The number of pair feet is 5,000,000 (1,000 loops x 5,000 feet). The number of sheath feet is 20,000 (4 sheaths x 5,000 feet). Therefore, the distribution investment is

- Cable: $50,000 (5,000,000 pair feet x $0.01)
- Installation and structure (pair-feet driven): $100,000 (5,000,000 pair feet x $0.02)
- Installation and structure (sheath-feet driven): $100,000 (20,000 sheath feet x $5.00)
- Total cost: $250,000

If the area were actually served by eight cables, rather than the four specified by the BCM, sheath feet would increase to 40,000 and total cost would increase by $100,000, which is 40 percent higher than the costs produced by the BCM.

The abstract nature of the BCM's distribution model is of more than academic interest. In the network cost elements reported in the May 30 update documentation of Version 2.2 of the Hatfield model submitted to the FCC, distribution plant accounted for 47 percent of the total cost of switched network elements in New York.

1 **3. Fill Factors**[14]

2 Q. How are fill factors used in a cost model?

3 A. Because telephone capacity is modular, i.e., it comes in sizes greater than a single
4 unit, there is more capacity in place than volumes in service. Capacity exceeds
5 volume even when the most efficient engineering practices are followed. The
6 ratio of volume in service to capacity is the fill factor.

7 The spare capacity represented by a fill factor less than 1.0 is a *current* economic
8 cost of providing service. In a previous evaluation of the BCM, I participated
9 with Pacific Bell's cost experts in reviewing that model.[15] As part of their review
10 of the BCM engineering rules, Pacific's experts compared the model's fill factors
11 with the actual fill factors that would result from the best engineering practices.
12 In general, the fill factors for feeder plant in the BCM were moderately higher
13 than best practice and the fill factors for distribution plant in high density areas
14 were substantially higher than best practice. Distribution fill factors are relatively
15 low because of the high cost of adding capacity after the support structure has

[14] A theoretical discussion of these issues appears in Richard D. Emmerson, "Theoretical Foundation of Network Costs," in W. Pollard, editor, *Marginal Cost Techniques for Telephone Services*, National Regulatory Research Institute (1991) at 145-189.

[15] Timothy J. Tardiff, "Evaluation of the Benchmark Cost Model," (prepared on behalf of Pacific Bell, for filing with the California Public Utilities Commission, Rulemaking/Investigation on the Commission's Own Motion into Universal Service and to Comply with Mandates of Assembly Bill 3643, R.95-01-020/I.95-01-021, December 1, 1995).

been built. Accordingly, capacity for an indefinitely long planning horizon is installed initially and utilization of that capacity is low as a result.

Q. Does the Hatfield model employ realistic fill factors?

A. Unfortunately no. Version 2.2 of the Hatfield model has increased the already somewhat high distribution fill factors in the original BCM, as shown in the table below. This would cause the underestimation of loop costs to be even greater.

1.

	BCM		Hatfield	
Density Zone	Feeder	Distribution	Feeder	Distribution
1	0.65	0.25	0.65	0.50
2	0.75	0.35	0.75	0.55
3	0.80	0.45	0.80	0.60
4	0.80	0.55	0.80	0.65
5	0.80	0.65	0.80	0.70
6	0.80	0.75	0.80	0.75

1 Q How do the fill factors used in the Hatfield model compare to those dictated by
2 NYT's engineering practices?
3 A. On a company-wide basis, I estimate that NYT's average fill for loop plant is
4 about 59 percent. (This factor is in fact higher than the Pacific Bell fill factor
5 discussed elsewhere in my testimony.) In contrast, the Hatfield model produces
6 an average fill for loop plant of over 73 percent.
7 Q. What accounts for this difference in fill factors?
8 A. As I understand it, NYT's cost estimates are based on the average fill factor,
9 while the Hatfield model uses a design (or objective) factor. Because the average
10 fill factor accounts for the spare capacity necessary for efficient provision of
11 service, it is a *current* cost of doing business which needs to be recovered in the
2 prices charged by NYT.
13 The Hatfield model's use of unrealistically high fill factors causes costs to
14 understated in two ways.
15 Q. What is the first way excessive fill factors bias the result?
16 A. Because (1) the fill factor, in part, determines how much cable is needed and (2)
17 the cost of all the associated installation and structures are estimated by
18 multiplicative factors, overestimation of the fill factor will cause an unrealistically
19 large drop in the Hatfield model's loop costs. Because a higher fill factor would

1 produce less cable investment, the Hatfield model produces proportionately less
2 installation and structure investment as well. In reality, even if the Hatfield fill
3 factors were realistic, the savings in installation and structure would be
4 considerably less than proportionate, e.g., a smaller cable would be placed in the
5 same conduit.

6 Q. And what is the second source of bias introduced by high fill factors?

7 A. The Hatfield model appears to be based on the belief that competitive firms
8 would have minimal spare capacity. In this regard, the FCC's finding on spare
9 capacity in interstate long-distance, which was one of the bases for granting
10 AT&T non-dominant status, contradicts this apparent belief:

11 AT&T asserts, and no one disputes, that MCI and Sprint alone can
12 absorb overnight as much as fifteen percent of AT&T's total 1993
13 switched demand at no incremental capacity cost; that within 90
14 days MCI, Sprint, LDDS/Wiltel, using their existing equipment,
15 could absorb almost one-third of AT&T's total switched capacity;
16 or that within twelve months, AT&T's largest competitors could
17 absorb almost two thirds of total switched traffic for a combined
18 investment of $660 million. Thus, AT&T's competitors possess the
19 ability to accommodate a substantial number of new customers on
20 their networks with little or no investment immediately, and
21 relatively modest investment in the short term. We therefore
22 conclude that AT&T's competitors have sufficient excess capacity
23 available to constrain AT&T's pricing behavior.[16]
24

[16] Federal Communication Commission, In the Matter of Motion of AT&T Corp. to be Reclassified as a Non-Dominant Carrier, FCC 95-427 (October 15, 1995) ¶ 59.

1 To cast the FCC findings in terms relevant to the current discussion, note that
2 MCI and Sprint combined are roughly one-half of AT&T's size. Overnight they
3 can absorb 15 percent of AT&T's capacity. This implies that MCI and Sprint
4 have at least 30 percent spare capacity that could be deployed overnight.
5 The implication of these findings is that, if anything, competition may require a
6 firm to invest in more, rather than less spare capacity to be flexible enough to
7 respond the vicissitudes of the market. Failure to recover in current revenues the
8 current cost of business caused by the spare capacity necessary to operate in the
9 competitive environment would be detrimental to the shareholders of such
10 companies, perhaps even forcing some of them out of business.
11 Q. Has there been any regulatory review of the dispute involving fill factors?
12 A. Yes. In a recent Proposed Decision on cost studies, an Administrative Law
13 Judge of the California Commission concluded that Pacific Bell had appropriately represent

14 **B. Switching**

15 Q. How does the Hatfield model estimate the cost of local switching?
16 A. Version 2.2 of the Hatfield model systematically understates the cost of local
17 switching. By selectively using heavily discounted prices for new switches and
18 by assuming that a local service provider would instantly install all of the
19 switching capacity it needs at once, the Hatfield model produces results that are

[17] California Public Utilities Commission, Proposed Decision of ALJ McKenzie, July 2, 1996.

To cast the FCC findings in terms relevant to the current discussion, note that MCI and Sprint combined are roughly one-half of AT&T's size. Overnight they can absorb 15 percent of AT&T's capacity. This implies that MCI and Sprint have at least 30 percent spare capacity that could be deployed overnight.

The implication of these findings is that, if anything, competition may require a firm to invest in more, rather than less spare capacity to be flexible enough to respond the vicissitudes of the market. Failure to recover in current revenues the current cost of business caused by the spare capacity necessary to operate in the competitive environment would be detrimental to the shareholders of such companies, perhaps even forcing some of them out of business.

Q. Has there been any regulatory review of the dispute involving fill factors?

A. Yes. In its a recent Proposed Decision on cost studies, an Administrative Law Judge of the California Commission concluded that Pacific Bell had appropriately represented spare capacity in its cost studies.[17] In particular, the Proposed Decision rejected arguments that fill factors commensurate with those used in the Hatfield model should be employed.

B. Switching

Q. How does the Hatfield model estimate the cost of local switching?

A. Version 2.2 of the Hatfield model systematically understates the cost of local switching. By selectively using heavily discounted prices for new switches and by assuming that a

[17] California Public Utilities Commission, Proposed Decision of ALJ McKenzie, July 2, 1996.

substantially lower than the forward-looking local switching costs that real telephone providers actually incur.

Q. Please describe Hatfield's switching model.

A. Hatfield developed a relationship between switching cost per line and the size of the switch by piecing together information from various sources. In particular, the algorithm is driven by three data points constructed as follows.

- Small switch: the cost per line ($241 for 1994) was taken from the Northern Business Information report on the average cost of *new* lines for independent companies. Hatfield associated the average *installed* switch size of 2,782 lines for small LECs (LEC industry less RBOCs), calculated from statistics on lines and switches reported to the FCC for 1993.

- Medium switch: the cost per line ($104 for 1994) was taken from the Northern Business Information report on the average cost of *new* lines for RBOCs. Hatfield associated the average *installed* switch size of 11,200 for RBOCs, calculated from statistics on lines and switches reported to the FCC for 1993.

- Large switch: cost per line of $75 for a 80,000 line switch, "obtained from switch manufacturers."

Hatfield then drew straight lines between the three points to complete the relationship.

Q. Are there problems with Hatfield's representation of switching costs?

A. Yes. Hatfield's approach suffers from at least two problems. First, there is a mismatch between the data sources the model emr[1] Note, for example, that it matches a 1994 forecasted price with a 1993 average embedded switch size.

The approach also assumes that the *average* installed switch is of the same size as the average *new* switch, an assumption that is not necessarily valid.

Second, and more fundamental, the Hatfield model ignores the fact that LECs buy additional lines for installed switches as well as new lines for new switches. These additional lines cost more, as the study that Hatfield used for his switch prices suggests:

> The add-on market continues to retain revenue potential for the suppliers, particularly as the margins on new switches remain below the margins for the add-on market. A digital line shipped and in place will generate hundreds of dollars in add-on software and hardware revenue during the life of the switch. Suppliers can afford to forego losing (sic) a few dollars on the initial line sale in exchange for the increased revenue in the aftermarket, when prices are less likely to be set by competitive bidding.[18]

The local switching component of the Hatfield model graphically illustrates the fallacy of its scorched view of cost studies. In order for the approach to produce realistic costs (ignoring the data problems identified earlier), a new entrant would have to serve customers with initial lines only and also have the volumes to command the discounts that existing LECs apparently command. The fact that LECs expand their switches as demand grows and the existence of a lucrative

[18] Northern Business Information, *US Central Office Equipment Market—1994*, at 71.

1 aftermarket for this expansion demonstrate that the "instant LECs" posited by the
2 Hatfield model are inconsistent with reality.

3 **C. Converting Investments to Annual and Monthly Costs**

4 Q. How does the Hatfield model convert investments to monthly costs?

5 A. As described earlier, the various manifestations of the Hatfield model are
6 essentially models of the *investment* component of an LEC's cost structure.
7 These investments are converted into annual and monthly amounts by (1)
8 annualizing the investments through the use of cost-of-capital and depreciation
9 rates and (2) estimating out-of-pocket operating expenses through the use of
10 historical expense to investment ratios. In applying the model for this
11 investigation, Mr. Floyd has corrected one problem in earlier versions of the
12 model: the use of an unrealistically low rate of return.[19] A major problem
13 remains: depreciation rates are too low.

14 Q. Why are the depreciation rates in the Hatfield model too low?

15 A. While long investment lives may have been appropriate for a regulated monopoly
16 provider, the competitive environment fostered by the Telecommunications Act is
17 a different world. The forces of competition itself, as well as the technological

[19] Mr. Floyd used New York Telephone's authorized rate of return. In fact, given the uncertainty and competitive forces unleashed by the Telecommunications Act and other regulatory developments, a realistic rate of return may be considerably higher.

change that permeates this industry, invalidate the use of the old, long depreciation lives. In fact, Professor Hausman's May 30, 1996 reply affidavit demonstrates that accounting for the increased risk and uncertainty of competition increases the annual cost related to investments by a multiple of at least 3.

The Version 2.2 of the Hatfield model lists asset lives by type of facility, e.g., end office switches have a life of 20 years in the model. In contrast, earlier versions utilized an average life. For example, the BCM posited an average life of 18 years for all plant. Inspection of the lives in Version 2.2 suggest an average life of at least 18 years, which is equivalent to an annual depreciation rate of 5.7 percent. This rate is well short of the 1994 book depreciation of 7.16 percent for RBOCs, let alone the higher true economic depreciation rate.[20]

The 1994 Hatfield Report indicates that changing depreciation from an average 20 year life (5 percent rate) to 15 years (6.7 percent rate) would increase basic service costs by 13 percent.[21] Applying this relationship to the difference

[20] Federal Communications Commission, Statistics of Communications Common Carriers, 1994/1995 Edition, Table 2.9.

[21] These sensitivity tests are primarily illustrative. When the computer files for Version 2.2 are available and installed, sensitivity tests on the cost-of-capital and depreciation factors can be performed in a more direct manner (if the program code allows these factors to be changed by the user).

between the depreciation rate implied by an 18 year life and the RBOC's current book depreciation rate produces a cost increase of 12.6 percent.[22]

Of course economic depreciation rates are much higher. For example, Schmalensee and Rohlfs reported that AT&T's depreciation rate is 18.5 percent.[23] Even AT&T's 1994 book depreciation rate of about 11 percent is much higher than the rates used in the Hatfield model. Using the Schmalensee-Rohlfs and AT&T's book depreciation rates in the relationship from the 1994 Hatfield report increases costs by 100 percent and 42 percent, respectively.

V. CONCLUSIONS

Q. What conclusions can be drawn from your evaluation of the Hatfield model?

A. The fundamental flaws in the Hatfield model are that (1) it models the cost of no realistic local service provider and certainly not the incumbent LECs who will actually sell the unbundled elements it attempts to cost and (2) particular inputs and processes appear to systematically understate the costs of network elements. Indeed, at the same time that AT&T reported to the FCC that it would cost $1,240 per customer if AT&T provided local service to 20 percent of the market

[22] I am informed that New York Telephone's average depreciation life is 15.3 years, which implies a depreciation rate of 6.5 percent. The difference between this rate and that used in the Hatfield model implies that the Hatfield model's costs understate New York Telephone's costs by at least 7.6 percent.

[23] Richard Schmalensee and Jeffrey H. Rohlfs, "Productivity Gains Resulting From Interstate Price Caps for AT&T," National Economic Research Associates, September 1992.

1 (likely the least costly part of the market), it and MCI are supporting models that
2 produce investment costs of only $840 per line.[24]
3 Like any model, the Hatfield model is best interpreted in the context of why it
4 was built and what objectives it is intended to foster. The architects and
5 sponsors of the Hatfield model are quite clear in their purpose—they want to buy
6 elements from the LECs, most prominently switched access, at rates far below
7 current rates and even below the costs of the LECs require to produce these
8 elements. While we would all like to pay lower prices, markets only permit this
9 when those prices are commensurate with the costs of production.
10 The Hatfield model developers defend their costs by arguing that any difference
11 between the costs of their model and costs reported by the LECs (either
12 accounting costs that are required by law and by regulators or the cost produced
13 by LEC incremental cost models) represent the costs of overinvestment. For
14 example, the report describing the "greenfield" version of the Hatfield model that
15 was attached to MCI's opening comments claims that about half of the LEC's
16 current plant represents overinvestment. Apart from the facts that this label is
17 entirely circular and Hatfield's estimate of the so-called gap is fatally flawed by

[24] The FCC's April 19, 1996 Notice of Proposed Rulemaking in CC Docket No. 96-98 listed the costs AT&T reported it would incur. The Hatfield investment per line is calculated from the "greenfield" version of the model.

1 the theoretical and measurement problems with the Hatfield models, it defies
2 common sense to believe that the overinvestment of this degree could take
3 place.[25]
4 Of course, the more important concern is how network elements are unbundled
5 in a way that promotes competition. Basing prices on costs that no real-world
6 provider could hope to meet is *anti-competitive*, because it would stifle, not
7 promote the most effective type of competition—facilities-based. In addition,
8 requiring incumbent LECs to sell inputs at non-compensatory rates would have
9 the deleterious effects of forcing other customers to subsidize the below-cost
10 input prices and/or severely handicapping firms that represent a substantial
11 proportion of this dynamic industry.
12 Q. Mr. Floyd reports that the Washington State Commission has apparently
13 endorsed a version of the Hatfield model. Is this significant for this Commission?
14 A. Obviously, this Commission will weigh the evidence put forward by the various
15 parties, taking notice of actions in other jurisdictions as appropriate. Of course,
16 circumstances differ between jurisdictions, so that Commission rulings will differ
17 accordingly.

[25] Some of the gap between book investment and forward looking investment could represent the effect of the decline in prices for facilities such as end office switches. The fact that current prices recover some of these costs is entirely consistent with the economic fact that with technological change, no firm could survive by charging prices that completely reflect the decline in new equipment prices, as Professor Hausman's recent affidavit cogently demonstrates.

1 Having said this, I believe that the recent Proposed Decision by the California
2 Commission is perhaps even more germane to the case at hand. AT&T and MCI,
3 as members of the California Telecommunications Coalition, severely criticized
4 Pacific Bell's cost studies and argued that the Hatfield model should be used
5 instead. The Administrative Law Judge concluded otherwise: "Pacific's cost
6 studies adequately conform to the TSLRIC principles adopted in D.95-12-016 so
7 that, with the adjustments we order in this decision, such studies can be used as
8 the basis for setting prices for bundled and unbundled BNFs and services."
9 (Conclusion of Law 2.)
10 Q. Does this complete your testimony?
11 A. Yes.

DOCKET NOS. 16189, 16196, 16226, 16285, 16290

SOUTHWESTERN BELL TELEPHONE COMPANY

DIRECT TESTIMONY

OF

TIMOTHY TARDIFF

PUC Issues

VII Costing/Pricing Issues
(j) Hatfield Model

SEPTEMBER 6, 1996

DOCKET NOS. 16189, 16196, 16226, 16285, 16290

SOUTHWESTERN BELL TELEPHONE COMPANY

DIRECT TESTIMONY OF TIMOTHY TARDIFF

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SOUTHWESTERN BELL TELEPHONE COMPANY

DIRECT TESTIMONY OF TIMOTHY J. TARDIFF

1 **Q. PLEASE STATE YOUR NAME, OCCUPATION, AND BUSINESS ADDRESS.**
2 A. My name is Timothy J. Tardiff. I am a Vice President at National Economic Research
3 Associates, 1 Main Street, Cambridge, MA 02142.

4 **Q. BRIEFLY SUMMARIZE YOUR QUALIFICATIONS AS THEY PERTAIN TO THIS**
5 **TESTIMONY.**
6 A. I received the B.S. degree from the California Institute of Technology in mathematics
7 (with honors) in 1971 and the Ph.D. in Social Science from the University of
8 California, Irvine in 1974. From 1974 to 1979, I was a member of the faculty at the
9 University of California, Davis. I have specialized in telecommunications policy issues
10 for about the last 14 years. My research has included studies of the demand for
11 telephone services, such as local measured service and toll; analysis of the market
12 potential for new telecommunications products and services; assessment of the
13 growing competition for telecommunications services; and evaluation of regulatory
14 frameworks consistent with the growing competitive trends. I have filed testimony
15 and reports on behalf of Pacific Bell before the California Public Utilities Commission
16 on incremental cost principles, rules for local competition, universal service funding,
17 open access and network architecture, regulation of wireless telecommunications
18 services, the treatment of accounting changes for post-retirement benefits under
19 price caps, the review of California's price cap plan, and flexible pricing for Centrex
20 service. I have also submitted reports on behalf of Pacific Bell before the Federal

1 Communications Commission on price cap productivity, access to intelligent
2 networks, interconnection pricing policies, and the treatment of accounting chang
3 for post-retirement benefits under price caps. I have also testified for GTE North on
4 intraLATA presubscription before the Illinois Commerce Commission, and filed a
5 report with the New York Public Service Commission on intraLATA presubscription on
6 behalf of New York Telephone. Appendix 1 is a copy of my resume.

7 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

8 A. I am filing testimony in this proceeding on behalf of Southwestern Bell Telephone
9 Company (SWBT) in the Public Utility Commission of Texas (Commission) Arbitration
10 proceeding. My testimony addresses Issue VII(j), Costing/Pricing Issues Hatfield
11 Model, of the Commission's Issues for Arbitration. The purpose of my testimony is
12 twofold. First, I will appraise, from an economist's perspective, the conceptual validity
13 and policy applicability of the Hatfield Cost Model, Version 2.2, Release 2 ("HCM
14 2.2.2") that has been submitted in this proceeding by AT&T Corporation. Second, I
15 will assess the problems inherent in the application of this Model to the determinati
16 of costs of various switched network elements offered on an unbundled basis by
17 SWBT.

18 **Q. PLEASE SUMMARIZE YOUR TESTIMONY.**

19 A. HCM 2.2.2 is a proxy cost model that should not be used to establish the costs of
20 (hence, prices for) unbundled network elements offered by SWBT. Cost studies for
21 that purpose should, more appropriately, be based on the forward-looking costs that
22 SWBT will encounter in operating its network consistent with the market
23 circumstances it faces rather than on some purely hypothetical view of the network,
24 both now and in the future. Moreover, since HCM 2.2.2 almost entirely disregards
25 SWBT's past, it succeeds only in approximating the costs that would likely be
26 experienced by a mythical (not realistic) brand new start-up firm that is completely
27 unconstrained by past network development and technology choices, but which is
28 instantaneously able to serve the entire volume that SWBT's network elements
29 currently serves. This limitation of the Model severely restricts its value in setti

policy goals and directions (and prices for unbundled network elements, in particular) for an *existing* network like SWBT's.

Q. WHAT DO YOU MEAN BY A MYTHICAL NEW ENTRANT?

A. HCM 2.2.2 combines the hyper-efficiencies that a network built instantaneously to serve a known level of demand would enjoy with the extremely low installation costs that would occur if all capacity could be installed instantly. Accordingly, the Model neither produces costs of an efficient entrant nor the cost of SWBT efficiently operating its network. Apart from this fundamental flaw in HCM 2.2.2's basic approach, the testimonies of Mr. Hearst and Mr. Raley show that particular input prices included in the Model are not consistent with the prices that telephone companies in Texas actually face using efficient technologies and network configurations. It is an elementary proposition in economics (as well as simple common sense) that using the wrong input prices in a cost calculation produces incorrect estimates of the costs of network elements.

Q. WHAT IS THE CONSEQUENCE OF UNREALISTICALLY LOW ESTIMATES OF NETWORK ELEMENT COSTS?

A. Basing prices on costs that no real-world provider could hope to meet is *anti-competitive*, because it would stifle, not promote the most effective type of competition—facilities-based. Two types of distortions to competition would result. First, pricing unbundled elements below any reasonable estimate of cost would thwart entry for local exchange service, contrary to the express intention of Congress in enacting the Telecommunications Act of 1996. Second, non-compensatory prices for unbundled elements would undermine SWBT's incentives to improve its network, because an adequate return for its investment would not be forthcoming.

In addition, requiring incumbent LECs to sell inputs at non-compensatory rates would over time have the deleterious effect of forcing whatever customers that may remain to subsidize the below-cost unbundled network element prices and/or severely

handicap the incumbent facilities providers, which represent a substantial proporti-
of this dynamic industry.

THE HATFIELD MODEL

Q. WHAT IS HCM 2.2.2?

A. HCM 2.2.2 is the Hatfield Cost Model, Version 2.2, Release 2, prepared by Hatfield Associates, Inc., of Boulder, Colorado, on behalf of its sponsors, AT&T Corporation and MCI Telecommunications Corporation. In its present form, HCM 2.2.2 is an engineering model that proports to construct the costs of switched network services (e.g., basic exchange service) or its switched network components (e.g., loop facilities, switching, signaling, transport facilities, etc.).

Q. WHAT IS TOTAL ELEMENT LONG RUN INCREMENTAL COST OR TELRIC?

A. An incremental cost is the cost incurred by a firm to produce the next increment of output. When the increment of output is the entire quantity of a network element, the cost may be called a total element incremental cost. When the cost is measured in the long run (i.e., a period of time long enough for the firm to vary or adjust its factors of production for supplying additional units of elements), it is called a total element long run incremental cost, or TELRIC. TELRIC may be measured as the difference between (i) the total cost of a firm's current outputs (including the elements for which TELRIC is being measured) and (ii) the total cost of the firm if it produced all but the element in question. The background assumption is that these costs are always measured using forward and efficient technology and following cost-minimizing practices. The TELRIC includes all the directly attributable parts of an element's economic cost. In addition, a suitable portion of common overhead) and/or shared fixed costs of the firm must be included in the prices of unbundled elements.

Q. IS THE PRODUCT OF HCM 2.2.2 A TELRIC STUDY?

A. No. HCM 2.2.2 is not a study per se of any costs, total long run incremental or otherwise and certainly is not a TELRIC study.

EVALUATION OF HCM 2.2.2

Q. IS THE HATFIELD MODEL COMPLETE AT THIS TIME?.

A. No. The Model appears to be undergoing continuous change. In particular, the estimated costs for unbundled network elements presented last month in this proceeding are different from the results submitted to the FCC in May of this year, because the Model has changed substantially to the point of completely new software being released. The new version, HCM 2.2.2 (Hatfield Version 2.2, Release 2) has supposedly retained the structure of the earlier HCM 2 .2.1 (Release 1) but modified a number of the assumptions and inputs embedded in it. Despite what appear to be substantial changes, some of which should substantially change the costs of unbundled network elements, the quantitative cost results appear not to differ significantly from those from HCM 2.2.1.

Of course, because the Model is still being revised and may change as described in the transcript from the scheduled August 30 Oral Deposition of Robert Mercer (Schedule A), it is not possible to perform a comprehensive evaluation at this time. Thus, although I have not had the opportunity to examine even a preliminary version of the full documentation on HCM 2.2.2 (I understand it is still being prepared), it seems plain from the Hatfield "results" for SWBT in Texas that the basic deficiencies of the prior version(s)[1] continue to exist. In particular, it seems clear that the remaining flaws in HCM 2.2.2 continue to bias the cost estimates downward.

Q. IN YOUR EVALUATION OF HCM 2.2.2 AND ITS PREDECESSOR HCM 2.2.1, WHAT IS THE PRIMARY FOCUS OF YOUR ANALYSIS?

A. My primary focus is on (i) "scorched node" approach used by the Hatfield Models, (ii) treatment of loop plant, especially distribution cable facilities, (iii) assumptions about

[1] See, e.g., Timothy J. Tardiff, *Economic Evaluation of Version 2.2 of the Hatfield Model*, prepared for GTE, July 9, 1996, and Comments of William E. Taylor and Aniruddha Banerjee, Before the Federal Communications Commission, CC Docket No. 96-45, August 9, 1996.

fill factors, (iv) assumption that *total* demand will be served by a single provider, even in the presence of multiple competitors, (v) input prices, and (vi) depreciation rates and cost of capital.

Q. WHAT, IN YOUR OPINION, ARE THE MAIN FLAWS OR LIMITATIONS OF THE HATFIELD MODEL?

A. The following is a non-exhaustive catalog of the flaws and limitations of the Hatfield Model.

1. The scorched node used by the Hatfield Model allows the LEC's existing central office locations to be treated as fixed, but assumes that the rest of the network (outside plant like feeder and distribution facilities, switches, etc.) are always available for instant redesign and re-optimization. Since a substantial portion of a LEC's investments and expenses arise from *those* facilities, this approach significantly departs from the forward-looking efficient network.[2] As a result, the Hatfield Model completely departs from the FCC's stated objective for TELRIC studies which is:

> This benchmark of forward-looking cost and existing network design most closely represents the incremental costs that incumbents actually expect to incur in making network elements available to new entrants.[3]

2. The Hatfield Model assumes that, despite competitive entry by new firms, a single company would continue to *fully* serve all volumes presently served by the incumbent LEC and, therefore, would be able to realize the fullest extent of the economies of scale and scope experienced by the incumbent. In a competitive market, no single firm (incumbent or entrant) is likely to serve the volume currently

---

[2] AT&T was an active participant in a California cost proceeding in which the parties agreed on several costing principles. Among these principles was a version of the "scorched node" approach that maintained the existing locations of *both* switches and outside plant. California Public Utilities Commission, Decision 95-12-016, December 6, 1995, Appendix C, p. 4.

[3] Federal Communications Commission, *Implementation of the Local Competition Provisions in the Telecommunications Act of 1996*, First Report and Order, CC Docket 96-98, May 30, 1996, ¶ 685.

being served by the incumbent LEC.[4] Accordingly, there is a strong possibility that, as it surrenders some portion of its market share to entrants, the incumbent LEC's own incremental costs are likely to rise because any reduction of the volume served by it may cause the incumbent to suffer a reduction of its scale economies as well.

3. The Hatfield Model assumes unrealistically high fill factors for both feeder and distribution cable (65(-80% for feeder and 50-75% for distribution).[5] Because *actual* fills are usually considerably less, the assumed fill factors tend to underestimate costs because higher fill means less cable investment.[6]

4. HCM 2.2.2 reportedly calculates structure costs separately from the cost of cable facilities. However, although an attempt has been made to rectify the theoretical flaw in HCM 2.2.1 that multiplicative factors produce, Mr. Hearst's testimony shows that the input prices for structures in HCM 2.2.2 are severely underestimated.

5. The Hatfield Models employ several input prices (e.g., for central office equipment) that are consistently lower than what LECs pay. For example, HCM 2.2.1 assumes that a medium size switch with an average of 11,200 lines would have a switching cost per line of $104. (The cost in HCM 2.2.2 is even lower: $86 per line). In contrast, Mr. Raley shows that SWBT actually pays $183 per line on new installations and $248 on additions. The Hatfield Models appears to assume

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[4] Of course, if the prices of unbundled network elements are set too low, efficient entry and competition could well fail to develop, thus undermining the purpose of the Telecommunications Act of 1996. In this event, use of the results of HCM 2.2.2 would serve to "verify" the assumption of total volume being served by a single provider, albeit at the expense of effective competition and to the detriment of consumers.

[5] The tables of fill factors in the Hatfield Model are used to determine necessary capacity. Because available units of capacity may not exactly fit the necessary capacity, actual fills from the Model may be somewhat lower than the tabulated values. The Hatfield Model documentation and output contain no information on the actual fills produced by the Model.

[6] The Federal Communications Commission's recent Order specifies that a "reasonable projection" of the fill should be used. See Section 51.511 of Appendix B (Final Rules).