BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

In the Matter of the Review of:	**)**	
Unbundled Loop and Switching	**)**	
Rates; the Deaveraged Zone	**)**	**DOCKET NO. UT-023003**
Rate Structure; and Unbundled	**)**	
Network Elements, Transport,	**)**	
And Termination	**)**	

REPLY TESTIMONY OF DR. ROBERT A. MERCER

on behalf of

AT&T COMMUNICATIONS OF THE PACIFIC NORTHWEST, INC.

May 12, 2004

I. IDENTIFICATION OF WITNESS

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Robert A. Mercer. I am the Principal of BroadView Telecommunications, LLC ("BVT"), a consulting firm specializing in analyses of the telecommunications infrastructure. The address of the firm is 5201 Holmes Place, Boulder, Colorado, 80303.

Q. ARE YOU THE SAME DR. ROBERT A. MERCER THAT FILED DIRECT TESTIMONY ON BEHALF OF AT&T IN THIS PROCEEDING?

A. Yes, I am. My resume was included as Exhibit RAM-1 to that Direct Testimony.

Q. WHAT IS THE PURPOSE OF THIS SURREBUTTAL TESTIMONY?

I will respond to assertions made in the reply testimonies of Verizon witnesses Dr. Timothy Tardiff, Christian Dippon, and Francis J. Murphy. I will focus on their numerous mischaracterizations of the attributes and operation of the HAI Model, Release 5.3 ("HM 5.3). Other AT&T witnesses will address claims made by the Verizon witnesses pertaining to their detailed areas of expertise.

II. RESPONSE TO THE TESTIMONY OF TIMOTHY J. TARDIFF

Q. PLEASE SUMMARIZE THE NATURE OF DR. TARDIFF'S TESTIMONY ABOUT HM 5.3 AND ITS INPUTS

A. The gist of Dr. Tardiff's testimony is his claim that the HM5.3 Model produces too little investment in network facilities and too few costs associated with that investment. Furthermore, he asserts, the Model has not been subject to reasonable validation tests. Dr. Tardiff claims that there are a number of reasons why the Model fails to produce sufficient investments and costs. These reasons fall into three categories, as alleged by

Dr Tardiff: 1) broad theoretical issues, including the Model's alleged failure to appropriately incorporate TELRIC principles and its unrealistic sizing of network facilities to meet current demand with insufficient excess capacity for growth; 2) issues pertaining to the Model's inputs, including the purported use of unsubstantiated, subjective judgments for various outside plant inputs, and an unrealistically low cost of capital and long depreciation lives; and 3) allegedly mistaken assumptions and errors pertaining to various Model details.

Q. PLEASE SUMMARIZE YOUR OVERALL RESPONSE TO DR. TARDIFF'S CRITICISMS OF HM 5.3.

.A. Five overarching comments are in order about these criticisms. First, for the most part, they are stale and outdated. Dr. Tardiff has been leveling many of these criticisms for years, particularly those pertaining to non-compliance with TELRIC principles and the blatantly false implication that the Model only installs "the equipment it will need at a single point in time." (Tardiff, p. 11) Such arguments have been frequently repudiated, as they should have been because they are false.

Second, a large majority of his criticisms address Model inputs. Should this Commission believe that any of his criticisms about input values – component prices, cost of capital, depreciation lives, etc. – are valid, they can readily change the inputs in the Model. The Model has been parameterized with more than 2,100 inputs to allow just this kind of flexibility. Using a "wrong" input value does not invalidate the HM 5.3 platform.

Third, Dr. Tardiff's criticisms of HM 5.3, particularly its inputs, are never accompanied by constructive alternatives, or even meaningful evidence that substantiates his claims.

For instance, while criticizing the prices of outside plant components used in the Model (and, for that matter, outside plant design practices assumed by the Model) because, he alleges, they are based on subjective, unsubstantiated opinions, he neither offers concrete evidence that the inputs and practices are wrong, nor does he offer alternative prices and practices he believes are more reliable, accompanied by supporting evidence. He simply does not like the findings of experts with decades of experience reviewing available data to arrive at reasoned judgments about inputs, and specifying the design practices HM 5.3 should follow. Similarly, while he (wrongly) criticizes the Model for having insufficient excess capacity, he offers no constructive comments as to how much extra capacity should be included in the Model.

Fourth, his complaints, like those of other Verizon witnesses, are never accompanied by a quantitative assessment of the impact of the alleged mistakes on the Model's results. It is hardly worth the Commission's attention to focus on criticisms which, even if valid, would have a minor effect on the results.

Finally, with two exceptions, Dr. Tardiff's claims about specific aspects of the Model's assumptions and calculations are without merit, as are the claims by other witnesses to which Dr. Tardiff refers. The two exceptions are discussed at the appropriate point in this testimony. One has to do with Dr. Tardiff's attempt to use a special Model feature that we had not intended to implement in Washington and that will not work as the Model is currently configured. The other concerns a potential modification in the way the Model determines whether the loop distances involved in a particular cluster require the use of fiber feeder and/or subdividing the cluster into smaller serving areas.

Q. ARE DR. TARDIFF'S CLAIMS ABOUT THE LACK OF VALIDATION OF THE HM 5.3 MODEL LEGITIMATE?

A. No. These claims are based on two arguments put forth by Dr. Tardiff. First, when one compares the investment and cost results produced by HM 5.3, they fall short of the current investments and costs reported by Verizon in its ARMIS data. Second, he claims, AT&T/MCI have not tested, let alone verified, whether HM 5.3 produces valid and accurate estimates of network investments. The first of these claims is irrelevant; the second is wrong.

Q. WHY IS THE COMPARISON OF THE INVESTMENTS AND COSTS PRODUCED BY HM 5.3 WITH VERIZON'S ARMIS DATA IRRELEVANT?

A. It is irrelevant because from the time the FCC adopted its TELRIC principles in the First Report and Order on Local Competition, it specifically excluded embedded costs from its definition of TELRIC. The U.S. Supreme Court also weighed in on this matter, dismissing the ILECs' comparison of model results with embedded data in harsh terms.

As for state proceedings, in the most recent findings in a UNE proceeding, the Proposed Decision by the Administrative Judge in the SBC-California UNE case ("SBC-CA Proposed Decision)," flatly rejects such a comparison in the following terms

> We do not agree with SBC-CA that HM 5.3 is automatically flawed because its proposed costs are lower than SBC-CA actual costs. SBC-CA makes generic statements that the characteristics of its current network best reflect an efficient forward-looking network because SBC-CA has years of experience running a network and has been operating under incentive regulation designed to make its network competitive. SBC-CA actual costs may not be forward-looking, may be skewed by unusual one-time expenses from that year, or may simply reflect the cost of running a network based on embedded choices that a new carrier would not make. In many ways, we consider SBC-CA's comparisons of model results to its

> actual network experience irrelevant because its actual costs may not be forward-looking. Further, we find these comparisons less useful because they are often made at a very aggregate level and do not allow us to compare discrete modeling results in an "apples to apples" fashion.
>
> SBC-CA's attempt to argue that HM 5.3 results are unrealistic when compared to SBC-CA's current operations appears to echo the unsuccessful arguments that ILECs presented to the U.S. Supreme Court. The Supreme Court recognized that "the problem with a method that relies in any part on historical cost, the cost incumbents say they actually incur, is that it will pass on to lessees the difference between most-efficient cost and embedded cost." (Verizon, 122 S. Ct. at 1673.) The court flatly rejected the idea of basing UNE costs on costs from SBC-CA's network today. (Proposed Decision, pp. 67-68)

Above and beyond these findings that ARMIS provides investments and costs associated with an embedded network, there are other reasons why HM 5.3 results should not be compared with ARMIS data. Prominent among these is the fact that ARMIS data contain a number of investments and costs associated with activities that are excluded from UNE rates. These include, for instance, marketing and most product management expenses. HM 5.3 appropriately assigns significant fractions of many categories of general support and overhead investment and expenses, such as those associated with buildings, land, furniture, and general purpose computers to such activities, and excludes them from the Model's calculations. In addition, ARMIS data may include investments and costs associated with elements for which UNEs are not being developed (such as fiber-based services other than DS-3), may reflect the provision of excess amounts of capacity or capacity for as-yet-not-offered services, and the like.

In light of all these considerations and past findings, Dr. Tardiff is beating a dead horse by continuing to attempt to indict HM 5.3 on the basis that it does not produce results close to those reported in ARMIS data.

Q. WHAT ABOUT DR. TARDIFF'S CLAIMS THAT AT&T HAS NOT VERIFIED, LET ALONE TESTED, THE INVESTMENTS IT PRODUCES?

A. Given that HM 5.3 models a forward-looking network, not the incumbent's embedded network, any comparisons of the Model's investment and cost results with incumbents' results are highly suspect. Furthermore, the absolute level of investment, and thus of expenses, produced by the Model are critically dependent on the input values used in the Model. I have already commented that the merits of the Model's platform – that is, the assumptions, algorithms, and calculations of the Model -- are a separate issue than the values used for the Model's inputs. Dr. Tardiff blurs this critical distinction.

There is a comparison the Model's sponsors have consistently tried to make that is independent of the Model's inputs for investment and cost. It is the total amount of outside plant route miles produced by the Model compared to the incumbent's route miles. While Dr. Tardiff apparently disagrees,[1] I believe route miles to be a more meaningful comparison than average loop length, because the latter is strongly influenced by the particular configuration of serving areas in a wire center and by the placement of the serving area interface (SAI) within a serving area. As AT&T witness Mr. Fassett testifies, distribution areas may be established and structured differently than those in the existing network (Fassett Reply Testimony, p. 10). Average loop length is likely to change, perhaps significantly, as a result of the restructuring of distribution areas. On the other hand, while it may be possible to lay out the loop plant in a way that somewhat reduces the total route miles required to connect all customers to each other and the wire center that serves them, customers are where they are, and mathematics dictates that a

certain amount of cable is required to reach them no matter how much restructuring is done.

When we have received the necessary data from the incumbents, we have generally found that HM 5.3 produces more route miles than currently exist in the incumbent's network. This is not surprising – the Model is conservative in a number of key respects, an important one being that it assumes right-angle, rather than straight line, routing between two points. In mathematical terms, this means one follows the two legs of a right triangle whose acute vertices are the two points in question, rather than following the hypotenuse of the triangle. It is a straightforward mathematical exercise to show that assuming right angle routing adds an average of 27% to the straight-line route distance.

Unfortunately, while Verizon has average loop length data by wire center, it does not to my knowledge have the total route mile information. On the other hand, Verizon's VzLoop model provides route mile information. In some ways, for the sake of selecting a cost model, this is even more valuable than knowing the route miles in the existing network, because it allows the direct comparison of the two models' results. Mr. Dippon has presented the following comparison of the total outside plant route miles between HM 5.3 and the Verizon VzLoop model:

> HM 5.3 models a total loop route distance of 95,642,749 feet, or 18,114 miles. VzLoop, on the other hand, models a total loop route distance of 79,486,330 feet, or 15,054 miles—17 percent less than HM 5.3. Similarly, HM 5.3 models 80,659,622 feet of distribution cable, while VzLoop models 57,086,648 feet. (Dippon Testimony, p. 63)

(continued)

[1] Tardiff, p. 96.

Thus, HM 5.3 is producing a conservatively higher estimate of route miles than is the Verizon cost model. Given this comparison, it strikes me as ironic that Dr. Tardiff would nevertheless imply HM 5.3 is defective because

> For example, the cost model must produce feeder and distribution routes of sufficient lengths, (Tardiff testimony, at p. 3)

and that the Model

> only serves to produce uneconomically low cost estimates. In particular, the hypothetical routes modeled and facilities deployed by HM 5.3 do not take into account real-world obstacles such as rivers and roads -- an erroneous modeling technique that unjustifiably decreases costs. (Tardiff, p. 9, emphasis added)

Q. PLEASE COMMENT ON DR. TARDIFF'S ASSERTION THAT HM 5.3 FAILS TO INCORPORATE APPROPRIATE TELRIC PRINCIPLES.

A. Similarly to his comparison of model investments and costs with ARMIS data, Dr. Tardiff has made this claim in a number of state proceedings. The claim has not fared well in the outcomes of those proceedings. The SBC-CA Proposed Decision found

> SBC-CA's criticisms of HM 5.3 principally highlight questionable inputs that [Joint Applicants] have used in HM 5.3, but we do not agree that HM 5.3 violates TELRIC requirements overall. SBC-CA takes issue with how HM 5.3 applies TELRIC to build a network instantaneously to meet current demand. While we agree that it may be unrealistic to assume a network can be constructed overnight, we find that HM 5.3 for the most part follows well-established TELRIC guidance and SBC-CA's criticisms center largely around quarrels with the inputs that are used in the model. (Proposed Decision, p. 64)

Given that Dr. Tardiff's claims have been found to be specious, and that my Supplemental Direct Testimony dealt at some length with HM 5.3's consistency with the FCC's TELRIC principles, I will not discuss further discuss his claims to the contrary.

Q. DR. TARDIFF CLAIMS HM 5.3 DOES NOT PROVIDE SUFFICIENT CAPACITY FOR GROWTH. IS THIS A VALID CRITICISM OF THE MODEL?

A. No, it is not. As with his discussion of ARMIS comparisons and compliance with TELRIC (of which this discussion about capacity is an adjunct), this is a careworn argument that is simply inconsistent with the facts about HM 5.3. According to Dr. Tardiff,

> HM 5.3 specifically excludes, by design, the costs incurred in operating a dynamic network (i.e., one with sufficient capacity) on a going-forward basis. A network with insufficient capacity to accommodate churn, irregularly distributed demand, fluctuations in demand over time, and overall growth in demand, cannot serve a carrier's customers without an unacceptable risk of service disruption or a high probability that customer demand for service would go unsatisfied. A network cannot be said to "serve" existing demand if it is not flexible enough to accommodate changes and rearrangements in that demand. . . .
>
> In this environment, it is not efficient for a telecommunications carrier to install only the equipment it will need at a single point in time. Rather, an efficient carrier will install plant that includes enough capacity so that the utilization of that capacity (e.g., "fill factors") are adequate to: (1) accommodate movement of existing customers and their services, (2) meet short-run demand growth (e.g., two to three years for new switches), and (3) implement growth jobs and upgrades over the life of the plant. (Tardiff, pp. 10-11, emphasis added)
>
> One of the problems with HM 5.3's modeling approach is its removal of a substantial amount of the current, and very real, costs needed to accommodate growth and respond to changes in demand. HM 5.3 implicitly assumes that an ILEC would instantly size its entire outside plant network based on the amount and location of current demand, and thereby realize unrealistic economies that can only be obtained when total demand is served by ideally-sized facilities purchased at maximum volume discounts. (Tardiff, p. 12, emphasis added)

There are numerous problems with Dr. Tardiff's argument. First and foremost, he and I disagree about how much excess capacity for growth a properly-crafted model like HM 5.3 should provide – and, I would add, HM 5.3 does provide sufficient excess capacity.

For instance, as the Model output demonstrates, the overall distribution fill attained by the Model is 48.5% percent.[2] Given the way the Model calculates costs, this means that each working line pays for more than two lines over the lifetime of the distribution cable, with no later relief as customers purchase additional lines, or new businesses or households are added to the area where a cable is currently installed. HM 5.3 thus provides a substantial amount of excess capacity in distribution cable to accommodate growth, churn, and customer rearrangements, and it is misleading for Dr. Tardiff not to acknowledge that fact . As for the general issue of providing extra capacity, HM 5.3 calculates costs taking into account utilization factors not only for distribution cable, but for feeder and interoffice cable, local and tandem switching, loop and interoffice digital circuit equipment, and signaling elements – in short, every component of the network where extra capacity may be required for the reasons Dr. Tardiff cites. While it is true the fill factors in the Model are generally set higher for components other than distribution cable, that is done in recognition that adding extra capacity in other parts of the network – switched lines, plug-in cards in various kinds of circuit equipment, etc. – is a simpler, faster process than placing new distribution cables.

Second, while Dr. Tardiff still complains that the Model is sized only to meet current demand, which is manifestly false, he also makes the less extreme statement that HM 5.3 is defective due to its "modeling of lower amounts of capacity (or higher fill factors) than Verizon NW maintains in its network." (Tardiff, p. 9). But matching the fill factors the incumbent maintains in its current network is *a priori* inconsistent with the TELRIC requirement to exclude embedded costs. According to the SBC-CA Proposed Decision:

[2] Density Zone Expense Module output, "Cost Detail" worksheet, Cell K57.

> There are several reasons why we find that SBC-CA has not met its burden of proving that its embedded fill level is a reasonable proxy for forward-looking utilization. First, when setting the copper distribution fill factor in the prior OANAD proceeding, the Commission adopted a level 5 percent higher than SBC-CA's embedded fill level. (D.96-08-021, *mimeo.*, p. 30.) SBC-CA has not provided any new rationale for using its actual fill levels now. SBC-CA merely proposes that its current fill rates are forward-looking on the reasoning that its current achieved fill is expected to remain at the same level in the future and because its fill rates have remained unchanged for some time. SBC-CA has not provided an analysis to show that the current fill level may be either too low or too high. The fact that SBC-CA has maintained the same fill level over time does not prove that level is efficient. While SBC-CA reiterates that fill levels have remained constant over time, this could merely be because SBC-CA works to ensure the fill remain constant. It does not mean that this is optimum.
>
> Second, the FCC has not looked favorably on excessive levels of spare capacity or sizing a forward-looking network to serve ultimate demand. SBC-CA's fill level leaves approximately two-thirds of its network unused, and the FCC has criticized this much spare as excessive. Further, SBC-CA sizes its network based on projections of usage exceeding two lines per household without reconciling this standard to current growth estimates or its own temporary guidelines calling for less than two lines per house. SBC-CA interprets the FCC as supporting the use of embedded fills as forward-looking based on an FCC statement that fill factors must be based on a reasonable projection of actual total usage. We find it more reasonable to read this FCC passage as supporting the concept that a forward-looking fill factor should reasonably project actual usage, not that embedded fill levels are automatically forward-looking.
>
> Third, we are not persuaded that a fill level of 51.6% will cause dramatic service delays or installation cost increases, as suggested by SBC-CA. In Section VI.E.8 below, we discuss why SBC-CA's correlation of fill factors and maintenance expenses is not persuasive. Moreover, a fill level of 51.6%, only 10 percent above the fill level proposed by SBC-CA, is premised on the installation of 1.5 to 2 lines per household and leaves 48% spare capacity. It is reasonable to conclude that this level of spare can accommodate customer churn, maintenance, and growth without the need for service interruptions or the installation of additional lines. (SBC-CA Proposed Decision, pp. 167-168, emphasis added)

The final problem with Dr. Tardiff's arguments about fill factors is that, once again, he has blurred the distinction between the model platform and its inputs. Even if Verizon were to prevail in its argument that fills should be set to the level of its embedded

network, as Dr. Tardiff appears to propose, the fill factors for all categories of equipment are user-adjustable inputs in HM 5.3.

Q. DR. TARDIFF OFFERS A SET OF DETAILED CRITICISMS OF THE MODEL'S OPERATION. WHAT IS YOUR REACTION TO THESE CRITICISMS?

A. In general, they are assertions without proof or even substantive arguments underlying them, they are often misleading and/or erroneous, they ignore serious problems with Verizon's alternative approach, notably the extensive use of information taken from Verizon's embedded network, and they are presented with no quantitative assessment of the impact they have on the Model's results. I will not deal with each and every such criticism, but will focus on those that may raise concerns with the Commission because they may appear to be legitimate and potentially of significant impact on the results. Any I do not discuss are, in my opinion, obviously wrong or of little potential impact.

Q. DO YOU AGREE WITH DR. TARDIFF THAT MORE THAN ROUTE DISTANCE AFFECTS THE AMOUNT OF INVESTMENT REQUIRED IN OUTSIDE PLANT FACILITIES (TARDIFF, P. 24)?

A. Yes, of course I do, and I have never made a representation to the contrary. For instance, outside plant investment along a given route is affected by cable size and type (copper wire gauge, copper versus feeder), type of structure (aerial, buried, and underground), the amount of structure sharing with other utilities and between different components of the Verizon network (e.g., sharing of structures by distribution, feeder, and distribution routes), and HM 5.3 takes all such factors into account. To treat such factors appropriately, a team of outside plant experts advised the HAI Model developers as to

how the Model should design outside plant. That advice included the identification of design parameters that should be available to the Model's users as inputs so they could be varied as necessary in a particular jurisdiction or for the purpose of testing the sensitivity of the Model. In each such jurisdiction, one or more outside plant experts typically advise the Model's sponsors as to the input values that should be used. Mr. Dean Fassett has performed that role in this proceeding.

The reason I put a lot of emphasis on route distance (or average loop length, if route distance information is not available) is because Dr. Tardiff and other ILEC witnesses in various jurisdictions have repeatedly claimed that the Model produces an insufficient amount of cable to reach all the customer locations. These claims rest on unsubstantiated or misleading statements, such as that the Model ignores real-world constraints (Tardiff, pp. 22-23) or doesn't use the customer location information determined by TNS (Tardiff, Footnote 35, p. 22).

Q. DR. TARDIFF CLAIMS THE VERIZON MODEL IS SUPERIOR TO HM 5.3 BECAUSE IT TAKES INTO ACCOUNT THE ACTUAL ROAD LOCATIONS AND RIGHTS OF WAY WHEN IT ROUTES CABLES, WHEREAS HM 5.3 DOES NOT (TARDIFF, P. 23, LINES 3-10). IS THIS AN ACCURATE STATEMENT?

A. No. Verizon presenters in a recent California workshop admitted that VzLoop links terminal locations using straight-line cable segments, not segments that follow the actual roads and other rights-of-way. In that sense, the Verizon model will actually tend to produce fewer route miles than does HM 5.3, because VzLoop makes a highly unrealistic straight-line routing assumption whereas HM 5.3 uses right angle routing to account for

geographic and other routing constraints. Thus it is not surprising Mr. Dippon finds HM 5.3 actually produces more, not less, route miles than does VzLoop. Dr. Tardiff has thus turned the actual situation upside down -- it is HM 5.3 that accounts for routing constraints, whereas VzLoop does not.

Q. DR. TARDIFF CLAIMS THAT THERE ARE MANY DESIGN ERRORS DUE TO THE OVERSIZED CLUSTERS USED IN THE MODEL, AND THESE CAN'T BE FIXED BECAUSE THE CLUSTERS ARE DEFINED IN A PRE-PROCESSING STEP BEFORE THE MODEL RUNS. IS HE CORRECT?

A. No, and this claim single-handedly demonstrates several of the overarching flaws in Dr. Tardiff's criticisms. First, he provides no evidence the clusters are oversized, nor even why he believes that to be the case. Clusters are allowed to be as large as they are in HM 5.3 because the outside plant experts advising the HM 5.3 developers said that the clusters reasonably could be that large to take advantage of the capacity available in controlled environment vaults and associated digital loop carrier equipment. Second, Dr. Tardiff presents no alternative maximum size cluster that should be utilized instead.[3] Third, he has not quantified what effect if any changing the maximum cluster size would have on the results. And, finally, he ignores the fact that one of his colleagues, Mr. Dippon, did change the maximum cluster size criterion and reran the Model with new clusters. The result of that analysis was that the cost results changed very little. Mr. Dippon found that result unreasonable, but Mr. Donovan and I have both explained on prior occasions that the result is what one would expect.

Q. DR. TARDIFF CLAIMS IT IS NOT REASONABLE FOR A REDUCTION IN INVESTMENT TO CAUSE A CORRESPONDING REDUCTION IN EXPENSES CALCULATED BY THE MODEL (TARDIFF, P. 50, AND PP. 90-92). DO YOU HAVE ANY COMMENTS ON HIS DISCUSSIONS OF THIS SUBJECT?

A. In these passages, Dr. Tardiff is complaining about the fact that the operating expenses associated with a particular plant category are calculated as a ratio of expense to investment ("E/I") for that category times the forward-looking investment estimated by the Model, so when the forward-looking investment is less, the direct expenses will be less as well. Many cost models calculate plant-specific operating expenses in this fashion, including the FCC Synthesis Model, the model presented by SBC-California in the UNE proceeding in that state, HM 5.3, and Verizon's cost models in this proceeding. There is good reason for calculating expenses in this fashion. In California, AT&T and MCI witnesses Tom Brand and Art Menko demonstrated the strong correlation between plant expenses and investments that justifies this treatment.

There are two reasons why the investment in a given plant category produced by HM 5.3 might be lower than the corresponding amount in Verizon's embedded data, causing the Model to produce less direct expenses associated with that plant category through the application of an E/I ratio. One is that the price per unit of material has dropped. The other is that the Model produces a lower quantity of plant. Dr. Tardiff addresses the first reason. His point that changing the unit price of an item of plant due to vendor discounts

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[3] Dr. Tardiff talks several times about clusters sized for 200-600 lines, but he attributes that size to an earlier statement by AT&T witness John Donovan, and he also admits the average cluster size in VzLoop is considerably larger than 600 lines.

(or any other reason) is correct. But it is irrelevant to the extent the Model correctly represents the price Verizon pays for a unit of equipment, which is what the Model's inputs do.[4]

This leaves the other consideration – that the forward-looking Model calculates a lesser quantity of material investment than Verizon has in its embedded network, and therefore the application of an E/I ratio to that lower level of investment produces lower expenses. This is an entirely appropriate result in a forward-looking cost model. The fact that Verizon has eliminated this effect, by applying a correction factor to the E/I ratio so as to maintain the current level of expenses (Tardiff, p. 91, Footnote 132) is an indictment of the Verizon models, not of HM 5.3.

Q. DR. TARDIFF CLAIMS THAT THE FACT HM 5.3 PRODUCES LOOP COSTS LESS THAN THE VZCOST MODEL IS UNREASONABLE BECAUSE OF THE "EXPECTATION OF MCI'S COUNSEL, THE UNITED STATES SUPREME COURT, AND THE CLECS THEMSELVES THAT LOOP FACILITIES DO NOT EXHIBIT THE POTENTIAL FOR RAPID COST REDUCTION LIKE OTHER NETWORK COMPONENTS" (TARDIFF, P. 52). IS THIS A VALID POINT?

A. No, it is absurd. The fact that HM 5.3 produces a cost lower than Verizon's embedded costs, or those estimated by Verizon's cost model, says nothing whatsoever about the trend in loop prices. For instance, HM 5.3 does not assume future network component prices will be lower than they are today, nor that the operations cost per unit of

[4] One might argue that the embedded investments represent historical purchases, whereas the Model utilizes forward-looking investments based on today's prices. Recognizing this, the FCC took the current-to-book price ratios into account in calculating the E/I ratios that have been utilized in the Washington runs of HM 5.3.

investment (i.e., the E/I ratios) should be less than the FCC found appropriate based on the analysis of the incumbents' existing expenses. The fact that HM 5.3 produces lower costs than Verizon's booked costs says only that Verizon's embedded costs are not a good indication of its true costs to provide UNEs, for the reasons outlined earlier. As for the comparison of HM 5.3 and VzCost results, the lesson to be learned is that one has to consider two competing models on the relative merits of their platforms and inputs.

Q. SIMILARLY, DR. TARDIFF CLAIMS THAT BECAUSE LATER VERSIONS OF THE HAI MODEL PRODUCE LOWER LOOP COSTS THAN DO EARLIER VERSIONS OF THE MODEL, THIS MEANS THE MODEL IS ASSUMING TECHNOLOGICAL DEVELOPMENTS THAT WILL LOWER LOOP COSTS (TARDIFF, PP. 55-56). IS THIS A CORRECT REPRESENTATION OF THE MODEL'S ASSUMPTIONS?

A. No. The differences demonstrate only that the Model itself has advanced, both in the sophistication of its modeling techniques and in its subject matter experts' knowledge of the proper input values the Model should utilize. The Model assumes the same network configurations and loop technologies that it has assumed from the earlier versions. But it is much more sophisticated in its approach.

For example, non-POTs loops, particularly DS-3 and other broadband loops, share outside plant structures and can utilize pairs/strands in the same cables as are used for POTs. This produces economies of scope in the provision of multiple loop types. Thus, the FCC's guidelines for UNE models were that all loop demand should be taken into account (subject, of course, to having the modeling technology that allows this to be done). Earlier versions of the HAI Model were unable to account for the presence of

non-POTS loops, except through the imprecise (and often-criticized, by Dr. Tardiff and others) method of counting voice grade equivalents (VGEs). The development of more advanced modeling and database techniques, and the availability of the ILECs' own customer address databases, allow HM 5.3 to model such loops.

Dr. Tardiff's superficial comparison of the results of different model versions does not consider or discuss such changes in modeling capabilities. Given his predisposition that higher cost results are more accurate, he implicitly indicts the model for such advances. But these changes are reasonable and in line with the FCC's guidelines. Furthermore, the right way to assess HM 5.3 is to review the assumptions, techniques, and inputs in that model, not to draw comparisons with earlier versions of the model that were subject to the limitations that existed when they were developed.

Incidentally, it is telling that Dr. Tardiff finds that the HM 5.3 loop investments are higher than those in predecessor versions when comparable price inputs are used. One would expect this: when the model is accounting for more loop types, and thus more capacity, <u>total</u> investments should increase. What he does not seem to realize, or at least acknowledge, however, is that, barring any other model changes, the per-POTS-line investments might actually decrease due to the increased sharing of structure and cables that is now reflected in the Model.

Q. DR. TARDIFF MAKES LIGHT OF YOUR EMPHASIS ON MODEL INTEGRATION (PP. 64-66). PLEASE COMMENT ON HIS ASSESSMENT.

A. I have a number of comments about the importance of integrating UNE calculations in a single model. First, Dr. Tardiff does not discuss two of the primary benefits of

integration. The first of these is that by integrating the calculation of investments and expenses for all portions of the exchange network, the Model can make available the results of calculations done in one stage of a model to modules that required those results in later stages of the Model's flow. This avoids the potential for transcription errors in moving results from one module to another; further it minimizes the effort required to set common model inputs such as cost of capital and the level of support expenses. The second is that integration ensures investments and costs associated with different UNEs are calculated once and assigned to UNEs in a fashion that ensures the amounts involved are neither under-counted nor over-counted.

Dr. Tardiff attributes the use of a single set of interoffice plant structure percentages, instead of different figures by density zone, as a failure to properly integrate the Model. It is nothing of the sort. Interoffice percentages could have been done on a per-density-zone basis. However, it was the judgment of the outside plant advisors to the HAI Model that such a degree of granularity would contribute little to the overall accuracy of the results produced by the Model, particularly since interoffice costs are not deaveraged by density zone. Cost models obviously involve many tradeoffs between complexity and accuracy, and this judgment was one such tradeoff. Furthermore, interoffice routes often do not run through areas where no customers are located, so integration would not have yielded all the data necessary to do such a breakdown in any case.

Dr. Tardiff points out that by using a single representative density zone to set the interoffice structure percentages, the Model is assuming too little of the interoffice facilities are placed in conduits in urban areas. True enough – and, likewise, it also is putting too <u>much</u> into conduits in rural areas where the bulk of the interoffice facilities

are likely to be located due to the long distances between wire centers. That is the nature of an average – it exceeds members of the averaged population in some cases, and is less that other members of the population.

Dr. Tardiff also criticizes the use of "assumed" amounts of overlapping structures – for instance, the amount of sharing between feeder and distribution routes. The "assumptions" to which he is referring are the reasoned judgments of the outside plant expert advisors to the HAI Model team. The amount of sharing is a user-adjustable parameter that can be changed if users have cause to believe the HAI outside plant experts are wrong. Dr. Tardiff himself discusses how he has done sensitivity runs in which he has changed the assumed sharing percentages. In the process of commenting on the results of these analyses, he puts himself in the odd position of criticizing the amount of sharing assumed by the Model and then turning around and criticizing the Model for not showing a larger effect of sharing.

Q. STARTING IN HIS DISCUSSION OF INTEGRATION, AND CONTINUING ON TO A MORE GENERAL DISCUSSION OF MODEL SOPHISTICATION, DR. TARDIFF CLAIMS THAT THE MODEL IS NOT AS SENSITIVE TO VARIOUS CHANGES AS ONE MIGHT EXPECT (TARDIFF, PP. 66-68). ARE DR. TARDIFF'S CLAIMS CORRECT?

A. No. In the first place, it is interesting how Dr. Tardiff interprets the motives of the HAI Model developers for including integration in the Model:

> Dr. Mercer's emphasis on integration stems from his apparent belief that there are large savings to be had when different components of the network (e.g., feeder and distribution) share structure (e.g., telephone poles and buried trenches). (Tardiff, p. 66)

Dr. Tardiff has no ability to interpret my motives or those of the rest of the HAI Model team. In fact, the Model assumes sharing of various kinds because the outside plant experts have emphasized that kind of sharing is done in the real world. Obviously, if we wanted investments to drop a lot, we would simply set the various sharing percentages at 100%, or assume a more aggressive degree of sharing, and be done with it. Alternatively, if we were results-oriented, we could have simply dropped the structure sharing features of the Model when we were disappointed with the results. Instead, we have used the reasoned judgment of experts who know about such matters, whether that produces effects that meet Dr. Tardiff's expectations or not.

Second, Dr. Tardiff's arguments are a prime example of conclusions he makes without basis, and without even disclosing what he believes to be the right answer. Dr. Tardiff is apparently sure structure sharing should have a much bigger effect than it does. Likewise, he apparently knows terrain factors (bedrock depth and hardness, water table depth, soil types) should have a bigger impact than they do. Nowhere does he say <u>what</u> he believes the impacts should be, or <u>why</u> they should be of that magnitude. Nevertheless, on the basis of his unstated beliefs, and the Model's failure to meet them, he is able to state that the Model's optimization features are "dubious" and that the such modeling features are "flawed." (Tardiff, p. 68)

Perhaps Dr. Tardiff's intended point is that it is not important to build an integrated model because the HM 5.3 loop results are not very sensitive to the issues that integration addresses anyhow. If that is his point, I still disagree with him. Neither he nor I nor this Commission could have known how much the Model's results were sensitive to the

various sharing factors until the Model was run. Thus integration plays an important role because without it the sensitivities would not be known.

Third, in concluding the Model is flawed because it seems insensitive to the changes he has made, Dr. Tardiff has used the wrong measure of sensitivity. He has reported only the total loop cost. The loop cost is the sum of many contributing factors, including the NID, drop, terminal and splice, distribution and feeder cable, digital loop carrier common equipment and plug-in cards, and the distribution and feeder structure. It is not surprising, then, that the total cost is not highly sensitive to changes in any one factor. To appropriately test the effects of changing the amount of structure sharing, or any other model factor, one should therefore look at the specific investment (or cost) impacted by the change.

I have repeated two of the sensitivity analyses Dr. Tardiff has identified: I have changed the amount of feeder-interoffice sharing from 75% to 0%, and, separately, the amount of feeder-distribution sharing from 55% to 0%. In these two runs, I have, respectively, examined the amount of feeder plus interoffice structure investment and the amount of feeder plus distribution structure investment, in both cases considering the type of structures that can be shared. The results are shown in the following table – the investments change by 14.2 percent and 5.2 percent, respectively. Obviously, the amount of assumed structure sharing has a substantial impact on the Model's results for the relevant investments.

	Feeder-Distribution Sharing Reduced To 0%	Feeder-Interoffice Sharing Reduced To 0%

Relevant Structure Investment	Feeder plus Distribution	Feeder plus Interoffice
Investment Before Change	$90,359,486	$68,481,686
Investment After Change	95,080,957	$79,783,328
Investment Change	4,721,471	$11,301,642
Percentage Change	5.2%	14.2%

I have not analyzed the sensitivity of the outside plant structure investment to the "most favorable [terrain] conditions everywhere," as Tardiff names that particular study (Tardiff, p. 68). When he made a similar claim in a Massachusetts proceeding, however, I did a sensitivity analysis that showed the statewide outside plant placement costs were 14.7% higher for the terrain conditions assumed in the Model than for the most favorable terrain conditions.[5] This is not a negligible impact, considering that unfavorable terrain conditions exist only in a portion of the state of Massachusetts.

Q. DR. TARDIFF CLAIMS THAT WHEN HE USED THE NEW CAPABILITY OF HM 5.3 TO LIMIT SAI SIZE, THE EFFECT ON THE RESULTS WAS NOT WHAT AT&T JOHN DONOVAN HAD CLAIMED THE WOULD BE IN THE SBC-CALIFORNIA PROCEEDING (TARDIFF, P. 69) CAN YOU COMMENT ON THIS FINDING?

[5] Investigation by the Department of Telecommunications and Energy on its own Motion into the Appropriate Pricing, based upon Total Element Long-Run Incremental Costs, for Unbundled Network Elements and Combinations of Unbundled Network Elements, and the Appropriate Avoided Cost Discount for Verizon New England, Inc. d/b/a Verizon Massachusetts' Resale Services in the Commonwealth of Massachusetts, D.T.E. 01-20, Surrebuttal Testimony of Dr. Robert A. Mercer, December 17, 2001, p. 21.

A. Yes. The capability to which Dr. Tardiff is referring was a special feature added to the Model for testing purposes. It was not intended for use in Washington, but instead of recoding the Model to eliminate it, we simply turned it off in the user interface. Unfortunately, it was only turned off, not disabled, meaning a user could turn it on again. I unintentionally exacerbated that problem by describing the feature in the HM 5.3 Model Description submitted as Attachment RAM-4 to my Supplemental Direct Testimony.

When the feature is invoked, as Dr. Tardiff has done, the calculation requires a table that is not populated in the version of the Model submitted in this proceeding. Therefore, the Model produces erroneous results. The solution is simple – turn this feature off, as it was turned off when originally filed with the Commission.

Q. DR. TARDIFF SUPPORTS MR. MURPHY'S FINDING THAT BECAUSE THE MODEL UNDERSTIMATES THE NUMBER OF HIGH-RISE BUILDINGS, IT REDUCES COSTS BY SUBSTITUTING LOW-COST AERIAL DISTRIBUTION STRUCTURES FOR COSTLY UNDERGROUND FEEDER FACILITIES IN HIGH DENSITY AREAS (TARDIFF, P. 72). IS THIS A VALID CRITICISM?

A. No, it is nonsensical. Whether a cluster is identified as a high-rise building or not, feeder is extended from the wire center to the centroid of the cluster. The amount of feeder and the type of supporting structure for that feeder is determined by the density zone to which the cluster belongs, not by the nature of the subsequent distribution cable.

What does happen as a result of not identifying all the high rise buildings is that regular distribution cable is then used instead of riser cable. Inasmuch as the riser cable investment should not be considered to be part of the loop, while distribution cable

clearly is part of the loop, this means that, if anything, the Model is overestimating the amount of distribution investment required.

Q. DR. TARDIFF SEEMS TO TAKE ISSUE WITH THE FACT THAT "ALTHOUGH THE [STRAND DISTANCE NORMALIZATION] OPTION WAS INTRODUCED TO ADDRESS REGULATORS' CONCERNS ABOUT INSUFFICIENT FACILITIES IN LOW-DENSITY AREAS (THUS PRODUCING COSTS THAT ARE TOO LOW), USING THE OPTION HAS TYPICALLY REDUCED THE ESTIMATED COSTS IN HIGHER DENSITY AREAS." (TARDIFF, P. 74). IS THERE ANYTHING INCONSISTENT WITH THESE TWO RESULTS?

A. No. The strand distance normalization option was added to the Model for the reason Dr. Tardiff mentioned: concern that by distributing building lots uniformly in rural areas, the Model might not produce enough strand distance (because the effective lot sizes determined by the Model may be so large in clusters with small numbers of lines that in effect customers are placed too far from the borders). The strand distance normalization process fixes this problem. On the other hand, in residential and urban areas, customers are often not distributed uniformly throughout a cluster, due to parks, school grounds, undeveloped land, and (in dense urban areas) parking garages, plazas, and other unoccupied areas. In such cases, customers are in effect concentrated into one or more "sub-clusters" that tends to reduce the amount of cable required to reach them. Appropriately, then, strand normalization tends to reduce, not increase, the amount of route miles required to connect all customers to the SAI.

Dr. Tardiff has not identified any reason why this is an odd or unexpected result, nor does he indicate that there is a problem with the Model. Thus when Dr. Tardiff says:

> More importantly, if anything, HM 5.3's use of the strand distance makes the distribution clusters less representative of the areas in which Verizon NW's actual customers live. . . .
>
> The Model's MST adjustment only serves to further distort the clusters modeled by HM 5.3. . . .
>
> As a result, the MST adjustment distorts all of the clusters (and implicitly the customer locations within the clusters) modeled by HM 5.3 (Tardiff, pp. 74-75),

and then goes on to claim

> For example, when the MST adjustment calls for less cable than the Model would have provided absent the adjustment, the rectangular clusters are compressed along both dimensions. In the process, customers are in effect packed into smaller, higher density lots. Conversely, when the strand distance exceeds the calculated route distance, the cluster in effect expands and potentially overlaps with adjoining clusters. . . .
>
> In the process, the Model either shrinks or expands the entire grid (cable sizes and all), with no regard as to how the locations originally included in the cluster could actually be connected, (Tardiff, pp. 75-76)

he is dramatically mischaracterizing the purpose of strand normalization. Normalization is neither intended to shrink or expand the distribution areas, but to better capture where customers are actually located within the clusters that have been defined. For instance, when a strand normalization factor is greater than unity in a rural area, it does not mean the cluster area has grown. Rather, it means that the Model has originally assumed customers are closer together within the cluster than they actually are. By invoking normalization, the Model correctly calculates the amount of cable required to reach their actual locations. Dr. Tardiff is in the inconsistent position of having criticized the assumption that customers are uniformly distributed within a cluster, and then turning

around and criticizing the modeling process that specifically addresses and eliminates this concern.

Q. DO YOU AGREE WITH DR. TARDIFF THAT VERIZON'S VZLOOP MODEL "PRODUCES A MUCH MORE REALISTIC REPRESENTATION OF THESE ROUTES THAN DOES HM 5.3'S ABSTRACT 'GRILLS'" (TARDIFF, P. 76)?

A. Not at all. The effect of strand normalization is to match the modeled distribution route miles to a realistic representation of the amount of cable required to connect customers (along right angle paths to add enough cable to accommodate geographic obstacles and other routing impediments) to each other and the SAI. Verizon ostensibly starts from actual terminal locations. But it then connects those locations assuming straight-line routing, which is not at all a realistic representation of the amount of cable required to reach customers.

Dr. Tardiff's claim that in the real world, cables are routed to fit the "unaltered layout of a distribution area," whereas HM 5.3 expands and contracts the serving areas, is nonsense. The whole point of the strand normalization process is to better determine where customers are located so appropriate amounts of cable can be used to reach them. The right way to think of this process, notwithstanding Dr. Tardiff's comments to the contrary, is that the model makes an initial estimate of where customers are located and how much cable is required using the backbone and branch grids, then refines the cable estimates using the strand normalization. The process does not shrink or expand the area where customers are located; rather, it effectively increases or decreases the amount of cable required in response to better estimates of the customer locations.

Q. DR. TARDIFF CLAIMS THAT THE MAXIMUM ANALOG COPPER DISTANCE SHOULD BE CHECKED, AND THE COPPER VERSUS FIBER FEEDER DECISION MADE, USING POST-NORMALIZATION DISTANCES RATHER THAN PRE-NORMALIZATION DISTANCES (PP. 77-78). IS THIS AN APPROPRIATE APPROACH?

A. Although his proposal is caught up in erroneous rhetoric about the expansion and compression of serving areas that is taking place, Dr. Tardiff's proposal may have merit, subject to further examination. To the extent the strand normalization factor is greater than unity for a cluster, it suggests customers are more spread out than the backbone and branch calculations originally assume. That being the case, it makes sense to check the need to deploy fiber feeder and potentially subdivide clusters using the post-normalization, rather than pre-normalization, distances.

Given the limited time available since Dr. Tardiff's testimony was filed, we have not yet been able to test the Model with such a change properly implemented. However, we have been able to do a strict upper-bound check of the effect by assuming distribution cable runs all the way to the corners of the cluster, whether strand normalization indicates it should run that far or not. When this is done, the average loop cost increases on the order of $0.20, or approximately a 2.5% increase.

Q. DR. TARDIFF FINDS IT PECULIAR THAT THE OPTIMIZED SET OF INTEROFFICE RINGS DOES NOT CHANGE WHEN THE RELATIVE CIRCUIT DEMAND OF DIFFERENT WIRE CENTERS IS ALTERED (TARDIFF, P. 80). DOES THAT LACK OF VARIABILITY SURPRISE YOU?

A. Not really. The optimization process considers the optimum physical ring structure – that is, the way interoffice fiber cables are routed from wire center to wire center. The number of logical rings implemented on those physical rings is determined in a later stage of the IOF calculations. Thus the ring optimization outcome is dominated by the relative costs of different possible physical route arrangements, which in turn are most influenced by the geographical layout of the wire centers (which doesn't change just because demand changes). The amount of multiplexing required in the wire centers where different rings interconnect is a secondary consideration, but the variability in the multiplexing costs associated with ring interconnection is generally much less than the variability in facilities costs (outside plant structures and cabling) that can occur when routes are changed.

Q. DR. TARDIFF APPARENTLY FINDS IT SURPRISING THAT THE ASSUMED FRACTION OF HIGH CAPACITY LOOPS REQUIRING INTEROFFICE CIRCUITS HAS A RELATIVELY SMALL IMPACT ON TOTAL RING COST OVER A CONSIDERABLE RANGE OF INTEROFFICE CIRCUIT COUNTS, AND THEREFORE A HIGH IMPACT ON THE COST PER CIRCUIT (TARDIFF, P. 82, TABLE 9). IS THIS SURPRISING?

A. No, it is not. There are considerable "economies of scale" in the interoffice network, because there are large fixed costs – outside plant structures, fiber cable (the Model automatically deploys a 24-strand cable at a minimum), and the fixed part of the circuit equipment investment – and relatively small costs to add circuits to this fixed investment. Therefore, the behavior depicted in Tardiff's Table 9 is exactly what one would expect – adding circuits increases total investments somewhat, but the cost per circuit goes down.

This misapprehension on Dr. Tardiff's part is another example of his pre-conceived notion of what a result should be, lacking any supporting evidence or even a rationale for holding that view. And in spite of that lack of a basis for his opinion, it leads him to the inaccurate description of the "Model's insensitivity to many aspects of ring design" (Tardiff, p. 81), and of "the shaky foundations of HM 5.3's interoffice calculations [that]produce results that defy common sense" (Tardiff, p.82)

Q. BUT DOESN'T DR. TARDIFF ACKNOWLEDGE THE ECONOMIES OF SCALE IN THE INTEROFFICE NETWORK, AS DISCUSSED ON P. 82 OF HIS TESTIMONY?

A. Yes, but he does so in the context of claiming that the cost per DS-3 IOF circuit should be less than the cost of a DS-3 loop, because of the economies of scale in the interoffice network. What this comparison misses is that there are both economies of scale and scope in the loop. Every component of the cost incurred by a DS-3 loop, with the exception of the termination equipment at the customer's premises, is shared with the provision of POTS service. There are a lot of POTs loops that consume a large share of structure and cable costs. Thus the fixed cost of an increment of DS-3 loops may well be substantially less than the fixed cost of an increment of DS-3 IOF circuits. Since the relationship of the two costs is a complex function of so many factors, there is no way Dr. Tardiff or anyone else can know *a priori* what the resulting cost relationship should be – that is the value of cost models.

Q. DR. TARDIFF IDENTIFIES PROBLEMS WITH THE INTEROFFICE CALCULATIONS IN EARLIER VERSIONS OF THE HAI MODEL IN THE PROCESS OF SAYING IT IS NOT SURPRISING THE CURRENT VERSION'S

INTEROFFICE CALCULATIONS ARE IN ERROR (TARDIFF, PP. 83-84). HOW DO YOU RESPOND TO THIS DISCUSSION?

A. First of all, when all is said and done, Dr. Tardiff has not demonstrated a single *bona fide* problem with the IOF calculations in HM 5.3. Rather, he has demonstrated the danger of making *a priori* assumptions that don't withstand scrutiny, then sticking to those assumptions even after they prove to be wrong.

More importantly, he is off the mark with respect to the key lesson to be gleaned from the discovery and correction of problems in earlier versions of the Model. That lesson is that throughout the history of the HAI Model, its developers have put the Model out for public scrutiny, invited feedback, and responded to constructive criticisms by making necessary corrections. The Model is better as a result of that process, and the fact that corrections were made in the past is not evidence there are still corrections to be made. By contrast, the Verizon model is new, untested, and prone to the many errors Mr. Steven Turner describes in his testimony on behalf of AT&T.

Q. WHAT IS YOUR REACTION TO DR. TARDIFF'S ASSERTION THAT SWITCHING COSTS SHOULD REFLECT THE COST OF PROVIDING GROWTH LINES AS WELL AS PURCHASING NEW SWITCHES (TARDIFF, P. 84)?

A. TELRIC is designed to estimate the cost of providing the current level of demand, with excess capacity for near-term growth. Through the switch administrative fill factor, HM 5.3 provides a modest amount of capacity for near-term growth. Including the cost of capacity needed to serve future demand at allegedly higher prices would unfairly and uneconomically burden today's customers. Because of the way the Model calculates

capital costs, the current ratepayers would be paying the higher growth prices over the lifetime of the switch, even though they are not the beneficiaries of that growth. I do not see why this would be an any more reasonable course of action than it would be to anticipate future price increases in any other part of the network.

Further, it should be kept in mind, that any growth experienced by Verizon implies that Verizon will be receiving revenues from this growth. Dr. Tardiff's solution seems to be that the cost of growth should be paid for by current demand and the revenue Verizon experiences from growth simply falls into the pockets of Verizon. In other words, Dr. Tardiff's solution would be for Verizon to double recover the cost of any growth lines.

Q. HAS DR. TARDIFF OFFERED ANY EVIDENCE THAT LINES FOR GROWTH ARE MORE EXPENSIVE THAN LINES IN NEW SWITCHES?

A. He offers as evidence only an old document that HAI Model developers used back in the late 1990's to develop switch prices. He offers no evidence that Verizon would today have to pay any more for new lines than for growth lines.

Q. DR. TARDIFF CLAIMS THAT BASED ON THE HAI MODEL SWITCHING DESIGNS SWITCHES WOULD HAVE TO BE REPLACED MORE FREQUENTLY THAN THE CURRENT DEPRECIATION RATES (TARDIFF, P. 85). IS THIS CORRECT?

A. No, Dr. Tardiff clearly does not understand the HM 5.3 switch design. The Model assumes that switches placed have an ultimate capacity of 120,000 lines (this is a user adjustable input). Tardiff seems to believe that the switches in HM 5.3 are deployed at 94% of their ultimate capacity. This is not the case. The Model will add switches whenever the line

demand exceeds the input maximum line size, adjusted for fill. Currently the maximum switched lines in any Verizon office is 78,167. This leaves room for 34,633 additional lines (120,000 * .94 - 78,167). This is a 44% increase over the current lines in this office.

Dr. Tardiff further implies that based on the HM 5.3 design, switches would have to be replaced each year for technological advances. Again this is false. Switches do not need to be scrapped every time there is a new technological development. The GR-303 interface is a particularly relevant example. When new interface standards for transmission or loop equipment become available, switch vendors develop new interfaces for their switches that are compatible with the standard. Lucent's predecessor, Western Electric, for example, didn't scrap the 5ESS design when the first TR-303 interface requirements were specified (sometime after the 5ESS commercial introduction), nor did the 5ESS design become obsolete when standards became available to allow the development of an integrated SONET OC-3 trunk interface. The switch development organization just set about the task of designing an interface that allows the switch control and fabric to accommodate the new external service.

Q. DR. TARDIFF CLAIMS THAT HM 5.3 DOES NOT INCORPORATE THE FCC'S SWITCH COST COMPUTATION (TARDIFF, P. 87). IS THAT CORRECT?

A. This is a misleading claim. The FCC's switch cost "computation" is the same as the HM5.3 calculation. What Dr. Tardiff is referring to is the DLC line offset input. The FCC believes the value of this input should be zero; AT&T does not agree for the reasons stated in the HM 5.3 Inputs Portfolio, Attachment RAM-5 do my Supplementary Direct Testimony. Just because HM 53. uses a different input value than the one set in the FCC

model does not make the computation different – this is just Dr. Tardiff's usual blurring of the distinction between a model platform and the model's inputs.

Q. ACCORDING TO DR. TARDIFF, THERE IS NO <u>LOGICAL REASON</u> TO ASSUME THAT A REDUCTION IN NETWORK INVESTMENTS WOULD <u>AUTOMATICALLY</u> IMPLY THAT AN EFFICIENT FIRM COULD PROPORTIONATELY REDUCE ITS NETWORK OPERATIONS EXPENSES (TARDIFF, P. 90, EMPHASIS ADDED). HOW DO YOU RESPOND TO THIS STATEMENT?

A. I agree with Dr. Tardiff – there is no *a priori* reason to assume a linear relationship between the level of network investment and the level of network operations expenses. Instead, one should undertake the appropriate analysis. Just such an analysis was undertaken by AT&T/MCI witnesses Thomas Brand and Arthur Menko in the Verizon of California proceeding.. They showed that there is a very strong correlation of network operations expenses with total network investment over a wide range of companies they considered. On that basis, HM 5.3 as submitted in the Verizon of California UNE proceeding and this proceeding use the results of their analysis.

Q. PLEASE COMMENT ON DR. TARDIFF'S ASSERTION THAT IT IS UNREASONABLE TO CALCULATE CORPORATE OVERHEAD EXPENSES AS A PERCENTAGE OF TOTAL EXPENSES CALCULATED BY THE MODEL.

A. Again, the Brand-Menko testimony in California is instructive. They showed that there is a high degree of correlation of corporate overhead expenses to total company expenses minus corporate overhead (cite Brand-Menko, Section VI.C). This is the form of the calculation of corporate overhead expenses that has been used in this proceeding.

Q. DOES DR. TARDIFF PRESENT A BALANCED PICTURE OF THE TREATMENT OF THE HAI MODEL BY STATE REGULATORY AGENCIES?

A. No, he does not. He mentions that the Model has been rejected in several states. He does not, however, mention that

- The states he identified rejected earlier versions of the Model, not HM 5.3;
- HM 5.2a, the predecessor to HM 5.3 was adopted in Arizona, Colorado, Minnesota and Utah; and
- The CPUC Staff's Proposed Decision rejects both HM 5.3 and the SBC-California models, but does so in terms that are closely aligned with the positions that AT&T has taken in this proceeding in a large number of instances. In particular, the Proposed Decision rejects many of the same claims by SBC-California against HM 5.3 that Dr. Tardiff and other Verizon witnesses have made in this proceeding.

III. RESPONSE TO THE TESTIMONY OF CHRISTIAN M. DIPPON

Q. PLEASE SUMMARIZE THE NATURE OF MR. DIPPON'S TESTIMONY ABOUT HM 5.3

A. Mr. Dippon addresses the processes used to produce the customer location database for HM 5.3. According to Mr. Dippon, the customer location database is flawed to the point that this Commission cannot properly use HM 5.3 to estimate Verizon's UNE costs. He categorizes these flaws as conceptual, technical, and factual. Conceptually, Mr. Dippon says, the Model develops cost estimates for a "utopian network" that even AT&T/MCI admit cannot realistically be built. Technically, Mr. Dippon asserts that the cost

estimates developed by HM 5.3 do not demonstrate sensitivities they should possess. Factually, Mr. Dippon alleges that maps of the outside plant network modeled by HM 5.3 show that the Model produces cost estimates that are entirely unrealistic.

Q. PLEASE SUMMARIZE YOUR OVERALL RESPONSE TO MR. DIPPON'S CRITICISMS OF THE HM 5.3 DATABASE AND THE PROCESS THAT PRODUCED IT.

.A. In the first place, Mr. Dippon uses extreme statements in an apparent effort to distract the Commission from analyzing the merits of his arguments Thus, Mr. Dippon claims the Model produces a "fantasy network design" (Dippon, p. 3); it is an "artifice to obtain Verizon's NW's UNEs at a fraction of their forward-looking cost" (id.); it develops costs for "a utopian network that even ATT/MCI admit cannot realistically be built" (Dippon, pp. 3-4); and it produces cost estimates that are "predominately driven by the overly simplistic and arcane modeling assumptions embedded in the modules that determine HM 5.3's outside plant network" (Dippon, p. 5). Such statements are devoid of substance.

Second, Mr. Dippon, like Dr. Tardiff, has preconceived notions about sensitivities the Model should possess. Not surprisingly, the thrust of many of these preconceptions is that costs should increase when certain changes are made. When those increases fail to materialize, he concludes it must be the Model that is flawed, rather than his preconceptions. In at least a couple of cases, he has previously stated these preconceptions in the SBC-California proceeding, yet notwithstanding the fact that it was demonstrated why his preconceptions are misguided, he repeats them here.

Third, by Mr. Dippon's implications, the supposed failings of the model are equally draconian in their impact on the Model. Mr. Dippon apparently believes that each individually is cause to reject the Model and that none have small or non-existent impact on the results produced by the Model. Such contentions on their face are simply not realistic.

Finally, Mr. Dippon's criticisms demonstrate an unreasoned bias in favor of his client's VzLoop model, a bias, I might add, that is shared by Mr. Murphy (Murphy, p. 21). Thus, according to Mr. Dippon,

> maps of VzLoop's modeled outside plant demonstrate how VzCost, unlike HM 5.3, follows feasible network routes by generally avoiding physical obstacles and boundaries, accounting for rights-of-way, and thereby producing representative investment estimates of a forward-looking network in the State of Washington (Dippon, p. 6).

This is a misleading statement, because as I have already pointed out, Verizon's cost modelers admitted during a workshop in the Verizon of California workshop that all routes are based on straight line segments between terminals. The resulting routing is so overly optimal that it cannot be "avoiding physical obstacles and boundaries," or "accounting for rights-of-way." Indeed, as Mr. Dippon himself finds, HM 5.3 produces more route miles than does VzLoop, precisely because it allows extra route miles to bypass obstacles and accounts for the non-linearity of many rights-of-way. Therefore, while Mr. Dippon can produce impressive maps that show the terminal <u>locations</u> assumed by VzLoop follow roads and rights-of-way, the same is not true of the routes connecting those locations.

Q. DO YOU AGREE WITH MR. DIPPON'S CHARACTERIZATION THAT "HM

5.3 ASSUMES THAT VERIZON NW'S CUSTOMERS ARE UNIFORMLY SPREAD IN RECTANGULAR-SHAPED DISTRIBUTION AREAS—AN ASSUMPTION THAT IS ENTIRELY DIVORCED FROM REALITY (DIPPON, P. 3)?

A. No. This statement completely ignores the important role played by the strand normalization process, as described in Section 8.4 of the HM 5.3 Model Description. That process is designed to ensure the amount of distribution cable reflects the actual locations of customers within the clusters, to the extent they are not uniformly distributed in the cluster.

Q. MR. DIPPON STATES THAT "MOST OF THE CRITICAL DATA THAT HM 5.3 USES TO DETERMINE QUANTITIES" IS "HARD-CODED IN THE CLUSTER INPUT DATABASE, AND IS THE RESULT OF AN ENORMOUS AMOUNT OF UNVERIFIABLE, LARGELY UNDOCUMENTED, AND CONVOLUTED PREPROCESSING STEPS THAT ARE DONE OUTSIDE THE MODEL BY TNS" (DIPPON, PP. 7-8). IS THIS AN ACCURATE CHARACTERIZATION?

A. No. In the first place, it is a considerable overstatement to claim the cluster database contains most or all of the data used by the Model. The Model also uses the distance file that contains the location of each Verizon wire center, information from the Local Exchange Routing Guide that, for instance, describes the type of each switch in the network and which tandem switch each local switch homes on, ARMIS data on traffic volumes and operating expenses, and a database containing the values of more than 2,100 user inputs.

Second, the database is not the product of "unverifiable, largely undocumented, and convoluted preprocessing steps." Mr. Dippon has had an extensive opportunity to be on-line with TNS in order to understand the processing steps that have produced the database. Notwithstanding his claim that he was "denied access to the clustering source code, and in general ha[s] had to rely on very limited information as to the functioning and objectives of many other files" (Dippon, p. 11), his knowledge is extensive enough that he has been able to create a new cluster database on his own and successfully run HM 5.3 using that database.

Third, the statement is entirely one-sided in not acknowledging the extreme amount of pre-processing involved in the Verizon models as well. In an era of complex models, with their sophisticated calculations on state-of-the art databases, I believe it is inevitable that pre-processing of data will be necessary. Were it not done, it would take many hours to perform each run of the Model. The issue is not with pre-processing per se, it is with access to those pre-processing steps by parties to the proceeding. I believe Mr. Dippon has had such access.

The SBC-CA Proposed Decision agrees with me on the necessity of pre-processing steps and on Mr. Dippon's access to the TNS processes:

> In response, [Joint Applicants] contend that SBC-CA was given everything it needed to review, understand, and test the TNS clustering process. (JA, 3/12/03, p. 51.) We agree with [Joint Applicants] that it provided reasonable access to its clustering process since SBC-CA's witness Dippon was able to run his own clustering scenario where he reduced the maximum lines in the cluster from 6,451 to 1,800. (SBC-CA/Dippon, 2/7/03, p. 42.) While the clustering algorithm was performed by TNS as an outside input to HM 5.3, it is comparable to SBC-CA's preprocessing of its loop records before they were input to LoopCAT. In other words, both parties had to "preprocess" vast amounts of data to

> prepare it for input to the actual UNE cost models, and there are aspects of both the TNS and the LoopCAT preprocessing work that outside parties and Commission staff are not able to replicate or scrutinize for various reasons. Nevertheless, [Joint Applicants] did describe the TNS clustering process in some detail in its filings and through discussions with SBC-CA, and SBC-CA was evidently provided enough information to be able to run its own version to test a different set of clustering criteria (Proposed Decision, pp. 72-73).

Q. DO YOU AGREE WITH MR. DIPPON'S CHARACTERIZATION THAT "THE MODELING DONE BY HM 5.3 IS MERELY THE FINAL STAGE OF AN OBSCURE PROCESS <u>THAT ESSENTIALLY STARTS WITH THE MODELED NETWORK PLANT ALREADY IN PLACE</u> (DIPPON, P.8, EMPHASIS ADDED)?

A. No, Mr. Dippon cannot reasonably claim that the modeled network plant is already in place in the TNS database In fact, he goes even further, claiming

> HM 5.3 merely fills-in-the-blanks . . . AT&T/MCI give the impression that the outside plant modeled by HM 5.3 can be changed with user-adjustable inputs. This is wrong. The preprocessing module largely determines the layout (and hence the costs) of the modeled network, and there is not a single user-adjustable input contained in HM 5.3 that is capable of curing the network design produced by the Model's extensive preprocessing" (Dippon, p. 17).

There are any number of decisions and tasks left to be performed, and this is the role of the HM 5.3 processing modules. For instance, what should the layout of cable be – a single cable with enough capacity snaking around the entire cluster? Multiple cables branching off main cables in a "tree and branch" arrangement like HM 5.3 assumes? A spanning tree arrangement such as that assumed in the FCC Synthesis Model? This decision has not been made in the customer location database. How large should the cables be – just enough to meet current demand, or should they contain some extra capacity? What gauge of cable should be used? How much does a foot of cable cost? A foot of the supporting structure? Should

the cluster in question be served by copper or fiber feeder? There are hundreds of such questions to be asked and answered. This is done in the HM 5.3 modules, not the database. And the answers involve large numbers of the 2,100+ user inputs, the values of which very much influence the design of the network – contrary to Mr. Dippon's characterization that "[a]t least in terms of the outside plant configuration, the user-adjustable inputs are of little to no use" (Dippon, p. 18).

Q. ACCORDING TO MR. DIPPON, THE LOTS MODELED BY HM 5.3 ARE "ENTIRELY DIVORCED FROM THE ACTUAL LOCATIONS OF VERIZON NW CUSTOMERS" (DIPPON, P. 14). DOES THAT CLAIM MAKE SENSE?

A. No, it is an extreme overstatement, and meaningless at that. The Verizon customer addresses are first geocoded – I assume Mr. Dippon would agree no such "divorce" occurs at that point. They are then assigned to clusters that are no more than approximately three miles on a side, and usually much smaller. The cluster locations are determined by TNS – Mr. Dippon makes no claim and presents no evidence those locations are stated in error. Within each small cluster, the customers are originally distributed uniformly. Mr. Dippon may claim they may be moved in the process, but they are certainly still within the confines of the cluster in which they were located. Finally, since a properly-functioning cost model does not need to know the precise location of any one customer, but the amount of dispersion between all the customers, the Model further refines the amount of customer dispersion using a connectivity measure determined from the original customer locations.

Where is the "divorce" in this process? Customers remain within the confines of the small clusters to which they were originally assigned after being geocoded. Mr. Dippon may be concerned that ultimately the precise location of any given customer is not known, but ultimately only the relative positions of the customers, captured by the route distance require to connect them, is required by the cost model.

Q. PLEASE COMMENT ON THE CLAIM BY MR. DIPPON THAT "HM 5.3'S MODELED NETWORK DOES NOT MODEL TO A SINGLE VERIZON NW CUSTOMER LOCATION" (DIPPON, P. 18)

A. Let me do so by reference to the pictures Mr. Dippon includes on pp. 81-82 of his testimony. While Mr. Dippon uses these pictures to nitpick about certain anomalies he claims exists, what they really show is that customer locations can be logically grouped. The logical groupings – the clusters – are located where customers are located. The bulk of these clusters can obviously be reasonably represented as rectangles. Customers are located along roads in the cluster, not for instance in the water adjacent to the clusters. The use of the strand distance – the amount of cable require to connect the customer locations in a cluster – provides a useful measure of the number of cable route miles required.

For the overwhelming number of customers shown in these pictures, the model is working as it should. Mr. Dippon focuses on "anomalies," but ignores the fact that the exceptions prove the rule. As the pictures demonstrate, this is not a case of a glass being half empty or half full – it shows the glass is a fraction of a percent empty or well over 99% full. And even in the case of the supposed anomalies, the model workshops in the

Verizon of California workshops demonstrated that the Verizon models, too, have their own anomalies.

Q. MR. DIPPON CLAIMS "VERY LITTLE INFORMATION GAINED FROM THE ELABORATE GEOCODING AND SURROGATING EXERCISE, IF ANY AT ALL, IS USED TO DERIVE THE FINAL UNE COST ESTIMATES (DIPPON, P. 19). IS THIS A CORRECT ASSESSMENT?

A. No, not at all. First, it is amusing that the information on the location, size, and shape of the clusters should be characterized by Mr. Dippon as "marginal." This information plays a key role in determining the amount of cable plant that will be deployed by the Model. Beyond this basic information, however, there are any number of parameters retained in the cluster database and used by the Model. These include the strand distance, which is a key measure of customer dispersion, the number of lines of each type modeled in HM 5.3, the number of households, the numbers of different kinds of buildings in which those households are located, the number and size of businesses, and geological considerations that will affect cost – bedrock depth and hardness, water table depth, surface textures. These parameters play varying, but all important, roles in determining the UNE estimates that are ultimately provided by the Model.

Q. ACCORDING TO MR. DIPPON, REFERRING TO PICTURES SHOWN IN HIS EXHIBIT CMD-6, "[THE] INCORRECT DETERMINATION OF THE CENTROID'S LOCATION FURTHER DISTORTS THE DISTRIBUTION OF DEMAND BECAUSE IT THEN MOVES CUSTOMER LOCATIONS ROUND A FALSE CENTER POINT" (DIPPON, P. 20). IS THIS A VALID CONCERN?

A. Not significantly. As Mr. Dippon notes, the Model assumes the rectangle representing a given cluster is drawn centered on the SAI location. When the centroid of the cluster, as defined by the TNS database, happens to fall on or near one edge of the cluster, this can lead to a peculiar appearance – it appears the real cluster location has been shifted over to a new location. However, this is only an appearance: from the point of view of calculating distribution costs, it makes no difference where the rectangle is located. That is, whether (1) the SAI was originally centered in the cluster, as Mr. Dippon suggests, with backbone and branch cables emanating out from that location to reach the boundaries of the cluster; or (2) the SAI is located at the centroid, which in an extreme case is along the edge of the cluster, and all the points are conceptually picked up and moved over the same amount so they are centered on the SAI, the distribution cost calculations will still yield the same result.

The only potential impact on costs is that if SAIs were relocated from the centroid to a center point of the cluster, as suggested by Mr. Dippon, the sub-feeder cables to those SAIs would then be running to slightly different locations. This might cause feeder costs to change slightly, but whether the net change would be upward or downward cannot be know *a priori*. Thus, Mr. Dippon is wrong that the SAI location (or, as he sees it, mis-location) has serious consequences.

Q. ACCORDING TO MR. DIPPON, NOTHING MUCH HAS HAPPENED TO THE MODEL'S ALGORITHMS BETWEEN VERSION HM 2.2.2 OF THE MODEL, RELEASED IN 1996, AND VERSION 5.3 OF THE MODEL, EXCEPT, HE SAYS, HM 2.2.2 MODELED SQUARE SERVING AREAS AND HM 5.3 MODELS RECTANGULAR AREAS (DIPPON, P. 22) IS THIS AN ACCURATE

STATEMENT?

A. No. It seriously misrepresents the numerous vast differences between HM 2.2.2 and HM 5.3, even with respect to the layout of plant, let alone many other aspects of the Model. For example, the "square areas" in HM 2.2.2 were entire Census Block Groups. These could be as large as 30 miles on a side, although most are much smaller. There was no correlation of those CBGs with the location of telephone customers. Nor were CBGs selected with any telephone design criteria in mind. Finally, cable plant was modeled as a fixed (small) number of distribution cables of a fixed length, irrespective of the number of households actually falling in the CBG.

By contrast, the clusters in HM 5.3 are determined using telephone company data on where its customers are actually located. Specific counts of various kinds of lines are associated with clusters using these data. Clusters are small. The number, length, and size of the distribution cables are determined by the size of the cluster and the number of lines being served. Strand normalization is used to ensure the total cable distance meaningfully reflects the route miles of cable required to connect customer locations to each other. Mr. Dippon may attempt to wave away the vast changes in modeling and database techniques that have been incorporated into successive versions of the Model, but those changes are no less real.

Q. MR. DIPPON CLAIMS THAT THE VERIZON VZLOOP MODEL MORE ACCURATELY REFLECTS RIGHTS OF WAY, ROAD LOCATIONS, AND GEOGRAPHIC OBSTACLES THAN DOES HM 5.3 BECAUSE, FOR INSTANCE, THE TERMINALS IT MODELS ARE TYPICALLY LOCATED ON ROADS (DIPPON, PP. 23-24). IS THIS AN ACCURATE REFLECTION OF THE

SUPERIOR ASPECTS OF VZLOOP?

A. No, it is not. I agree that existing terminal locations are likely to be located along roads or in other rights-of-way. But ultimately, it is not the terminal locations that matter, it is the route miles required to connect those locations to each other. In that respect, VzLoop completely fails to model the road and rights-or-way routes, because it connects terminals together using straight line segments. Such "beeline routing," to use a pejorative term formerly applied by ILECs to the HAI Model before it adopted more realistic routing assumptions, is oblivious to geographic and other routing obstacles. Mr. Dippon may fault the HM 5.3 model for failing to account for geographic obstacles (p. 27) and may falsely claim AT&T/MCI admit to that failing (p. 22) – but the fact is HM 5.3 more appropriately accounts for routing realities than does the VzLoop model.

Q. MAP 1 ON P. 27 OF MR. DIPPON'S TESTIMONY SUGGESTS LARGE AREAS OF RICHMOND BEACH ARE OMITTED FROM HM 5.3 DISTRIBUTION AREAS. IS THIS AN ACCURATE REPRESENTATION?

A. Either this is the most anomalous situations I have seen in any HM 5.3 database or Mr. Dippon is not portraying the full set of HM 5.3 clusters that cover this area. Mr. Dippon may fault the movement of customers within a cluster, but the TNS process does not omit clusters covering such a populated area unless the customer data were missing in the first place. We have not had sufficient time to fully investigate Mr. Dippon's claims in the short time since he filed his testimony, but subject to further check, I can only assume Verizon omitted the data on customer addresses for this area, or that Mr. Dippon has not drawn the complete picture. The kind of coverage shown in the maps on p. 81-82 of the testimony is what one sees in the overwhelming majority of cases.

Q. MR. DIPPON CLAIMS THAT "SINCE WORKING AROUND PHYSICAL BOUNDARIES AND RIGHTS-OF-WAY IS COSTLY FOR REAL-WORLD LOCAL EXCHANGE CARRIERS, IGNORING THEM CAUSES THE MODEL TO PRODUCE SIGNIFICANTLY UNDERSTATED COST ESTIMATES" (P. 28). DOES HE PRODUCE EVIDENCE THAT SHOWS HM 5.3 UNDERESTIMATES COSTS?

A. No. In fact, as I have previously noted, he shows that HM 5.3 produces more route miles, not fewer route miles, than does VzLoop (Dippon, p. 63). This is true because HM 5.3 uses right angle routing to conservatively overestimate the route miles required between two points. Therefore, while others may erroneously argue HM 5.3 underestimates costs because of its price or other inputs, Mr. Dippon is certainly in no position to do so based on this route mile comparison. And he is on shaky ground when he makes statements like

> "[L]ogic tells us that Verizon NW cannot place cables across highways or through impenetrable natural or manmade structures, and it cannot ignore rights-of-way. Nevertheless, this is what HM 5.3 assumes, thereby rendering the Model itself and the cost estimates it produces useless (Dippon, p. 38),

and

> VzLoop, unlike HM 5.3, is able to model plant to customers using appropriately sized distribution and feeder cables, and deploy the plant along feasible network routes, such as roads (Dippon, p. 40).

Q. DOES THE FACT THAT MR. DIPPON OSTENSIBLY USED A CBG-BASED CLUSTERING MECHANISM, AS DESCRIBED AT PP. 40-42, AND GOT ROUGHLY THE SAME RESULT AS HM 5.3 PRODUCES, PROVE THAT THERE IS NO VALUE TO USING THE HM 5.3 CLUSTERS?

A. No, not at all. There are a myriad of factors that make up the final result produced by the Model, some of which increase costs and some of which decrease costs. The fact that a particular study happens to turn out about the same statewide average result is, for all we know, fortuitous. It would have been far more meaningful to show the results for a set of wire centers, or for particular areas within that set of wire centers, to see if Mr. Dippon had identified any specific cause why the results are invariant to the clustering assumption.

Q. MR. DIPPON FINDS IT A "FATAL" ERROR IN THE MODEL THAT AS THE NUMBER OF CLUSTERS INCREASES, THE MODEL "ASSUMES AN APPROXIMATELY EQUAL-SIZED DECREASE IN THE INVESTMENT PER CLUSTER. FOR INSTANCE, IF THE NUMBER OF CLUSTERS IS DOUBLED, THE INVESTMENT PER CLUSTER IS DECREASED BY APPROXIMATELY 50 PERCENT (DIPPON, P. 42-50). IS HE CORRECT THAT THIS IS A FATAL FLAW OF THE MODEL?

A. First of all, the Model "assumes" no such thing. Mr. Dippon is identifying a model result, not an assumption the Model makes.

Is the relative invariance to cluster size a fatal error? No. Mr. Dippon has no *a priori* basis for assuming this is an unreasonable result. In fact, when he made a similar claim in the SBC-California proceeding, both Mr. Donovan and I explained why results might not vary over a range of cluster sizes. As cluster size decreases, the increased investment in feeder fiber and DLC equipment needed to penetrate more deeply into the network and serve more customers is offset by a decrease in distribution investment because smaller cables are less expensive. The CPUC Staff accepted this conclusion:

> We find JA's explanation on this point reasonable and we do not agree with SBC-CA that Dippon's "1800 run" proves HM 5.3 is flawed (CPUC Proposed Decision, p. 79)

In that proceeding, Mr. Dippon's analysis changed the maximum cluster size from 6,451 lines to 1,800 lines, which doubled the number of clusters. Here, he has made what may appear to be a much more dramatic change, using whole CBGs as clusters. CBGs can be very large in size, as I have noted previously. In fact, however, they are not large on the average, because, for instance, CBGs in a downtown area may consist of only a few city blocks. Mr. Dippon shows that the number of clusters increases from 1,019 to 2.517, or about 2.5 times as many, and that this is comparable to the increase in the number of clusters if the maximum cluster size is set to 900 lines. Therefore, it is not a dramatic departure from the concept of clusters to equate them to CBGs instead of groups of customer clusters.

In any event, the reclustering based on CBGs causes the loop cost to increase about 10%. This is not a negligible change, although Mr. Dippon characterizes it as "merely" a 10% change. And certainly the more than 25% change shown in Table 1 on p. 46[6] when the number of clusters is varied is quite significant. But whatever the changes, the key point is that there is no *a priori* reason to expect any particular result, and Mr. Dippon presents none. The only "fatal error" is that he had a pre-conceived notion of what the effect would be, and that notion did not pan out in practice.

Q. MR. DIPPON CLAIMS THE REASON THE RESULTS ARE INSENSITIVE TO CLUSTER SIZE IS THAT NO MATTER WHAT SIZE CLUSTER IS ASSUMED,

[6] ($10/$7.87 is a 27% change, not a 15% change as Mr. Dippon claims.

CUSTOMERS ARE SPREAD EVENLY THROUGHOUT THE CLUSTERS TO WHICH THEY ARE ASSIGNED (DIPPON, PP. 52-53). IS THIS AN ACCURATE CHARACTERIZATION?

A. No. Once again, Mr. Dippon is ignoring the effect of the strand normalization factor. While customers are initially distributed uniformly throughout a cluster by the Model, the strand normalization process ensures that the actual distribution of customers is reflected in the amount of cable utilized. There is certainly no reason to expect that as clusters are sub-divided or combined, the strand normalization factors will continue to be the same or have the same collective effect.

Q. MR. DIPPON CLAIMS THAT "AFTER BEING SHOWN THE FIRST MAPS OF HM 5.3'S MODELED OUTSIDE PLANT NETWORK, HOWEVER, AT&T/MCI CHANGED THEIR APPROACH AND NOW CLAIM: 'HM 5.3 IS NOT A MODEL THAT BUILDS A NETWORK. IT'S A COSTING MODEL, AND IT PRODUCES COSTS'" (DIPPON, P. 59). IS THIS AN ACCURATE REPRESENTATION OF A CHANGING ATTITUDE ON THE PART OF AT&T/MCI AND THE HAI MODEL DEVELOPERS?

A. No, it certainly is not. It has <u>always</u> been my position, and I believe the position of my clients, that cost models estimate costs; they don't design networks. If Mr. Dippon believes to the contrary, he should produce engineering drawings showing Verizon running cable in straight line segments from one distribution terminal to another. For that matter, since HM 5.3 has accounted for geographic obstacles through the use of right angle routing to provide a surplus of route miles, I think it would be very difficult for Verizon to install cable in that pattern. Yet, from a <u>costing</u> point of view, the HM 5.3

treatment is more appropriate than the Verizon treatment because it is taking the cost of avoiding obstacles into account whereas VzLoop does not.

Q. DO YOU AGREE WITH MR. DIPPON THAT THE STRAND DISTANCE PROVIED BY TNS IS A FLOOR, RATHER THAN A CEILING, ON THE AMOUNT OF CABLE THE MODEL SHOULD INSTALL (DIPPON, P. 62)?

A. No, I do not. The strand distance is a right angle strand distance, which provides a considerably greater amount of cable than a straight minimum spanning tree would provide – as I have shown earlier, it produces on the average almost 30% more cable than straight-line routing. Mr. Dippon has not identified any basis for believing this is still an insufficient amount of route miles.

Q. MR. DIPPON INDICATES THAT HM 5.3 PRODUCES MORE TOTAL ROUTE MILES THAN DOES VZLOOP, BUT FEWER FEEDER MILES, THAT THIS IS DUE TO THE FEWER NUMBER OF DISTRIBUTION AREAS IN HM 5.3, AND THAT THIS IS A PROBLEM BECAUSE PER-FOOT FEEDER COSTS ARE HIGHER (P. 63-65). DO YOU HAVE ANY COMMENTS ON THESE OBSERVATIONS?

A. Accepting his calculation of the route miles in the two models, the first point is correct. I believe he has correctly identified the cause – the larger distribution areas in HM 5.3 – so I agree with the second point. Concerning the third point however, Mr. Dippon is forgetting his own analysis earlier in his testimony. There he showed that when clusters are made smaller, the costs stay relatively fixed. This is because the feeder costs do increase, but are offset by lower distribution costs. So modeling larger distribution areas do not produce unreasonably low costs.

Q. MR. DIPPON CLAIMS THE HAI MODEL VIOLATES ITS CONSTRAINT THAT THE MAXIMUM ANALOG COPPER DISTANCE SHOULD NOT EXCEED 18,000 FEET. IS HE RIGHT?

A. He is referring to the same issue I discussed earlier in connection with Dr. Tardiff's proposal to use post-normalization distances in deciding if a cluster needs to be split and/or served by fiber feeder. As I stated there, I believe there is merit to Dr. Tardiff's approach. However, I also showed that the effect was bounded by an increase of about 2.5% in the loop cost. So, Mr. Dippon appears to be right, but he has made no assessment of the effect violating the constraint has on the loop results. The effect is small.

Q. MR. DIPPON DESCRIBES AS "ONE OF THE PRINCIPAL FAILINGS OF THE MODEL" THE FACT THAT IT MODELS TO LOTS RATHER THAN TO INDIVIDUAL LOCATIONS (P. 74). IS THIS A FAILING OF THE MODEL?

A No. The lot count is used to obtain an initial estimate of the number of backbone and branch cables required, and their length. If there were more lots, as Mr. Dippon suggests there should be, the lot sizes would be smaller. According to the model's algorithms, this would cause there to be a greater number of branch cables (and hence more route miles), each of a smaller size because there are fewer lines served by each cable. That might or might not cause the total costs to be higher. However, with strand normalization turned on, the total route miles are normalized to the same strand distance in any case. Thus, the effect of larger lot sizes would be to have the same number of route miles, but smaller cables. Conversely, because we have reduced the number of lots, based on our experience with the amount of space occupied by typical businesses and households in

multiple dwelling units, we get the same number of route miles (with normalization turned on), but larger cable sizes. Thus, the lot reduction Mr. Dippon has identified causes cable sizes to be larger, causing more cable investment. Mr. Dippon has erred in his analysis of the effect of increasing the number of lots.

Q. MR. DIPPON CLAIMS THAT THE CLUSTER DATABASE ERRS IN USING THE CBG CHARACTERISTICS (LIKE LINE DENSITY, HOUSING OCCUPANCY, AND GEOLOGICAL PARAMETERS) OF THE DOMINANT CBG IN A GIVEN CLUSTER AS THE ATTRIBUTES FOR THAT CLUSTER, RATHER THAN CALCULATING THE WEIGHTED AVERAGE CBG CHARACTERISTICS ACROSS ALL THE CBGS SPANNED BY THAT CLUSTER (DIPPON, P. 83-84). WOULD THIS CAUSE A SIGNIFICANT DIFFERENCE IN THE MODEL'S RESULTS?

A. In suggesting this effect, Mr. Dippon claims that "Although I raised this issue before in the SBC-CA UNE proceeding, apparently AT&T/MCI did not deem it necessary to adjust their Model" (p. 84). He also claims "Dr. Mercer stated that I did not 'suggest exactly how this should be done,' and 'the alleged error…actually results in lower loop costs.' There is apparently some miscommunication here. In the SBC California In that proceeding, AT&T generated a new database that did exactly what Mr. Dippon requested. I reported in my Rebuttal Testimony the result was that the loop cost dropped, and provided the output that showed it.[7] Since AT&T/MCI did not agree with the philosophy behind this change, for the reasons I stated in my Rebuttal Testimony, it did

[7] See Rebuttal Testimony of Dr. Robert A. Mercer, CPUC Docket CPUC Docket A.01-02-024 et al. March 12, 2003, paragraphs 17-19.

not implement the change on a going-forward basis. But there was nothing "alleged" about the finding, and we were not uncooperative when Mr. Dippon made the request.

IV. RESPONSE TO THE TESTIMONY OF FRANCIS J. MURPHY

Q. PLEASE SUMMARIZE THE NATURE OF MR. MURPHY'S TESTIMONY

A. Like Dr. Tardiff's testimony, Mr. Murphy's attempts to cover the entire HM 5.3 waterfront -- in fact, there is a considerable overlap between the specific subjects dealt with in the two testimonies. And like Dr. Tardiff's testimony, many of Mr. Murphy's criticisms repeat old claims, many of which have arisen and been dealt with in other jurisdictions; they pertain to inputs, not the model platform itself; they are not constructive because they make criticisms without evidence or substance; they are offered without an assessment of their impact on the results; and they demonstrate pre-conceived notions of the way things should work that have no basis in fact.

Q. MR. MURPHY CLAIMS "THE MODEL DISCARDS THE VAST MAJORITY OF THE COSTS ATTRIBUTED TO THE ALL-FIBER NETWORK BASED ON AN ERRONEOUS ASSUMPTION THAT CERTAIN UNES INCLUDED IN HM 5.3'S SO-CALLED "HI-CAP" CATEGORY ARE NOT BEING PRICED IN THE INSTANT PROCEEDING. THESE ERRORS ULTIMATELY LEAD TO THE INAPPROPRIATE ELIMINATION OF MILLIONS OF DOLLARS OF INVESTMENT (MURPHY, P. 14). IS IT AN ACCURATE CHARACTERIZATION TO SAY THAT INVESTMENTS ARE BEING DISCARDED?

A. Not at all. A certain amount of structure and cable investment is associated with each of the loop types present in the network, according to sharing rules described in Sections 8.8

and 9.4 of the HM 5.3 Model Description. Costs for the UNEs associated with certain loop types – POTs and other narrowband loops, DS-1, DS-3 – are specifically calculated by the Model in this proceeding. For those, the associated structure and cable costs are of course included with the cost of other network components in arriving at the total cost of that UNE. UNE Costs are not being developed for other types of loops – for instance SONET OC-N loops. Those loops still have cable and structure costs associated with them, but the costs are never used. At first hearing, this may sound like chicanery – the investments are not discarded, they are just associated with UNEs for which costs are not being calculated, and are thus set aside. But it is not chicanery at all. The point of the sharing calculations is to get the right amount of cable and structure cost associated with each loop type. The amount associated with, say, POTS loops is the same whether OC-N UNE costs are presented in the Model output or not. It would not be appropriate to increase or decrease the POTS assignment depending on what other UNEs were being presented. Mr. Murphy may hold that all cable and structure costs should be assigned only to UNEs at issue in this proceeding. But this flies in the face of the FCC guideline for UNE models that held all demand should be reflected in sizing the network. It would be incorrect to size the network for services like OC-N, but then assign all the network costs to other UNEs.

Q. MR. MURPHY CLAIMS THAT "CONTRARY TO A REAL-WORLD NETWORK, HM 5.3 DOES NOT ACCOUNT FOR THE DEMAND PLACED ON VERIZON NW'S IOF AND SWITCHES BY OTHER CARRIERS' NETWORKS (SUCH AS WIRELESS SERVICE PROVIDERS AND CLECS)" (MURPHY, PP. 15-16). IS THIS CORRECT?

A. No, not as stated. First of all, other carriers require connections with Verizon to deliver and receive traffic to/from Verizon. Interoffice trunks are provided to carry a user-adjustable amount of traffic to other carriers. To the extent Mr. Murphy believes the percentage is too low, we welcome whatever data he can provide on the correct amount. Lacking such data, this becomes an idle complaint.

Second, in the SBC-California proceeding, it was claimed there are many more trunks than just those required to carry the switched and dedicated traffic. It is not clear why there would be a large amount of extra circuits, but let's suppose there is. With one significant exception, it seems to me such circuits should ultimately show up in the loop count, at the point where premises of the other carrier is connected to the Verizon wire center. That connection should appear in the broadband loop inventory for the wire center in question, and get treated as a broadband loop. To the extent a fraction of broadband loops are assumed to have an interoffice component (this fraction is user-adjustable), that fraction of loops to other carriers will also have an interoffice circuit. This is appropriate, because a CLEC connected to, say, Wire Center A will often need to connect to Wire Center B to deliver/receive traffic from that wire center, and will order an interoffice circuit from A to B in addition to the loop. Again, Mr. Murphy may believe the fraction of loops that have associated interoffice trunks is too low. If he has credible data to that effect, this parameter can be changed.

The one exception is that a CLEC or other carrier may be collocated in Wire Center A, yet still be ordering circuits to other wire centers above and beyond the number that the HM 5.3 engineering of switched traffic determines is necessary. We might be missing those circuits. They could readily be added – if Mr. Murphy reached the conclusion there

were extra IOF circuits by examining Verizon data, those data can be used to populate the wire centers with additional traffic as well.

But lets assume all these mechanisms ultimately fail to identify and count all the circuits present. Then the Model would calculate too little interoffice investment, which is unfortunate. On the other hand, as I have discussed in Section II, Dr Tardiff's testimony at p. 82 demonstrates a substantial economy of scale in the provision of interoffice traffic. Total investment goes up as the number of circuits increases, but the investment per circuit goes down. Thus, if there is an error in the number of IOF circuits the model is counting, it lies in the direction of overestimating IOF UNE costs, not underestimating them.

Q. ACCORDING TO MR. MURPHY, THE TREATMENT OF LOCAL SWITCHING IN HM 5.3 USES ILLOGICAL AND INCONSISTENT INPUTS AND ASSUMPTIONS BECAUSE, FOR EXAMPLE, "INVESTMENTS ARE DERIVED FROM A 1998 STUDY, BUT THEN [SWITCHES] ARE ASSUMED TO BE EQUIPPED WITH OPTICAL SONET INTERFACING CAPABILITIES, WHICH WOULD HAVE BEEN EXTREMELY RARE IN 1998" (MURPHY, P. 17). CAN YOU COMMENT ON THIS ASSERTION?

A. The Model is attempting to use forward-looking switch technology, hence the presence of SONET interface capabilities assumed by the Model. To the extent Mr. Murphy is correct that the switch prices we are using are outdated (presumably too high, since switch prices have continued to drop in the intervening years), he is welcome to provide the necessary data that shows the switch prices we should be using. Lacking such evidence, however, the complaint is not constructive.

Q. MR. MURPHY CLAIMS THAT YOU AND MR. DONOVAN BOTH ADMITTED DURING A WORKSHOP IN THE VERIZON-CALIFORNIA PROCEEDING THAT "AN ENGINEER WOULD NOT DESIGN A NETWORK IN THE MANNER MODELED BY HM 5.3." (MURPHY, P. 26). IS THIS A CORRECT CHARACTERIZATION OF WHAT YOU AND MR. DONOVAN ACTUALLY SAID?

A. What Mr. Donovan and I actually said at the workshop is as follows (emphasis added):

> MR. DONOVAN: I think that mischaracterizes what HM 5.3 is. HM 5.3 is not a model that builds a network. It's a costing model, and it produces costs. And in that regard, yes, I have reviewed the costs for the outside-plant portions of what that model does, and I'm familiar with that. It's not out there trying work prints and trying to emulate what an engineer does. It's a costing model.
>
> MR. MERCER: Just so the record is clear on that, I've heard that played back before: you're not really building a network. I mean, go back to the discussion this morning where I said, If you add up all the vertical distances of the minimum spanning tree, it doesn't matter at that point whether I draw that cable off to the left or whether I leave it as a bunch of vertical stacks; I still get the same amount of cable and same estimate horizontally. You certainly would not think that's any kind of engineering drawing. So when I now draw my cluster with a backbone cable right up the middle of it, that's certainly not what the engineer is doing who's got to put it in a real street, real corner. Nevertheless, because of the kind of discussion we had this morning, you're getting the amount of cable right. When we say we're not building a network, we mean it exactly and narrowly. This is not an engineering plan for going in and putting in the network. It's certainly a network that tries to get the total cost right, which is all that it needs to do.

It is quite clear that Mr. Donovan and I were differentiating between a cost model and an engineering plan, making the point that the goal of a cost model is to get costs right, not to produce an engineering plan for installing the network. We were certainly not saying an engineer would not design a network in the manner modeled by HM 5.3. Thus, Mr. Murphy has twisted and mischaracterized our

words to support his implication that HM 5.3 uses design principles different than those an outside plant engineer would utilize.

Let me also point out that no model, including VzLoop, provides engineering drawings for deploying the network. If such a drawing was the output of VzLoop, it would show cables running in straight lines through houses, fences, street lamps, and other obstacles that happened to be in the way.

Q. IN HIS DISCUSSION OF THE INVESTMENT EFFECTS OF STRUCTURE SHARING STARTING AT P. 31, HAS MR. MURPHY SHOWN THE MODEL MAKES ANY ERRORS?

A. No. He makes no demonstration that the amount of structure sharing assumed by the Model is incorrect. Nor does he point out that the amounts of all the forms of structure sharing he discusses – sharing with other utilities, sharing between different components of the Verizon network, and sharing between services on the same route – are all Model inputs the user can adjust if there is a reasonable basis for doing so.

Worse, his discussion also demonstrates a lack of understanding of what sharing should do to investment. According to Mr. Murphy,

> "While the Model sponsors refer to the removed investments as 'shared,' the investment dollars computed in HM 5.3, and identified in these charts, are not shifted from one part of the network to the other -- they are removed entirely, and thus are never captured in any of the calculations used to develop AT&T/MCI's proposed UNE prices. (Murphy, p. 33)

Mr. Murphy is right, and that is the way investment should be impacted. If through structure sharing – say, between distribution and feeder routes -- Verizon is able to trench once instead of twice, or construct one pole instead of two, half

the investment is eliminated. A properly-crafted cost model like HM 5.3 recognizes this and removes the extraneous investment. It is unclear why Mr. Murphy thinks the Model should put that investment somewhere else, or where he thinks it should go.

The point is, all Mr. Murphy's colorful pictures have demonstrated is that structure sharing provides Verizon with an opportunity to avoid investments it would otherwise make, and that HM 5.3 properly recognizes these savings in investments. They provide no basis for concluding the either the amount of sharing assumed by the Model or the way in which the model calculates the saved investment is wrong.

Q. STARTING AT P. 38 OF HIS TESTIMONY, MR. MURPHY PROVIDES A LENGTHY DISCOURSE ON WHAT HE BELIEVES TO BE APPROPRIATE OUTSIDE PLANT DESIGN PRACTICES AND HOW HM 5.3 FAILS TO MEET THEM. DO YOU HAVE ANY COMMENTS ON MR. MURPHY'S DISCUSSION?

A. Mr. Fassett has commented on this discussion at some length. I will focus on some key flaws I observe in Dr. Tardiff's discussion.

First, Murphy states that HM 5.3 errs in not providing sufficient capacity to meet the ultimate demand expected in a distribution area (p. 40; see also p. 22). Providing capacity for ultimate demand is not an appropriate goal for a properly–crafted model.

The SBC-CA Proposed Decision reaches a similar conclusion:

> We agree with JA that based on established TELRIC rules, HM 5.3 should not build to "ultimate demand." In its own modeling for federal universal service purposes, the FCC has stated that model inputs should reflect current demand, which it defines to include a "reasonable amount of excess capacity to accommodate short term growth." The FCC has explicitly rejected the notion of modeling based on "ultimate demand," because it is highly speculative. (CPUC Proposed Decision, p. 64-65, citations omitted)

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes, it does.