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Ms. Blanca S. Bayo, Director
Division of Records & Reporting
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

September 2, 1998

Re: Docket No. 980696-TP
Determination of the cost of basic local telecommunications service, pursuant to Section 364.025, Florida Statutes

Dear Ms. Bayo:

Please find enclosed an original and fifteen copies of revised pages for the Rebuttal Testimony of Timothy J. Tardiff, filed earlier today in this docket. Included are new pages 11, 14-18 and 20-25. These revised pages replace pages 11, 14-18 and 20-26 of Dr. Tardiff's earlier-filed Rebuttal Testimony. Please discard the old pages that have been superseded.

We apologize for any inconvenience this page replacement may cause. This second filing was necessary because AT&T failed to produce certain discovery information to GTE on time. If you have any questions, please contact me.

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Sincerely,

Kimberly Caswell/dm

Kimberly Caswell
KC:tas
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Hatfield Model appears to understate costs. Although it has progressed from Version 2.2 to Version 5.0a, the HAI Model continues to have the same flaws that made it unacceptable to this Commission in 1997. The Commission should similarly reject the HAI Model in this proceeding.

Q. DO YOU AGREE WITH MR. WOOD'S CONCLUSION (at 7) THAT THE HAI MODEL "REPRESENTS THE MOST ACCURATE AND VERIFIABLE COSTS FOR UNIVERSAL SERVICE COST CALCULATIONS"?

A. No. First, Mr. Wood does not provide any explanation, evidence, or backup for his conclusions. Without the details of his analysis, I cannot pinpoint Mr. Wood's misunderstanding of the topic. Second, as discussed above, NERA's and NECI's intensive research and analysis of the HAI Model have uncovered a wide array of economic, engineering, and modeling errors that render the model unfit for its intended purposes.

Q. DO YOU FIND THE MODEL TO BE "BASED ON THE PRINCIPLES OF PUBLIC ACCESS AND COMPLETE DISCLOSURE" AS MR. WOOD (at 10) CLAIMS?

A. No. I am sure Mr. Wood is well aware that major portions of the HAI Model are considered proprietary, intellectual property, or confidential. More specifically, this includes the development process of the HAI database – a crucial component in the cost calculations, as Mr.

Q. IN SECTION VI.A. OF THE ATTACHED *ANALYSIS*, YOU DEMONSTRATE THAT HAI 5.0a DOES NOT PROVIDE SUFFICIENT DISTRIBUTION CABLE IN THE STATES OF MINNESOTA, TEXAS, AND WASHINGTON. DID YOU DO A SIMILAR STUDY FOR THE STATE OF FLORIDA?"

A. Yes, I did.

Q. PLEASE DESCRIBE YOUR STUDY AND TELL US WHAT THE RESULTS WERE FOR FLORIDA.

A. Using an algorithm developed by Stopwatch Maps, Inc. that runs on Map Info (mapping software), we calculated a Minimum Spanning Tree ("MST") for all clusters in GTE Florida's serving territory. An MST is a mathematical graph theory construct used to connect a set of points in a network at the least possible distance. The MSTs generated by Stopwatch Maps' algorithm was used as the *low-end* benchmark to assess the results of the PNR/HAI data and algorithms. (PNR and Associates, Inc. provides the customer location input database that HAI uses.) As Dr. Wood (at 20) correctly points out in his testimony, "one must consider not only the branch and backbone cable produced by the model, but the drops as well . . . ." Therefore, to make a valid comparison, we calculated the drop length included in the HAI Model in addition to the Distribution Route Distance ("DRD"). Next, the ratio of the length of each MST to the modeled distribution distance plus drop was calculated for the same cluster and summarized by density zone and by wire center.

Based on the results of this analysis, we determined that 11.0 percent of the clusters in GTE Florida's service areas contain less distribution plant than is physically necessary to connect the existing customers. In 77 clusters (3.7 percent), the PNR/HAI algorithm produces estimated lengths that are less than 50 percent of the minimal plant necessary. When looking at the clusters contained in the lowest density zone, this flaw occurs in 46 clusters (92 percent) and underestimates distribution plant by at least 43 percent. In the second lowest density zone, 85 clusters (33 percent) have less route mileage than is physically necessary to connect customers.

This is further complicated by the fact that the MST is a low-end benchmark. The line segments of an MST run directly from one point to another and do not represent the actual amount of DRD required to connect customers as the MST ignores geographical features such as rivers, swamps, and rights-of-way.

Thus, the HAI Model severely underestimates outside plant required for the provision of service to customers. Furthermore, it does not represent the network that an efficient company would engineer or install. Section VI.A. and Appendix A, Section A of the attached *Analysis* discuss this in detail.

Q. ARE THESE RESULTS CONSISTENT WITH FINDINGS IN OTHER STATES?

A. Yes. We found similar results for GTE's territories in Minnesota, Washington, and Texas. Further, U S WEST and Sprint report similar results for their study areas.

Q. AT&T AND MCI HAVE ATTEMPTED TO DISMISS THE MST STUDY'S VALIDITY AT THE FCC AND ELSEWHERE. WOULD YOU LIKE TO COMMENT?

A. Yes. None of AT&T's and MCI's testimony filed with various state commissions or AT&T's *Ex Parte* presentation to the FCC contain any legitimate grounds for the dismissal of the MST study. Briefly, AT&T and MCI claim that: (i) the model provides sufficient distribution plant to reach customers in the lower density zones; (ii) the MST analysis is based on a misunderstanding of the HAI customer location approach; (iii) there are offsetting overestimations of distribution plant in outlier clusters; (iv) the drop cable was not included in the analysis; (v) the study does not account for the fact that there are surrogate points; and (vi) an MST is not the minimum amount of cable that is needed to connect customers.

Q. DO YOU HAVE A RESPONSE TO AT&T/MCI'S ARGUMENTS?

A. Yes. I will take them in order.

(i) While AT&T and MCI claim that HAI 5.0a models sufficient distribution cable to reach all customers, they do not provide any evidence. On the other hand, I have evidence that HAI 5.0a does not provide sufficient distribution cable for the majority of clusters.

(ii) Again, AT&T states without any support or evidence that the criticism of HAI 5.0a is based on a misunderstanding of the algorithms. I think the issue is clear. The HAI Model provides less distribution cable in the majority of clusters than is physically necessary to reach all customers.

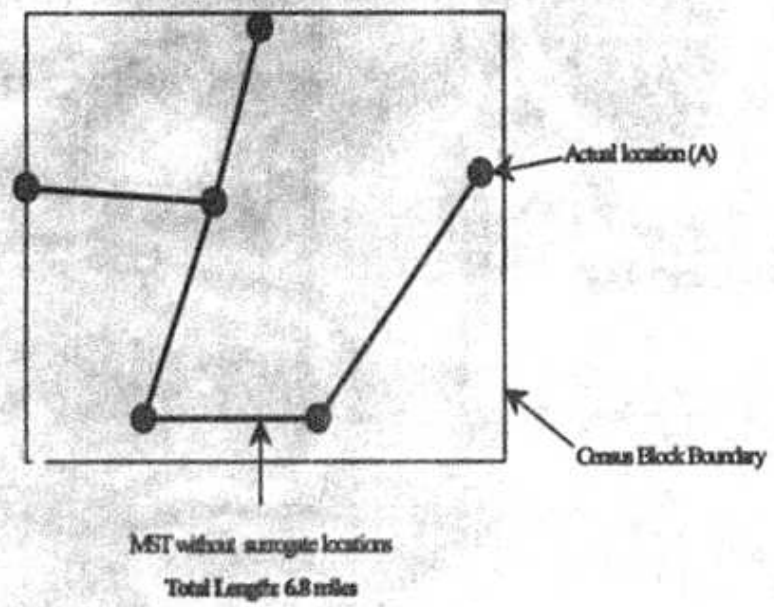
(iii) AT&T claims that there are "offsetting" overestimations in outlier clusters. Again, this argument has no merit, and AT&T does not provide any evidence in support of this statement. In addition, the vast majority of universal service support is in the lowest two density zones. Further, there is less than 0.5 percent of GTE Florida's total lines in outlier clusters. Thus, whether a certain area qualifies for USF support depends almost exclusively on the main clusters in the lowest two density zones. The fact that there might be a potential overestimation in an outlier cluster(s) in any density zone does not remedy the problem. Most important, it does not change the fact that the HAI Model does not contain enough distribution cable to physically connect all the customers in a serving area.

(iv) As noted above, this criticism does not apply to our MST study. Our study does include the drop cable length.

(v) AT&T insists that the MST analysis is flawed because no adjustment was made for the excess area that exists within the Model's clusters. AT&T and MCI both claim that because clusters are formed in part from surrogate points placed along the Census Block ("CB") boundaries, such a correction is necessary. This claim is incorrect for several reasons. First, the Model's sponsors have

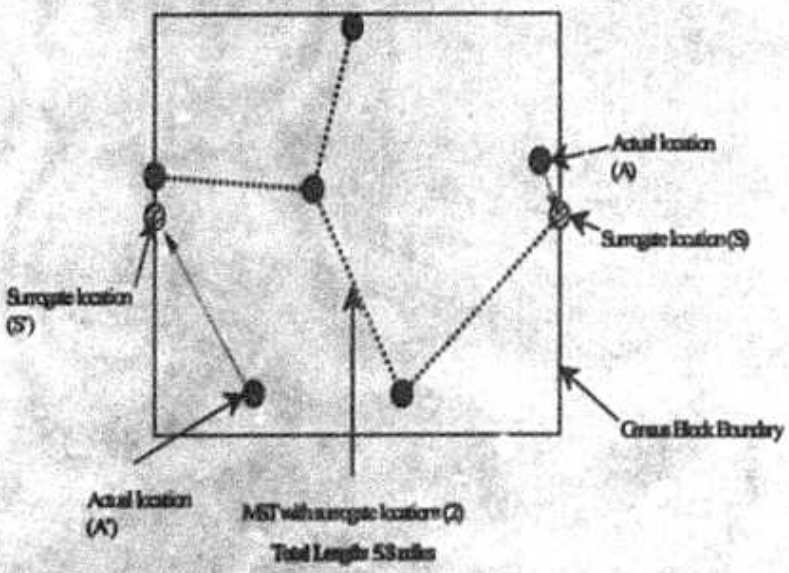
argued consistently that the data is highly accurate. If this is true, then a few surrogate points should not make a difference. Second, they are wrong in asserting that placing surrogate points on the boundary of a CB is conservative (*i.e.*, leads to higher costs). Placing surrogate locations on the border could either *increase* or *decrease* the length of an MST. This is illustrated in the following figures. Figure 1 depicts the actual locations of a hypothetical group of customers, with the MST for these locations. The length of the MST for the actual locations is 6.8 miles.

Figure 1



Now suppose that the rightmost location, labeled A in Figure 1, is not known, and a surrogate location, labeled S, in Figure 2 is used.

Figure 3



Contrary to the sponsors' statement, nothing can be said about the effect on the distribution network length of placing surrogate points on the border.

(vi) AT&T is correct that the MST is not the minimum amount of cable that is needed to connect customers. In fact, the minimum distance of a distribution plant network is believed to be *much greater* than the MST. The MST should be used only as an absolute lower bound. The line segments of an MST run directly from one point to another. They do not account for geographical obstacles such as rivers, swamps, lakes, or freeways. Further, they do not account for right-of-way issues and building permits. The MST is calculated using airline miles (the straightest distance between points). Thus, the MST does not represent the actual amount of cable (route miles) that would be

required to connect the customers given geographical features.

Q. WHOSE COSTS SHOULD A COST MODEL ESTIMATE – THE INCUMBENT CARRIER OR A HYPOTHETICAL CARRIER?

A. To answer that question, one needs to remember that in the end the prices generated are intended to mimic the effects of competition. The short answer to this question is that it must be the costs of the *incumbent* LECs that are estimated, not those of a hypothetical firm, which is what the HAI Model does.

There are two reasons for this, both of which come from understanding how prices and costs interact in competitive markets. The first role a price serves is to ration the use of existing facilities. For instance, if one does not want the existing facilities to be overused, the price must be set high enough. Similarly, if a facility is not to be underutilized, the price must be set low enough. Consider Internet access. If Internet access was suddenly free, there would be an excess of callers and access facilities would be overloaded. The Internet Service Provider ("ISP") would either have to increase the number of access lines or raise prices. Increasing the number of lines would require time and could only be done in the long-run. Moreover, if the price is too low, the ISP will have no incentive to increase the number of access lines because it will never recover its investment. In the short-run, the provider would have to use the price of access as a control to ration the use of its facilities. Otherwise, there would be

no Internet services available even if people were paying for it. Therefore, when it comes to rationing current resources, the incumbents' costs are the relevant ones.

The second role that prices serve is to signal the need for entry or expansion of facilities as alluded to above. If the price that correctly rations existing facilities is much above cost, then the solution is not to lower that price by fiat or regulatory mandate but to expand the facilities and allow competition to drive the price down. A price above cost signals new facilities-based providers to enter the market. Again, the relevant cost here is the *incumbent's* cost. For example, consider that the incumbent's economic costs are 20 percent higher than the costs of a potential entrant. Pricing at the incumbent's cost leaves a gap that gives a new entrant the ability to enter the market, begin production, and compete the price down.

If regulation attempts to anticipate the market by ordering that the price must be set equal to the incremental cost of a new, super-efficient entrant, there will be two unintended consequences. First, the super-efficient carrier now has no incentive to enter since it would only make, at most, a normal rate of return on investment. The investors will look to enter another market where the return is higher than normal. Second, the customers will not get the benefits this new, super-efficient provider might offer. Although rate payers might have lower rates, this will be an inefficient outcome because the price no

longer correctly rations the use of the existing system. Thus, the relevant costs on which prices should be based are the forward-looking costs of the *incumbent* firm. To its many failings, add that the HAI Model does not even *attempt* to measure the costs relevant to the question here: the actual costs of GTE Florida's network. Instead, it generates generic "proxy" costs, based upon an entirely *hypothetical* and futuristic telephone network that does not reflect the likely costs or engineering characteristics of GTE Florida's forward-looking local network. Thus, at best, one could say that the HAI Model attempts to measure the cost of a *hypothetical* LEC.

Q. ARE THERE ECONOMIC CONSEQUENCES ASSOCIATED WITH MODELING THE COSTS OF A HYPOTHETICAL CARRIER INSTEAD OF THE COSTS OF THE INCUMBENT CARRIER?

A. An incumbent LEC, such as GTE Florida that is forced to price products below their efficient economic costs, cannot possibly survive. Ironically, the incumbent LEC would end up cross-subsidizing alternative telecommunication providers, thus facilitating uneconomic entry by its rivals.

Q. DOES THE HAI MODEL CORRECTLY APPLY THE CONCEPT OF THE LONG-RUN?

A. No. The second fundamental flaw HAI 5.0a suffers from is an incorrect understanding and application of the concept of the long-run. Unlike the concept applied in the HAI Model, long-run does *not* refer to a period of time. Long-run is an analytical concept that answers

the following question – What are the costs of a firm producing *today's* output with *today's* technology at *today's* prices under the assumption that the firm was freely able and instantaneously able to vary all of its inputs so as to minimize cost? Sometimes, we economists refer to this very loosely as a period of time, most often when teaching principles of economics, because it is easier for students to think about. Nonetheless, the HAI Model supporters would have you think that extrapolating historical changes far into the future and using those future extrapolations as the "forward-looking" cost is a correct application of the long-run concept. This is simply not correct. Historical changes in network operations expenses already contain the effects of changes in input prices and changes in technology. By extrapolating these historical changes into the future, the HAI modelers fail to hold either the prices or the current technology constant. This is not long-run. Further, it demonstrates a complete misunderstanding of the concept by confusing a didactic device for teaching economic principles with a professional economist's analytical tool. For these and many other reasons as pointed out in the attached *Analysis*, the HAI Model violates sound economic principles and should not be considered a valid cost model.

Q. MR. WELLS CLAIMS (AT PAGE 14 OF HIS DIRECT TESTIMONY) THAT "A CONSIDERABLE AMOUNT OF VALIDATION OF THE OSP PORTION OF THE HAI MODEL HAS TAKEN PLACE." ARE YOU AWARE OF SUCH VALIDATIONS?

A. No. While I strongly support the modelers' attempts to validate their model, I have not seen any formal verification of any validation attempts of the OSP portion of the Model. First, Mr. Wells (at 20) claims that Mr. Fassett, an HAI engineering team member, collected validation numbers on the Model's default values. As pointed out in the attached *Analysis* and the testimony of Mr. Murphy, this analysis was fundamentally flawed and contradicts the Model's numbers on several occasions. Second, Mr. Wells lists his own efforts for the design of 10 CBGs in Georgia as validation of the accuracy of the model. This study was performed on a prior version of the Model and is not applicable to HAI 5.0a. I have not seen a similar analysis for this version of the HAI Model. Further, as I have pointed out in my testimony in other states, this analysis (after the correction of a mathematical error) did nothing more than confirm our findings that the Hatfield Model (as it was called at the time) did not provide sufficient outside plant.

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY

A. Yes.