserve level (also called the reserve ratio) is the percentage of investment for the total plant in service that has already been depreciated. There is no basis for the CLECs' suggestion that the reserve level proves *anything* about the underlying asset lives. As I explain below, the CLECs' reliance on reserve levels is a circular argument that does not demonstrate that the FCC-prescribed lives are appropriately forward-looking. Furthermore, as I also explain below, in today's climate of technological development and competition, reserve levels should be high. In fact, as my analysis demonstrates, current FCC-prescribed lives do not produce *high enough* reserve levels.

23. Mr. Majoros and Mr. Lee both present a highly misleading chart plotting the historic reserve level, claiming that it implies that the FCC-prescribed lives are adequate. Their strange choices for the horizontal and vertical scales imply that the reserve level is sharply increasing and about to go off the chart.[19/] In reality, the reserve level has been on a gentle upward slope for two decades and will likely peak sometime soon. In a recent report,[20/] the FCC found the book reserve level to be 55% on January 1, 2002 on the major ILECs' federally-regulated books. This upward curve reflects the fact that the

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19/ See *How to Lie with Statistics*, Darrell Huff, Illustrated by Irving Geis, 1954. See Chapter 5, "The Gee-Whiz Graph", at 60-65.

20/ Federal Communications Commission, *Report on Depreciation Reserve Analysis for 2002* (FCC Wireline Competition Bureau, Policy Pricing Division, rel. Oct. 2002), *available at* <http://www.fcc.gov/wcb/ppd/depreciation/documents/Depreciation_Reserve_Analysis_Update_Oct_2002.pdf>.

FCC adopted a more forward-looking approach in the 1980s and 1990s, and updated and shortened asset lives. But it says nothing about whether the 1990s FCC-prescribed lives remain appropriate — especially if applied to new assets in 2004.

24. Depreciation reserve is a function not only of the FCC's prescribed depreciation lives, but also of the applicable depreciation rates, which also are prescribed by the FCC. The depreciation rate is the percent of booked investment that is charged as depreciation expense on an annual basis. The reserve levels relied upon by Mr. Majoros and Mr. Lee in their analyses are produced by the FCC-prescribed depreciation lives and rates. In other words, the reserve simply indicates that the incumbents have recovered the amount the FCC has allowed at the rate the FCC has proscribed. It is unclear why Mr. Majoros and Mr. Lee believe that the mere fact that the incumbents are recording and recovering their depreciation costs at the rate the FCC requires can somehow prove that there is anything legitimate about the underlying lives themselves.

25. In fact, in today's era of intense technological change and facilities-based competition, if incumbents could depreciate their assets without the constraint of the FCC's rules, one would expect a *higher* reserve. High levels of depreciation reserve are expected as companies accelerate their depreciation schedules and shorten asset lives in anticipation of new technologies replacing existing plant or making existing plant less valuable. In my opinion, given the pace of competition and technology and the effects these have on asset lives, depreciation reserve levels should actually be *higher* than the levels produced by the FCC-prescribed depreciation lives and rates.

26. In addition, I should note that reserve levels increase for many reasons. For example, if the ILECs are deploying expensive assets that have short lives and thus high annual

depreciation expense, more depreciation will be taken annually, and thus the reserve will naturally grow. Since, in my view, asset lives should be shorter today, the reserve *should* grow. Also, as older assets age, the reserve should be growing, too, because the incumbents will have depreciated more of the cost of those assets.

27. My opinion that reserve levels should be even higher than the reported FCC book reserve is based on an analysis of the average remaining life (ARL) of incumbent facilities. The ARL is the average number of years that existing assets are expected to remain in service from a given date. The depreciation reserve level is related to the depreciation rate and the ARL by the following formula (assuming zero net salvage value):

Reserve Level = 1 - Depreciation Rate * ARL

28. My forecast for incumbent facilities suggests an ARL of roughly 5.9 years. (This number is computed directly from TFI forecasts for the various major network accounts, weighted by investment, as shown in Attachment 1.) Combined with the 2001 industry depreciation rate of 6.8% for FCC reporting, this ARL implies a reserve level of 60%. Thus, the book reserve level on which Mr. Majoros and Mr. Lee rely to try to show that FCC asset lives are appropriate is actually too low, in my view, assuming the current FCC depreciation rate.

VIII. ACTUAL RETIREMENTS DO NOT DETERMINE FORWARD-LOOKING ECONOMIC LIFE OR VALUE.

29. The CLECs suggest that ILEC retirement data also show that the FCC lives are appropriate, but here again they are wrong. Traditional rate-based depreciation was closely linked to actual retirements. In this context, a retirement occurs when an asset is both removed from service and removed from the company's books. Retirements were

used to measure historical lives and to estimate future lives. Today, retirement analysis serves neither of these purposes well, especially in the context of determining TELRIC rates.

30. Because facilities-based competition (especially intermodal competition) is relatively new, past retirements tell us little or nothing about future retirements. For all their detail, studies of historical retirements, such as those performed by Mr. Majoros and Mr. Lee, cannot predict the future because the data on which they are based do not reflect the new drivers for change.

31. There are several reasons why retirements are a poor indicator of forward-looking economic lives and value, namely:

- Retirement Lag: There is often a significant accounting lag between the time an asset stops being used and the time it is removed from service. More importantly, for some types of assets, equipment is not retired until well after its economic value has ended. Consider for example, a 900-pair cable on a feeder route. Suppose that 895 of the circuits that were once assigned to this cable have been rolled over to fiber optics, but that a handful are still used for marginal applications, for example, burglar alarms. Even though this asset is providing 1/2 of one percent of the economic value for which it was intended, none of it is considered "retired" in regulatory depreciation practice.
- Loss of Value: Accounting retirements provide no measure of the loss in value of an asset. When the cost (per unit of performance) of equipment is rapidly falling, the value of even recently installed equipment falls proportionally. This is because equipment cannot be worth more than the cost to replace it. For example,

the price of bandwidth on fiber optics has dramatically decreased, as has the cost of certain types of switching equipment.

- Loss of Revenue Production: Loss of customers or usage can cause equipment to be underutilized or stranded thereby reducing its ability to produce revenue. Facilities-based competition, displacement by other technologies such a wireless or cable, loss of minutes of use due to VoIP, etc., will likely reduce the revenue producing ability of an ILEC's assets, thereby shortening their effective economic lives. This is not reflected in retirement data, especially historical data.
- Forward-Looking Approach: By its nature, retirement analysis is backward-looking and tells us only about the technology in the installed base. As noted above, UNE cost models are required to assume forward-looking estimates, so it is inconsistent to use lives largely based on retirement analysis. If assets today have shorter lives than assets placed ten years ago, the retirement analysis as to the prior assets will not be relevant to determining whether those ten year-old lives should be revised.

32. In short, retirements tell us essentially nothing about the value or the economic lives of assets for UNE costing.

IX. SUMMARY

33. An accurate measure of the economic lives of the assets used by the ILECs requires an analysis of the effect of the intense competition and the technological developments that are occurring in the industry today. GAAP lives take these factors into account and provide a forward-looking measure of asset lives. My analysis confirms that SBC's GAAP lives are far more accurate and current than the FCC's regulatory lives. This

makes sense, given that the FCC's lives were set several years ago using data that is now seriously out of date, and cannot account for current trends. The CLEC arguments that are designed to show that the FCC lives are appropriate make no sense and do not affect this analysis: neither the reserve nor ILEC retirement data can show that outdated FCC lives should continue to be used today.

34. Finally, I note that there is nothing to the notion advanced by some parties that asset categories experiencing price increases will balance out asset categories experiencing price decreases. The reality is that all of the major accounts will experience severe declines in value due to either lost volume (e.g., lost access lines), declining equipment price trends (e.g. DSL line cards), declining intermodal cost trends (e.g., VoIP for circuit switching), or a combination of these (e.g., metallic cable). In fact, intermodal competition, which will affect all asset categories by reducing overall wireline demand by creating significant bypass opportunities, is probably the biggest threat, and could affect the economic lives of all assets.

35. This concludes my reply declaration.

Declaration of Lawrence K. Vanston

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 29th day of January, 2004.

Lawrence K. Vanston

Survivor Curves and Average Remaining Lives (ARL) for Embedded Investment Major Network Accounts - Based on TFI TLEN Forecasts*

Account Weightings

Account	Pct of Total Investment	Pct of Major Network Investment
Switching	18%	24%
Circuit	24%	32%
Metallic Feeder	14%	18%
Metallic Distribution	17%	22%
Fiber	3%	4%
Major Network Accts	76%	100%
Other Accts	24%	
Total	100%	

Survivor Curves for Major Network Accounts

Year	Switching	Circuit	Metallic Feeder	Metallic Distribution	Fiber	Investment Weighted Composite
2001	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2002	91.0%	86.9%	94.8%	99.2%	98.7%	92.5%
2003	79.7%	74.2%	82.6%	97.2%	96.3%	83.1%
2004	68.0%	62.1%	70.2%	94.1%	92.9%	73.5%
2005	56.5%	50.8%	58.0%	89.8%	88.3%	63.8%
2006	45.6%	40.1%	46.7%	84.4%	82.8%	54.4%
2007	35.5%	30.0%	36.6%	77.8%	76.4%	45.3%
2008	26.5%	20.3%	27.9%	69.8%	69.6%	36.4%
2009	19.4%	13.4%	20.6%	59.4%	62.3%	28.6%
2010	13.3%	7.2%	14.4%	46.3%	54.5%	20.8%
2011	8.7%	3.0%	9.5%	33.3%	45.8%	14.2%
2012	5.0%	1.0%	5.8%	23.4%	36.2%	9.4%
2013	2.6%	0.3%	3.5%	15.0%	26.3%	5.9%
2014	1.2%	0.1%	2.1%	10.6%	17.4%	3.8%
2015	0.6%	0.1%	1.3%	8.0%	10.5%	2.6%
2016	0.3%	0.0%	0.8%	5.5%	5.9%	1.7%
2017	0.1%	0.0%	0.5%	3.3%	3.1%	1.0%
2018	0.1%	0.0%	0.3%	1.9%	1.6%	0.6%
2019	0.0%	0.0%	0.2%	1.0%	0.8%	0.3%
2020	0.0%	0.0%	0.1%	0.5%	0.4%	0.2%
ARL (as of 1/1/2002)	**5.0**	**4.4**	**5.3**	**8.7**	**9.2**	**5.9**
TLEN Ref	Page 41	Page 46	Page 76 Base Scenario	Page 81 Late Scenario	Page 95 Late Scenario	

*Vanston & Hodges, *Transforming the Local Exchange Network: Review and Update* Techology Futures, Inc, 2003 (LKV-1)

Sources for Table 1:

Technological Substitution in Transmission Facilities for Local Telecommunications, Lawrence K. Vanston and Ralph C. Lenz, Technology Futures, Inc. (1988), pp. 87 and 119-126.

Technological Substitution in Switching Equipment for Local Telecommunications, Lawrence K. Vanston and Ralph C. Lenz, Technology Futures, Inc. (1989), pp. 18-19.

Technological Substitution in Circuit Equipment for Local Telecommunications, Lawrence K. Vanston, Technology Futures, Inc. (1989), p. 104.

Transforming the Local Exchange Network: Analyses and Forecasts and Technology Change, Lawrence K. Vanston (1994), pp. 55-59, 76, 78-79, and 178.

Transforming the Local Exchange Network: Analyses and Forecasts and Technology Change, Lawrence K. Vanston, Ray L. Hodges, and Adrian J. Poitras (1997), p. 70-74, 104-106, and 208.

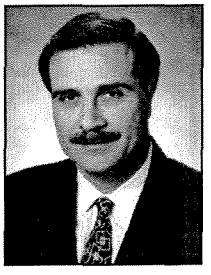
Transforming the Local Exchange Network: Review and Update, Lawrence K. Vanston and Ray L. Hodges (2003), p. 61.

Table 1
Comparison of Technology Futures Telecommunications Forecasts to Actual Outcome

Category	Old Technology	New Technology	Forecast Year	Forecast ARL[1]	Actual ARL[2]	Years Error[3]	Pct Error
Switching	Electromechanical	SPC	1989	2.0	2.5	**0.5**	**20%**
Switching	Analog SPC	Digital	1989	5.1	6.1	**1.0**	**16%**
Switching	Analog SPC	Digital	1994	2.9	3.8	**0.9**	**24%**
Interoffice Cable	Baseband Metallic	Derived	1988	3.3	3.9	**0.6**	**15%**
Interoffice Cable	Metallic	Fiber	1988	3.9	5.1	1.2	24% *
Feeder Cable	Baseband Metallic	Derived	1988	8.8 - 12.9	13.7 - 14.8	**1.9**	**13%**
Feeder Cable	Baseband Metallic	Derived	1994	8.5	8.9 - 10.1	**1.6**	**16%**
Feeder Cable	Baseband Metallic	Derived	1997	7.2	6.5 - 7.9	**0.7**	**9%**
Feeder Cable	Non-Fiber	Fiber	1988	8.8 - 12.8	15.1 - 16.2	3.4	21% *
Feeder Cable	Non-Fiber	Fiber	1994	8.7	10 - 11.2	2.5	22% *
Feeder Cable	Baseband Metallic	Fiber	1997	7.8	7.1 - 8.2	0.4	5% *
Circuit	Pre-SONET	SONET	1989	9.6	10	**0.4**	**4%**
Average						**1.0**	**15%**

*Not included in average because it was not used for computing ARL; the derived forecast was used instead.

1. As of January 1 of forecast year; range signifies alternative scenarios for historical forecast.
2. As of January 1 of historical forecast year. Includes current forecast if applicable. The range signifies alternative scenarios for current forecast.
3. Error computations are based on late scenarios for both histroical and current forcasts.



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President

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Dr. Lawrence Vanston is an internationally recognized authority in the use of technology forecasting in the telecommunications industry. As president of Technology Futures, Inc., Dr. Vanston has been monitoring, analyzing, and forecasting telecom technologies and services for more than 20 years. His research reports and forecasts are used and referenced extensively by telecom managers and professionals worldwide. As an expert on the impacts of new technologies and markets on the public telephone network, he is frequently called upon to testify before state and federal regulatory commissions.

Since 1985, Dr. Vanston has been the director and principal author of a number of ongoing reports commissioned by the Telecommunications Technology Forecasting Group (TTFG), which is comprised of ACS, Inc., Bell Canada, BellSouth Telecommunications, Qwest, SBC Communications, Sprint, and Verizon. Topics have included Internet access requirements, xDSL technologies, ATM switching, fiber optics, video services, and wireless communications. Many of the TTFG reports have drawn widespread industry attention.

Dr. Vanston's views and the results of his research are regularly cited by general business and industry publications including *Telephony, America's Network, Wired, Lightwave, Wireless Systems Design,* and *Communications News. The Wall Street Journal* featured Dr. Vanston in an in-depth interview entitled "Consultant's Call: Lawrence Vanston Makes Some Pretty Bold Predictions for the Future of Telecommunications. He Has Been Right Before."

Dr. Vanston is also a popular speaker on the subject of the future of telecommunications and its significance to organizations and people. Some of the prestigious programs he has participated in include the Brazil Telecom Summit, the Pacific Telecommunications Conference, the International Engineering Consortium's ComForum, SUPERCOMM, the Brazil Telecom Summit, and USTA's Capitol Recovery Seminar. Dr. Vanston was honored as Outstanding Speaker of the Year by attendees of the 11th Annual International Communications Forecasting Conference. In addition, he directs the popular TFI business seminar, *Technology Forecasting for the Telecom Industry.*

Before joining Technology Futures in 1984, Dr. Vanston spent four years with Bell Labs and Bellcore in network planning where he proposed and evaluated potential new long distance, billing, access, and data services. Prior to that, he was with the Texas Petroleum Research Committee and the Center for Energy Studies at the University of Texas at Austin. His academic achievements include a B.A. in government (1975) and an M.S. (1977) and Ph.D. (1979) in operations research and industrial engineering, all from the University of Texas at Austin.

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