Corrected page of prefiled Surrebuttal Testimony of Dr. Taylor as noted in the transcript, Vol. 1, at 10. Correction noted by ** **.

Q. What is your response to AT&T and Staff's claims that Verizon **MA's studies overstate costs by failing to assume the most efficient mix of Digital Loop Carrier technologies? [Baranowski Rebuttal at 15-16; Pitts Rebuttal at 27; Ankum Rebuttal at 46-50.]**

A. Verizon MA's models incorporate the mix of IDLC and UDLC that it expects to deploy over the planning period. My understanding is that Verizon MA expects that the same mix will be used in new plant going forward over the planning period. Verizon MA then projects that this mix is deployed *network-wide*, which results in a higher percentage of IDLC than Verizon MA expects to have in place for the foreseeable future. Accordingly, Verizon MA's approach is forward-looking.

With respect to GR-303, I understand that Verizon MA's studies assume a greater percentage than what it in fact expects to deploy in the foreseeable future. In reality, little GR-303 will be used because, among other things, greater deployment of GR-303 would require greater investment in and replacement of related complementary switching facilities than would be efficient to deploy over the foreseeable future. This is yet another illustration of why cost models should not assume it would be efficient to deploy only the most up-to-date technology at a single time on a wholesale basis. Such an instantaneous approach does not reflect how a real-world, efficient carrier acts to minimize costs over the long run and is not an economically appropriate interpretation of the FCC's TELRIC rules.

B. <u>Forward Looking to Current Factor</u>

Q. What is your response to AT&T and Staff's criticisms that Verizon's FLC is an attempt to recover embedded/historic expenses and inconsistent with TELRIC principles? [Baranowski Rebuttal at 34-35; Fischer Rebuttal at 9; Ankum Rebuttal at 13.]

Corrected page of prefiled Surrebuttal Testimony of Dr. Taylor as noted in the transcript, Vol. 1, at 10. Correction noted by ** **.

A. These arguments display the CLECs' misunderstanding of the forward-looking-to-current (FLC) factor. Verizon **MA's** studies calculate annual cost factors by comparing expenses *already adjusted to be forward-looking* to embedded investment.[2] If these ACFs were then applied to forward-looking TELRIC investment, which are usually lower than "embedded investments," then in effect the TELRIC adjustment would be double counted. The FLC, which is a ratio of embedded to TELRIC investments, corrects for that double counting. The key point is that, contrary to the CLECs' claims, the expenses generated by Verizon **MA's** model are forward-looking and lower than its "embedded" expenses.

I further note that Mr. Baranowski's claim that expenses decline as a matter of course as technology improves and expenses decrease is simplistic.[3] There is no reason to assume that just because investments can be reduced by one-half that expenses associated with that investment automatically would be reduced by half. Indeed, **Verizon MA's** experience suggest that is often not the case.[4]

C. Switches

Q. Do you agree with Ms. Pitts' contention that Verizon's Recurring Cost Study does not satisfy TELRIC principles for modeling a reconstructed local network because it does not assume the purchase of all *new* digital switches at new switch prices as defined by VZ-MA's switch vendors? [Pitts Revised Rebuttal at 3, 10-11.]

[2] Cost Panel Direct at 57. In contrast, while AT&T/WorldCom's model also adjusts embedded investments to be forward-looking when estimating expense factors, it makes no attempt to verify that expenses are forward-looking. Rather, because the forward-looking adjustments used to convert embedded investments differ from the investment levels assumed in the model, the resulting expenses are systematically understated. Tardiff Rebuttal at § V.C.1.

[3] Baranowski Rebuttal at 35-36.

[4] Cost Panel Direct at 57.

No. 96-324, the same Delaware proceeding to set TELRIC rates for unbundled elements as addressed in the Delaware federal case cited by **Ms. Pitts**, I submitted testimony where I stated:

> Real world LECs respond to increasing demand by adding lines to an existing switch, replacing the switch with a larger switch or adding another switch. These real-world incremental costs are not measured by a model that assumes that the LEC completely rebuilds its network optimally in a single day to serve the current level of demand. Such a model makes the highly unrealistic assumption that all switches can be instantly and at no extra cost resized and/or replaced to reflect current demand conditions.[6]

My testimony in transcripts from that proceeding is in fact consistent with my testimony in this proceeding. In particular, I made the following points:

- An economically appropriate approach does not require instantaneous network reconstruction. TELRIC should be based on how investments occur over the long run to serve demand as it emerges, not demand at one point in time.[7]
- TELRIC models should estimate the costs that an efficient incumbent expects to incur to provide unbundled network elements — *i.e.*, they should account for an incumbent's continuous investment decisions. It is not appropriate to model a network that instantaneously serves existing demand.[8]
- It is not economically appropriate to globally use a replacement switch discount or base cable sizes on the totality of expected demand as it stands today. Modeling the costs of a firm that starts from ground zero to serve today's demand without acknowledging the need to accommodate growth and future uncertainties over time is, in fact, a short-run approach.[9]

Furthermore, I have consistently testified that for purposes of a forward-looking study, it does not make any sense to assume that the entire network would be installed in one fell

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[6] Direct Testimony of William Taylor, *In the matter of the Application of Bell Atlantic-Delaware, Inc. for the Approval of Its Statement of Terms and Conditions under Section 252(f) 5 of the Telecommunications Act of 1996 (filed December 16, 1996),* P.S.C. Docket No. 96-324.

[7] Transcript v. 5, *In the matter of the Application of Bell Atlantic-Delaware, Inc. for the Approval of Its Statement of Terms and Conditions under Section 252(f) 5 of the Telecommunications Act of 1996 (filed December 16, 1996)*, pp. 1248, 1292-93, P.S.C. Docket No. 96-324.

[8] *Id.* at 1250-51, 1254-56, 1261, 1282.

companies and other industrial companies are more risky than natural gas and electric companies. Yet, Mr. Hirshleifer's methodology produces an average DCF result of 11.56 percent for the natural gas companies in the S&P 500 and **12.21** percent for the electric utilities in the S&P 500, as compared to 10.02 percent for the companies providing local exchange service in the S&P Industrials, and ** 8.67 ** percent for the remaining industrial companies in the S&P 500.[4]

Second, Mr. Hirshleifer claims that beta is a measure of risk, and that companies with higher betas are more risky than companies with lower betas. Therefore, companies with higher betas should have a higher cost of capital than lower beta companies. Yet, Mr. Hirshleifer's three-stage DCF methodology produces the opposite result: namely, the companies in his DCF analysis with higher betas generally have lower DCF results than companies with lower betas.

Third, companies with high dividend yields are generally recognized as having lower risk than companies with low dividend yields. However, once again, Mr. Hirshleifer's DCF methodology produces a result contrary to expectations: companies with higher dividend yields have higher DCF results than companies with lower dividend yields.

[4] These are data obtained using Mr. Hirshleifer's three-stage methodology applied to the S&P 500 at June 30, 2000, using stock price and dividend information from the Value Line Investment Survey, the source for Mr. Hirshleifer's September 1999 S&P 500 analysis. Mr. Hirshleifer did not update his September 1999 S&P 500 analysis.

11.56 percent. These results contradict the common perception that electric and natural gas companies are less risky than industrial companies. (See Table 1 below.)

Table 1

Anomalous Discounted Cash Flow Results From
Mr. Hirshleifer's Three-Stage DCF Model

Company Group	Three-Stage DCF Result
Industrials in the S&P 500	** 8.67% **
S&P 500	** 8.97% **
Local Exchange Carriers	10.02%
Natural Gas Distribution Companies	11.56%
Electric Companies	** 12.21% **

Second, Mr. Hirshleifer claims that beta is a measure of risk, and that companies with higher betas are more risky than companies with lower betas. I have performed a regression analysis of the relationship between the Mr. Hirshleifer's three-stage DCF model results for companies in the S&P 500 and their Value Line betas. The resulting regression statistics are shown in Table 2. Again, Mr. Hirshleifer's three-stage DCF Model produces lower DCF results for companies which have higher risk as measured by beta. The significant negative relationship between DCF results and beta for Mr. Hirshleifer's three-stage DCF Model is indicated by: (1) the negative value of the coefficient on the X 1 variable (beta); and (2) the high absolute value of the t Statistic for the X 1 coefficient (an absolute value greater than 1.96 indicates that the relationship is significant.)

Table 2

Regression of Hirshleifer Three-Stage Model DCF Results vs. Value Line Betas

	Intercept	Beta	Adjusted R Square	F
Coefficient	** 0.128 **	-0.026	**0.095**	**39.211**
T Statistic	**29.255 **	**-6.262**		

Third, companies with high dividend yields are generally recognized as having lower risk than companies with low dividend yields. Thus, one would expect the DCF results for high dividend yield companies to be lower than the DCF results for low dividend yield companies (that is, there should be a negative relationship between DCF results and dividend yield). However, the data in Table 3 indicates that there is a positive relationship between the three-stage DCF results and dividend yields for companies in the S&P 500. Thus, high dividend yield companies have higher three-stage DCF results using Mr. Hirshleifer's three-stage model. Once again, Mr. Hirshleifer's DCF methodology produces results that are contrary to the expectation that companies with higher risk (that is, those that have lower dividend yields) have higher DCF results.

Table 3

Regression of Hirshleifer Three-Stage Model DCF Results vs. Dividend Yield

	Intercept	Dividend Yield	Adjusted R Square	F
Coefficient	0.076	**1.071**	**0.821**	**1,742.512**
t Statistic	**96.051**	**41.743**		

Fourth, financial practitioners generally recognize that companies with higher expected growth are more risky than companies with lower expected growth, indicating that there should be a positive relationship between DCF results and growth. Contrary to this reasonable expectation, however, the regression results shown in Table 4 indicate that companies in the S&P 500 with higher expected growth have lower three-stage model DCF results. The negative relationship between DCF result and growth is indicated by the negative coefficient on the X 1 variable (growth) and the high absolute value of the t Statistic for the X 1 variable. Thus, Mr. Hirshleifer's three-stage DCF Model again produces results that fail the simple, common sense test that the cost of equity should increase with the risk of an investment.

Table 4

Regression of Hirshleifer Three-Stage Model DCF Results vs. Analysts' Expected Growth

	Intercept	Expected Growth	Adjusted R Square	F
Coefficient	**0.131**	** -0.238 **	** 0.186 **	** 87.877 **
t Statistic	**39.128**	** -9.374 **		

Q. **You have shown that Mr. Hirshleifer's three-stage DCF model produces DCF results that are contrary to the common sense standard that the cost of equity increases with risk, as measured by beta, dividend yield, and expected growth. Have you tested whether the constant growth DCF model produces results that are consistent with the expectation that the cost of equity should increase with risk?**

A. Yes. I have performed three simple regression analyses of the relationship between the DCF results produced by the constant growth

Q. Please summarize your surrebuttal testimony.

A. As Mr. Sovereign explains, Verizon MA's proposed depreciation lives and net salvages were prepared in accordance with GAAP and reflect the economic lives of network assets. In my opinion, a forward-looking cost study should use depreciation lives that are based on GAAP instead of regulatory prescribed lives because GAAP lives better reflect all information known to the company, including the effects of competition and technological changes. Indeed, Verizon MA's use of GAAP lives in this proceeding is conservative because it experiences unique risks associated with providing UNEs to CLECs — risks not faced by other carriers. For example, competitors may use Verizon MA's UNEs for only a short period and then use their own facilities, leaving Verizon MA with undepreciated costs to be written off as a loss, resulting in stranded facilities.

Mr. Lee incorrectly claims that because Verizon MA's depreciation reserve has increased since **1990**, the FCC prescribed depreciation lives are adequate and forward looking. Verizon MA's depreciation reserve is increasing simply because Verizon MA has been changing its mix of assets and because the age of Verizon MA's assets has increased (relative to their projected lives). Contrary to Mr. Lee's assertion, this fact does not mean that the depreciation lives prescribed by the FCC are forward-looking and appropriate for pricing unbundled network elements ("UNEs").

Finally, Mr. Lee's claim that Verizon's GAAP lives are biased because of the accounting convention of "conservatism" and therefore not appropriate for use in this proceeding is incorrect and in direct conflict with GAAP and the modern

A. The testimony addresses the recurring capital costs and ongoing maintenance expenses (*i.e.*, ongoing costs) that Verizon MA incurs as a result of the efforts to open the local exchange market to competition by providing access to Verizon MA's operations support systems ("OSS Access"). My testimony presents the estimates of these costs that will continue to be incurred annually and proposes means to recover these costs.

Q. Please describe the study attached to your testimony.

A. The study consists of a two page exhibit and associated workpapers. The exhibit portrays the annual costs of providing this UNE in Massachusetts along with the monthly unit cost.

Q. What are the ongoing costs of OSS Access?

A. The ongoing costs of OSS Access entail recurring capital costs and hardware and software maintenance expenses. These costs are associated with the new system capabilities, functionalities and interfaces that were created and the existing ones that were modified in order to provide competing carriers, whether Resellers or UNE purchasers, with the ability to interact with Verizon MA's OSSs. The Company has estimated the forward-looking TELRIC of Access to OSS as being approximately ** $52 million ** in ongoing annual recurring costs for the entire Verizon East footprint, and Massachusetts's share of this ongoing annual recurring amount is approximately ** $6.4 million **. These costs will continue for as long as Access to OSS must be provided to requesting CLECs and Resellers.

Q. How does Verizon MA propose to charge Resellers and UNE purchasers for these costs?

A. As described in more detail below, Verizon MA proposes monthly recurring charges for Resellers and UNE purchasers based on the number of UNE Loops, Platform/Combinations and Resold lines in service in Massachusetts. This rate structure correctly assigns the cost responsibility to the party making use of the unbundled network element.

Q. What ongoing maintenance and capital costs will Verizon incur to provide Access to OSS?

A. The ongoing costs reflect the annual system maintenance of the newly developed or modified core system functionalities, interfaces, and gateway systems, as well as the annual carrying cost of the capital investment needed to provide access to Verizon MA's OSSs. They include the capital-related and other associated expenses for general purpose computer investment, and system and hardware maintenance costs. These ongoing costs are above and beyond the development costs for the interfaces/gateways and functionalities themselves.

Q. Please provide an overview of how the Company calculated ongoing maintenance and capital costs.

A. Verizon MA identified computer requirements; applied appropriate cost factors to develop annual costs; added estimated ongoing maintenance activity expenses associated with the continuing support of the initial software development effort; and assigned the costs to ** Verizon East-North specific ** or Verizon East Combined categories, ** as described later. **

Q. Please describe how Verizon MA calculated the General Purpose Computer investments.

A. The General Purpose Computer investment is composed of equipment such as storage devices, controllers, routers, servers, concentrators, workstations, memory, processors and other items. Much of the equipment is used for systems serving both Verizon MA's marketing organization. After gathering this information, Verizon MA analyzed these inputs and history of actual demand to create a market forecast. Finally, demand for years 2006-2010 was projected from the year 2005 demand.

Q. Please summarize how the proposed OSS rates were computed.

A. First, the costs were separated into specific Verizon East - North costs and general Verizon East costs.

Next, the specific Verizon East - North ongoing costs were divided by the levelized number of Resold lines and UNE Loops and Platform/Combinations for Verizon East - North. Next, the general Verizon East ongoing costs were divided by the levelized number of resold lines and UNE loops and Platform/Combinations for the entire Verizon East Footprint.

Q. How do these calculations take into account the fact that demand will not be constant over time?

A. Since rates are calculated as a ratio of cost to demand, the demand used will reflect the levelized demand. This approach smoothes out any rate anomalies that might otherwise be created from increased demand during the study period. Levelization calculations are displayed on Workpaper 4 Page 9 and Workpaper 5 Page 1 of the attached study. Levelized rates provide certainty and consistency to CLECs even though Verizon MA may not be compensated adequately in the earlier years.

Q. Please describe the calculation of levelized demand.

A. To levelize the demand, Verizon MA employed a time- value approach. **[phrase deleted]**. Specifically, all of the demand in a given year is considered to occur at the midpoint of that year. Then, a present value of a future amount is applied the Michigan Commission decision.[50] When asked by Verizon MA if it were aware of other Commissions that had found space conditioning charges inconsistent with TELRIC, the CLEC Coalition objected to the question.[51]

Q. DO YOU AGREE WITH DR. ANKUM'S CLAIM THAT THE EXCLUSION OF SPACE CONDITIONING CHARGES IS CONSISTENT WITH PAST DEPARTMENT ORDERS WITH REGARDS TO TELRIC COSTS FOR COLLOCATION?[52]

A. No. To support his claim, he quotes the Department's statement that "[t]he presumption of the FCC's forward-looking costing approach is that a new network is being built to offer collocation, not that an old network is being reconfigured to make space for collocation."[53] Dr. Ankum's attempt to use this single line to support his position that the Department's orders are consistent with a position should be rejected.

Dr. Ankum notably fails to explain the subject matter to which this sentence responds. In the sentences prior to that quoted by Dr. Ankum, the Department explained that "MCI argues that Bell Atlantic has included demolition-related costs in its cost studies, and asserts that to do so is inconsistent with TELRIC principles. **We agree.** The TELRIC methodology should not include allowances for demolition-related costs." The Department in no way disallowed Verizon MA's space conditioning costs; instead it approved them – less a small reduction for excluded demolition costs and five

50 *Id.*
51 VZ-CC 1-38.
52 Ankum Rebuttal at 96; VZ-CC 1-37.
53 Phase 4-G Order at 13.

knowledge other local exchange companies – and will continue to be used on a forward-looking basis. It is particularly ironic that Dr. Ankum makes this assertion in this proceeding since the DTE is aware that Verizon has entirely reconstructed a large portion of the loop facilities in the city of Boston using this design.

Second, Dr. Ankum states "There is nothing in VZ-MA's engineering guidelines that suggests that 100% dedicated RT is the most cost efficient design." Apparently, either Dr. Ankum has not actually reviewed or does not understand the Verizon guidelines. The evaluation and placement of fiber based DLC within buildings is addressed in the guidelines.[15] The dedicated remote terminal design for large buildings results from a logical application of the guidelines in the forward looking network. Providing a dedicated remote terminal at a large building goes beyond the simple quantitative analysis of the Metro cell, which is supported in our cost study. Many economic and operational factors, such as real estate space available, security and access to equipment, and projected bandwidth requirements are taken into account in the deployment decision. Dedicated remote terminals in buildings, sized to optimize capacity, eliminate the real survivability and security concerns of building tenants and result in fewer

[15] For example, **in 1998-00397-OSP** Section 5 paragraph 6, page 15: "Perform a cost analysis for areas close to the CO to determine if it is economical to place a fiber fed loop electronics system. Consider locating the RT site within a customer premises location and obtain an easement that allows us to serve other areas from this location. Review out-of-hours access, powering requirements and any unique factors associated with a customer premises location."

but several interrelated formulas are needed to produce the results. In fact, as described in detail below, the distribution cable results from the Model do not match what the description of the Model indicates should happen.

Q. Are the input assumptions in the Hatfield Model based on a statistically valid sample, and have they been validated in any way?

A. No. Many inputs are based on the opinion of either one "expert," or the opinions of a group of "experts." ** [text deleted] ** Furthermore, most of their actual engineering experience ended many years ago.

Q. Are any of the Hatfield Model's default inputs based on vendor information?

A. Some of the inputs are allegedly based on vendor information; however, AT&T and the Model developers selectively decide when to use vendor information and when not to, thus making the use of vendor information highly suspect. When asked to produce all of the vendor quotes, or the documentation used to support some of these vendor-provided "default" inputs, AT&T responded by producing a medley of redacted documents that show how little the Hatfield Model actually relied upon meaningful vendor quotes.[12]

Q. Can the Hatfield Model "input" assumptions be validated by AT&T's own experience?

A. One would think so. However, AT&T has steadfastly refused to provide any of its actual cost information or its own engineering practices to support the

[12] *See* Before the Massachusetts Department of Telecommunications and Energy, Case No. D.T.E. 01-20, *AT&T's Response to Verizon's Data Requests, No. 1-80* (May 29, 2001).

B. The Hatfield Model Systematically Understates Costs

Q. What is your assessment of the cost estimates produced by the Hatfield Model?

A. The Hatfield Model's cost estimates are results-oriented. An analysis of the differences between the different versions of the Model reveals a pattern: when the Model developers respond to certain problems which understate costs, inputs or other assumptions are often changed in ways that neutralize the impact of the change on the Model's cost estimates. Thus, when the widely-criticized representation of distribution facilities in Version 2.2 was changed in a way that substantially increased the route feet (and associated support structure), the cost input assumptions -- previously advocated by the Hatfield Model experts as reasonable -- conveniently changed to offset the impact and substantially reduced average unit structure costs. Similarly, the Model developers offset the additional costs of formerly excluded distribution and feeder cables by lowering the default cost inputs for larger cables.

Q. Are there other examples that illustrate the results-oriented nature of the Hatfield Model?

A. Yes. The Hatfield Model arbitrarily reduces current network operations expense (Account 6530) <u>immediately</u> by one half. There is simply no basis to conclude that the cost of an ILEC's forward-looking network operations expense will be instantly reduced by one half, and will continue to ** incorporate that 50% decrease each year. **

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[23] Before the Massachusetts Department of Telecommunications and Energy, Case No. D.T.E. 01-20, Verizon's *Motion to Compel* Discovery (July 5, 2001).

total loop cost for Massachusetts of $17.25, which is more than **140%** higher than the Hatfield Model's estimate of $7.11.[34]

A. Patently Unreasonable Results

Q. Do the theoretical failings and methodological concerns you discuss translate into inaccurate costs estimates?

A. Yes. The Hatfield Model seriously underestimates the investments and expenses for UNEs in Massachusetts. Table 3 compares the investments and expenses produced by the Hatfield Model with the investments and expenses Verizon MA currently incurs to provide telephone service in Massachusetts.[35] The "99 Actual" data in Table 3 is from data reported in the Hatfield Model outputs and used in the Model's calculations, and according to the Model sponsors, was taken from Verizon MA's ARMIS reports. In general, the Model produces investment levels that are about one-third of Verizon MA's total actual investment, and expenses that are generally less than Verizon MA's current levels. These results defy common sense and sound economic reasoning, especially given the fact that Verizon MA has been operating under a price cap/incentive regulation plan for several years -- a plan that gives Verizon MA a substantial incentive to reduce costs. It is nonsensical

[34] Consistent with the fact that the Hatfield Model produces a loop cost that is less than half of that produced by the FCC Synthesis Model is the observation that the investment in cable and wireless facilities (ARMIS account 2410) produced by the Hatfield Model is also less than 50 percent of the investment the FCC Synthesis Model produces.

[35] The Hatfield Model "Expense Modules include a USOA Detail worksheet that breaks out investment and expense results by Part 32 account for comparison with embedded ARMIS data." Hatfield Model, Release 5.2a-MA, Model Description at p. 68 ("Model Description"). Thus, the documentation itself offers the "sanity check" comparison that I describe here, even though AT&T and its experts have tried to distance themselves from this Model output.

For telephone poles, at current prices Verizon would have to expend 8 times as much as the investment level assumed in the Hatfield Model. As discussed in Mr. Gansert's testimony, the Hatfield Model significantly underestimates pole investment because: (1) a substantial amount of aerial cable is assumed not to require any poles; (2) the distance between poles is excessive;[42] and (3) it erroneously assumes that almost three-quarters of the costs of telephone poles are paid for by companies other than Verizon MA. As the table shows, the investment required to reconstruct Verizon MA's actual OSP facilities is several times higher than what the Model produces. Perhaps most informative is the comparison of the different types of cable: the Hatfield Model claims that the same customers could be connected to the same wire centers at a cost 27 percent **[text deleted]** to replicate Verizon MA's existing plant. Clearly, the Hatfield Model believes that you need to install a lot less wire and/or much cheaper wire than reality would indicate.[43]

Q. Are there other reasons why the Hatfield Model understates actual investment?

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[42] The "buried cable" multiplier is relatively low because the Hatfield Model assumes that a disproportionate amount of cable will be buried.

[43] In the case of telephone poles, it is possible to identify the relative contribution of price and quantity. 1999 ARMIS data shows that Verizon MA owns approximately 670,000 poles and the FCC reports a current-cost-to-book-cost ratio of 2.39 for poles (i.e., if all existing poles were replaced with new ones, pole investment would be 2.39 times as high as book investment). Thus, if we multiply this ratio by the investment in Table 3A and divide by the number of poles, we get a cost per pole of about $1,040, which is about 150 percent higher than the Hatfield Model input price. Thus, the $8.00 greater investment in poles is explained by (1) the 150 percent price difference, and (2) the quantity of actual poles being about 3.2 times as high as the number of poles produced by the Model. The quantity difference, in turn, is explained primarily by (1) greater "structure sharing," and (2) the minimal use of poles for aerial cable in high-density areas assumed by the Model.

(a) The Hatfield Model uses a geo-coded process to identify customer locations and then "clusters" customers. The FCC rejected the Hatfield Model's cluster database and the Hatfield Model's clustering algorithm.[48]

(b) The Hatfield Model uses rectangularized serving areas to design distribution plant, an approach rejected by the FCC.[49]

(c) The Hatfield Model uses line density and cluster area conditions to determine "high rise building" conditions for the modeling of distribution cable, a methodology that, as discussed below, assumes that buildings serve thousands of lines and are hundreds of stories high. This methodology is not used in the FCC Synthesis Model.

(d) The Hatfield Model utilizes installed cable unit costs that do not vary by plant type, apparently assuming that the installation costs are the same for aerial, underground and buried cable. The FCC disagreed with this assumption and adopted separate input values for aerial, underground and buried cables.[50]

(e) The Hatfield Model places underground fiber cable using $500 pullboxes at 2,000-foot intervals. The FCC did not acknowledge pullboxes as an appropriate technology.[51]

(f) The Hatfield Model uses Digital Loop Carrier ("DLC") common equipment inputs that are significantly lower than the inputs proposed by the FCC. Mr. Donovan claims, in his testimony on page 37, that the FCC double-counted line card costs, but his claim was rejected by the FCC.

(g) The Hatfield Model deducts an analog line port "savings" of ** $30 ** per line from switch costs, an adjustment the FCC rejected.[52]

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48 Fifth report and Order at ¶¶ 47-53; Further NPRM at ¶¶ 28-29.

49 Fifth Report and Order at ¶ 40.

50 Further NPRM at ¶ 68.

51 Further NRPM at ¶¶ 103-25.

52 Further NPRM at ¶ 181. Note that the FCC's rejection of this analog offset is in direct contrast to the support provided in the Inputs Portfolio, p. 83, where the Hatfield Model claims that its input was "calculated in the FCC's Inputs Order."

A. Although in principle the Model uses terrain attributes to adjust the cost of placing support structures (e.g., poles and conduit), the adjustments have very little impact on costs. For instance, the Model estimates an average loop cost of $7.03 per month when structure placement costs are set at their lowest values (i.e., terrain conditions are very favorable). This cost is only slightly lower than Dr. Mercer's result of $7.11. In contrast, engineers such as Mr. Gansert, who are familiar with the difficult terrain in Massachusetts, agree with Mr. Donovan that accounting for differences in terrain should have a noticeable impact on cost.

Q. Have you identified other areas where the Hatfield Model is not performing as described by the Model developers?

A. Yes. One example is the claim that the Model automatically adjusts the placement fractions for buried and aerial cable to reflect their relative economics.[71] In particular, in areas where buried placement is difficult due to soil conditions (which Verizon MA informs me is the case for much of Massachusetts), one would expect a substantial shift away from investment in buried cable in the Hatfield Model. However, the Model shifts less than one-half of one percent (0.5%) of the buried lines and, as a result, the buried share of investment produced by the Model is almost double the actual buried share. The inadequacy of this feature is illustrated in Table 3A, which shows that while only

[71] Before the Massachusetts Department of Telecommunications and Energy, Docket No. D.T.E. 01-20, *Direct Testimony of Robert A.* Mercer (May 8, 2001) at pp. ** 36 ** ("Mercer Direct Testimony"); Model Description at p. ** 77 **. Another example from every previous Model Release, and which the Model developers did not fully correct in the current version, concerns the network interface device ("NID") maintenance expense. While that expense is designed to be applied to total lines, the Model applies it to only residential and business lines. This oversight excludes special access and public lines, which account for 8 percent of the lines in Massachusetts.

The Model produces the required SAI line capacity by multiplying the number of households by 3.5 and the number of non-residential lines by 2, i.e., of 3.5 x 304 + 2 x 602 = ** 2,268 **. The next largest SAI size is 2,400, so that's what the Model picks.

The calculated distribution fill implies that 2,400 lines terminate at the SAI on the distribution side, leaving no room for connections on the feeder end. However, applying the 80 percent feeder sizing factor produces a required capacity of ** 1,084 ** lines, which requires a ** 1,200 ** pair cable. Thus, there is an SAI capacity shortfall of ** 1,200 ** lines in this example.

Q. Is this situation a rare occurrence?

A. No. The situation illustrated by this example is quite common: over 2,600 of the approximately 4,300 distribution areas produced by the Model have SAI's that are too small to handle the distribution and feeder cables that are supposed to meet at the SAI, and these clusters account for over 3.2 million of the approximate 5 million lines.

Q. Do you agree with Dr. Mercer's claim that the Hatfield Model (1) identifies customer locations, (2) groups these locations into areas that correspond to distribution areas, and (3) efficiently builds OSP to serve these areas?[72]

A. No. An additional and important example of how the Model does not match its description is the way the Model purports to locate customers and design

[72]Mercer Direct Testimony at pp. 38-47.

whether actual customer locations are adequately depicted, because the Hatfield Model itself does not represent individual locations. Rather, as in previous model releases, customer locations in the Hatfield Model are simply assumed to be uniformly spread across the rectangular serving areas.

Q. If the uniform distribution assumption is plausible, does the Hatfield Model build plant to the uniformly distributed customer locations?

A. Not necessarily. The *Model Description* indicates that, when distribution plant is deployed, a combination of backbone and branch cables purportedly reach all customer locations throughout the rectangular serving areas.[73] An examination of the distribution plant built by the Model for particular distribution areas shows this is not always the case.

Q. Could you provide examples of this flaw?

A. Yes. Exhibit B, which compares the dimensions of the distribution areas to the plant that is built, depicts two such areas. In the first area (Cluster 2 in Sturbridge (STBR)), although the distribution area itself is about 16 square miles, the backbone and branch cables are packed into an area of only ** 5.6 ** square miles, or less than ** 35 ** percent of the actual area.[74] Cluster 4 in the Rochester (ROCH) wire center depicts another extreme compression of distribution plant.[75]

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[73] The rectangular areas to which the Model designs OSP are somewhat smaller than the full rectangle, because the backbone and branch cables do not extend to the edges of the rectangle, but to within one lot depth and frontage, respectively, of the edges.

[74] In addition, the branch cables are spaced about 210 feet apart, which is smaller than the average lot depth of 773 feet.

[75] The area of the cluster is about 15.2 square miles, while the area determined by the backbone and branch cable lengths is about ** 5.2 ** square miles.

calculates the ratio of the distribution distance produced by the Model to the adjusted MST distance.

Q. How is this ratio used?

A. All distribution distances (e.g., cable lengths and associated support structure distances) are scaled by this ratio. The associated investment and expenses for distribution plant are then based on these scaled distances.

Q. Why is this procedure inadequate?

A. The MST distance is the minimum distance; however, actual distribution distance can be considerably larger than a mathematical minimum (e.g., natural obstacles, the layout of streets, etc.). Forcing distribution lengths to correspond to this bare minimum (or even a somewhat greater amount) could provide inadequate facilities. Further, in high-density areas, which are relatively prevalent in Massachusetts, the adjustment effectively overrides the distribution layout presented in the *Model Description*[84] and in effect substitutes a "connect-the-dots" layout for the grid layout that was purportedly based on engineering principles. The impact in these high-density areas is a substantial reduction in distribution facilities.

Q. How does the MST adjustment affect the results of the Hatfield Model?

A. For Massachusetts, the MST adjustment potentially distorts all clusters (and implicitly the customer locations within the clusters), which exacerbates the clusters' distortion of actual customer locations. For example, when the MST

[84] Model Description at ** p. 80 **.

> Therefore, add-on lines are priced higher than lines on new systems and represent higher marginal sales.[85]

The McGraw-Hill Study showed that carriers actually spend about three times more to purchase additions to existing switches than to purchase new switches, and noted that the "gap between additions and new installations will continue to increase as the installed base approaches 100% digitization."[86] As the 1995 study anticipated, Verizon MA's forward-looking switch costs will be only the cost of upgrades and growth switch additions -- Verizon MA has no plans of installing new local switches because it has achieved "100% digitization." Yet, the Hatfield Model assumes away all costs of upgrades and growth switch additions.

Q. Are the Hatfield Model's input assumptions consistent with respect to switching costs?

A. No. If the Department wants to accept the Hatfield Model's approach, and assume that there is never any growth switching added or upgrades, then it would need to revise a number of the Hatfield Model's input assumptions in ways that would increase greatly the Model's cost estimates. For example, if Verizon MA actually installed switches with no plans to ever purchase additional lines, which is not realistic, then the switches would need substantial excess capacity -- much higher than assumed by the Hatfield Model. For example, if lines were growing at 3 percent annually, and ** 6 ** percent capacity is needed for administrative fill, installing a switch with enough capacity for the 16-year life

[85] Northern Business Information, *US Central Office Equipment Market – 1994*, McGraw-Hill.

[86] *Id.* at p. 61.

3 years to serve line growth and maintain an assumed administrative fill of 94 percent would also increase the cost per-line substantially, even using the seriously understated costs for new switches in the Hatfield Model.

Of course, the need for floor space, the costs for interconnections between the additional switches, as well as the costs of disrupting the central office, should also be included.

In addition, the Hatfield Model inputs are inappropriate because, if Verizon MA only deployed new switches and never added growth lines, the manufacturers' discounts would be much smaller (and thus prices would be higher) for new lines. If switch manufacturers could not count on the higher margins they currently receive for growth lines, they would be unwilling to accept the low margins currently earned on initial installations.

Q. Does the Hatfield Model incorporate the FCC's switch cost computation?

A. No. The Hatfield Model reduces switching costs when DLC lines are deployed; the FCC Model does not. The result is a reduction in end-office switching investment by about ** 8 ** percent.

C. Interoffice Facilities

Q. Have you reviewed how the Hatfield Model calculates investments in IOF?

A. Yes. In particular, I have examined in detail the IOF output for Verizon MA and the particular formulas that produce these results. My objectives were (1) to ascertain whether the Model was actually doing what the *Model Description* reported, and (2) to provide Mr. Gansert with enough specific detail so he could evaluate whether the Hatfield Model's IOF were consistent with sound engineering principles.

Q. Please briefly summarize the IOF produced by the Hatfield Model for Verizon MA.

A. The Model depicts three ring systems, one for each of the tandems considered by the Model (Cambridge, Framingham, Springfield). Each of the systems consists of several rings, which are linked together, either because the tandem is part of multiple rings or by a fiber link that joins the remaining rings in the system. The rings can contain up to 16 nodes, and in Massachusetts are generally close to the maximum permitted by the Hatfield Model.[87]

Q. Does the Model documentation fully explain how the Model works?

A. Not completely. First, the Model is inconsistent in determining the quantities of various electronic components. In particular, while the add-drop multiplexers ("ADMs") located in each wire center and those that are used to connect rings that do not overlap at a tandem are equipped with OC3 multiplexers; ADMs used to join the so-called "logical rings" do not. Also, the Hatfield Model has changed, without explanation, the prices for ADM electronic components from earlier versions of the Hatfield Model.[88] For Massachusetts, the original input prices (which the FCC Synthesis Model uses based on AT&T's recommendation) would increase investment by about $134 million, or over 85%.

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87 The Hatfield Model produces a total of 20 rings with an average size of ** 13.3 ** wirecenters.

88 In fact, in AT&T used the old prices in a filing <u>after</u> the present Massachusetts proceeding. Before the Maryland Public Service Commission, Case No. 8879, *Direct Testimony of Brian F. Pitkin*, (May 25, 2001).

Correction to the prefiled Surrebuttal Testimony of Mr. Dippon as noted in the Transcript, Vol. 16, at 3126. Deletion of text noted by ** **.

Q. DID VERIZON MA SEEK ADDITIONAL COMPONENTS OF HAI 5.2a-MA's CUSTOMER LOCATION DATABASE?

A. Yes. According to TNS, HAI 5.2a-MA's customer location database was derived from numerous underlying models and algorithms, including Metromail Corporation's ("Metromail") national database and TNS's own National Access Line Model ("NALM"). Against this backdrop, Verizon MA requested the following components of HAI 5.2a-MA:

- Rastorization algorithm as described on page 34, footnote 36, of the Model Description (ATT-VZ 1-1).
- Latitude and longitude of each geocoded and surrogate customer location (ATT-VZ 1-9).
- All documents concerning, referring, or relating to the estimated total business line count of 12 million that is used for the business adjustment referenced on page 27 of the Model Description (ATT-VZ 1-25).
- All software and inputs that constitute the PNR clustering algorithm (ATT-VZ 1-26).
- An electronic copy of the Dun & Bradstreet national database, including all documentation concerning, referring, or relating thereto (ATT-VZ 1-27).
- An electronic copy of the Metromail national database, including all documentation concerning, referring, or relating thereto (ATT-VZ 1-28).
- An electronic copy of the CENTRUS Geocoding Software, including all documentation concerning, referring, or relating thereto (ATT-VZ 1-29).
- An electronic copy of the NALM, including all inputs and documentation concerning, referring, or relating thereto (ATT-VZ 1-32).
- All contracts, memoranda, or any other documents exchanged between PNR and AT&T concerning the development of HAI 5.2a-MA's (or any predecessor version's) geocoding process or clustering algorithm (ATT-VZ 1-35).

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Q. Did AT&T provide the information verizon MA Requested?

A. No. AT&T did not produce the requested information in each of the aforementioned Information Requests. It took a motion to compel to get AT&T to agree to provide limited access to the data requested in <u>one</u> of the previously mentioned requests. Specifically, AT&T agreed to make available the geocoded customer location file, requested in ATT-VZ 1-23. Such access, however, was limited to inspection via remote access.

Q. WAS THIS THE FIRST TIME THAT VERIZON MA OR ANY OTHER PARTY ASKED TO SEE THE MODELS AND ALGORITHMS USED TO DERIVE THE HAI MODEL'S CUSTOMER LOCATION DATABASE?

A. No. Verizon MA's pre-merger entities, Bell Atlantic and GTE, have been asking for access to these files since the introduction of the HAI Model's customer location database in late 1997. The FCC, Sprint, and BellSouth all made similar requests, and all met with the same unsuccessful result. In fact, given the database's obvious shortcomings, the FCC rejected the use of this database and opted for an all road-surrogate database instead. The FCC stated:

> While we affirm our conclusion in the *Platform Order* that geocode data should be used to locate customers in the federal mechanism, we conclude that no source of actual geocode data has yet been made adequately accessible for public review. We conclude below that we will use an algorithm based on the location of roads to create surrogate geocode data on customer locations for the