ATTACHMENT A

Joint AT&T/MCI Exhibit No. 13
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COMPLIANCE PROCEEDING FOR IMPLEMENTATION OF THE TEXAS HIGH COST UNIVERSAL SERVICE PLAN	§ § § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

AT&T COMMUNICATIONS OF THE SOUTHWEST, INC. AND MCI TELECOMMUNICATIONS CORPORATIONS'S ADDITIONAL SUPPLEMENTAL DIRECT TESTIMONY

OF

ROBERT A. MERCER

AND

JOHN C. KLICK

Q. PLEASE STATE YOUR NAMES AND BUSINESS ADDRESSES.

R. Our names are Robert A. Mercer and John C. Klick. Dr. Mercer is President of HAI Consulting, Inc. ("HAI"), located at 737 29th Street, Boulder, Colorado 80303. Mr. Klick is President of Klick, Kent & Allen, Inc., located at 66 Canal Center Plaza, Suite 670, Alexandria, VA 22314.

Q. HAVE YOU PREVIOUSLY SUBMITTED TESTIMONY IN THIS PROCEEDING?

A. Yes. Dr. Mercer submitted testimony on behalf of AT&T and MCI on February 17, 1998, February 27, 1998, March 4, 1998, June 5, 1998, and June 10, 1998. Mr. Klick previously submitted testimony on behalf of AT&T and MCI on February 27, 1998 and jointly with Dr. Mercer on June 10, 1998.

Q. WHAT IS THE PURPOSE OF THIS ADDITIONAL DIRECT TESTIMONY?

A. The purpose of this testimony is to respond to allegations by the BCPM sponsors that the HAI Model fails to provide sufficient distribution plant, based upon a "minimum spanning tree" ("MST") analysis.

Q. HOW IS YOUR TESTIMONY ORGANIZED?

A. First, we explain why the minimum spanning tree analysis – as a

conceptual matter – is an inappropriate standard for asserting that the HAI Model fails to build sufficient cable in a given distribution area. In Section II, we raise concerns that we have with the MST program that was received from the BCPM sponsors, and that both parties presumably are relying upon. In Section III, we set forth the results of MST analyses that we undertook using the HAI Model and the BCPM for the wire centers in Orders 16 and 17. Using these results as a starting point, we first explain that the customer allocation procedures used by the BCPM are so unsophisticated that they *force* the analyst make *assumptions* in order to conduct a MST analysis – assumptions that can determine the output. Second, we use our results to demonstrate that the HAI Model *does* install sufficient distribution plant. Third, we show how these results confirm what we have said earlier about the BCPM, *i.e.*, that it fails to build sufficient backbone and branch cable to actually reach the customers where the BCPM, itself, assumes them to be. In short, our MST results confirm that the BCPM builds too much plant, and still fails to reach many Texas customers. Under such circumstances, the BCPM should be rejected by the Texas PUC in favor of the HAI Model, which clearly is superior.

Finally, we discuss the import of the fact – demonstrated in the AT&T/MCI June 26 filing – that the BCPM results for Texas include a significant

number of loops with copper distances in excess of 12,000 feet (and a few loops that are in excess of 18,000 feet).

I. A MINIMUM SPANNING TREE IS NOT THE APPROPRIATE STANDARD TO ASSESS WHETHER THE HAI MODEL BUILDS SUFFICIENT DISTRIBUTION PLANT

Q. IN OTHER JURISDICTIONS, THE BCPM SPONSORS HAVE CONTENDED THAT APPLICATION OF A MST ANALYSIS HAS DEMONSTRATED THAT THE HAI MODEL FAILS TO BUILD SUFFICIENT DISTRIBUTION PLANT. IS THE MST DISTANCE A VALID BASIS FOR ASSERTING A GENERALIZED CLAIM THAT THE HAI MODEL BUILDS TOO LITTLE CABLE?

A. No. Sprint's claim is misleading and overstated. Although in certain circumstances the procedures used by the HAI Model to convert cluster shapes into rectangular shapes (with a vertical/horizontal orientation) can understate the amount of cable required, the BCPM sponsors' claim is exaggerated, however, and is based on partial information.

Sprint's claim that a MST should be the *minimum* amount of distribution cable installed in a cluster also is wrong for at least two important

reasons. First, the issues raised by Sprint tend to be most pronounced in sparsely populated clusters, precisely those clusters in which the HAI Model is most likely to place a high proportion of customers – those that are non geocodeable -- on CB boundaries. Several filings at the FCC have shown that this approach (placing surrogate locations on the CB boundaries) tends to disperse customers too widely and, therefore, overstates the amount of cable required.[1] Thus, the MST distance calculated by the BCPM sponsors, based on these conservative surrogate locations, will likely *overstate* the minimum amount of cable that would be required to serve the customers where they are located in reality.

In addition, Sprint admitted at the hearings on June 16 and 17 that the Steiner tree, not the MST, constitutes the minimum true distance required to connect a series of points in a network.[2] As Sprint stated at the hearing, the MST can overstate the minimum amount of cable required by as much as 13 percent.

A third conceptual issue with the MST analyses that Sprint has undertaken to date is that they do not include the digital loop carrier ("DLC") and feeder/distribution interfaces ("FDI," sometimes referred to as

[1] *See* AT&T/MCI Ex Parte filing of June 10, 1998, *HAI Model v 5.0a, Why It Engineers the Appropriate Amount of Distribution Plant*, slide 15.

[2] This is consistent with the simplified example provided in the third "bullet" on page 16 of Dr. Mercer's June 5, 1998 Joint Supplemental Testimony in this proceeding.

"serving area interfaces," or "SAI") as nodes that must be connected by any MST or Steiner tree. To create a functional network, it is obvious that the various customer locations in a distribution area must be connected not only to each other, but to the rest of the network as well. Because this connection takes place through the DLC and/or FDI nodes, these locations could have been included as part of the MST calculation - - failure to do so can understate the calculated MST distance. In order to minimize potential differences between the parties presentations, the MST analyses that we provide with this testimony also *exclude* the DLC/FDI nodes from the calculations, consistent with Sprint's approach.

Q. DR. MERCER'S JUNE 5, 1998 JOINT SUPPLEMENTAL TESTIMONY SUGGESTED THAT THERE ARE "BOTTOM LINE" WAYS OF DEMONSTRATING THAT THE PROBLEMS CITED BY THE BCPM SPONSORS ARE NOT SIGNIFICANT. CAN YOU PLEASE SUMMARIZE THESE?

A. Yes. First, AT&T/MCI Joint Exhibit No. 9A (RAM-13, revised 6/16/98) was provided to the Commission by AT&T/MCI during the hearing on June 17. This exhibit demonstrates that for the wire centers in Order No. 16, the HAI Model produces average loop lengths for the Contel, GTE, and SWBT wire centers that are longer than the "actual" loop lengths provided

by the companies.[3] Furthermore, for the 39 wire centers listed in Order No. 16 for which "actual" average loop lengths were provided, the HAI Model results generated average actual loop lengths longer than "actual" for 34. For the five wire centers in which the HAI Model average loop length results were *below* the "actual" loop lengths, the average loop lengths developed by the BCPM also are below those identified as "actual."

A second way of demonstrating the adequacy of the HAI Model's distribution plant algorithms is to compare the amount of backbone and branch cable constructed by the HAI Model to the amount of backbone and branch cable constructed by the BCPM for a comparable set of wire centers.[4] When we suggested this at the hearing on June 17, the BCPM sponsors objected to focusing *only* on backbone and branch cable, arguing that one also should include vertical and horizontal connecting cable in the analysis.

We continue to believe that the most appropriate comparison is one which focuses only on backbone and branch cable. In both models, these two components of the distribution network represent the cable that

[3] "Actual" loop lengths have not been provided for the Centel or United wire centers listed in Order No. 16.

[4] Backbone and branch are the cables that each cost proxy model builds along the grid system of streets hypothesized for each distribution area. It is the cable that runs along individual customer lot lines, to which individual customer drops are attached.

actually passes by the customer locations and to which the customer drops are connected. If the HAI Model has significantly more backbone and branch cable than the BCPM, for the same wire centers, this means that it has constructed a more extensive distribution plant network to reach the individual customer locations than has the BCPM.[5]

Included as Attachment RAM/JCK-A are comparisons of the HAI Model and the BCPM, run with the Staff inputs, for the Order Nos. 16 and 17 wire centers. For the Order No. 16 wire centers, the HAI Model produced approximately 37 percent more backbone and branch cable than did the BCPM. For the Order No. 17 wire centers, the HAI Model produced nearly 23 percent more backbone and branch cable. The HAI Model produced more backbone and branch cable than did the BCPM for 46 of the 55 wire centers identified in Order No. 16. Similarly, the HAI Model produced more backbone and branch cable than did the BCPM for 30 of the 40 wire centers identified in Order No. 17. In short, the HAI Model constructs significantly more cable to reach customers in the distribution areas than does the BCPM – a fact that is inconsistent with claims made by the BCPM sponsors that the HAI Model fails to construct sufficient

[5] Because the MST analyses conducted by Sprint in the past have *excluded* the DLC and FDI node locations, as noted above, they explicitly exclude the cable lengths that would correspond to the vertical and horizontal connecting cable in the BCPM output. Because we are seeking to evaluate the claims made by Sprint, based on an MST approach that excludes connecting cable, it is entirely appropriate for us to focus only on the relative amounts of backbone and branch cable produced by the two models.

cable to "connect the dots" in distribution areas.[6] Just as importantly, it is clear that the HAI Model produces more backbone and branch cable than does the BCPM, even in light-density wire centers.

Finally, even in Nevada -- the state in which the BCPM proponents originally raised their concerns -- it is clear that the HAI Model did not understate the amount of plant required to serve customers. In the universal service proceeding in that state, Nevada Bell produced actual cable data. The HAI Model run for Nevada Bell customers in the state produced *more* than sufficient cable, however, demonstrating that the HAI Model builds sufficient plant, even in a state with relatively low densities.

0 PROBLEMS ENCOUNTERED IN PERFORMING THE MST ANALYSES

Q. EARLIER, YOU ALLUDED TO PROBLEMS WITH THE MST ALGORITHM THAT YOU RECEIVED FROM SPRINT. PLEASE ELABORATE.

R. In order to minimize the potential inconsistencies between the parties, AT&T and MCI asked Sprint to provide, for their use in analyzing the BCPM, the same algorithm that it had asked PNR to use in calculating

[6] For the reasons articulated earlier, we believe that the appropriate comparison of the two models is a comparison of backbone and branch cable. However, a comparison of *all* distribution cable (*i.e.*, all cable on the customer side of the FDI) confirms that the HAI Model constructs sufficient cable. This analysis is included as Attachment RAM/JCK-B.

MST distances for the HAI Model. Sprint provided this information on Thursday, June 25, and we immediately began to use it to calculate MST distances. However, we quickly discovered that the MST algorithm that Sprint provided for our use in analyzing the BCPM is *different* from the version of the MST it asked PNR to use on the HAI Model. Apparently, the algorithm has been modified to eliminate a problem that causes MST distances to be calculated even when there is only *one* point in a cluster, which is illogical. This raises concerns about the data used in earlier FCC filings by Sprint, and also creates the strong potential for internally inconsistent comparisons between the HAI and the BCPM analyses.

Nevertheless, we have used Sprint's MST algorithm with one modification – we have zeroed out MST distances for distribution areas (clusters in the HAI Model and quadrants in the BCPM) with only one (or a fractional) node location. This creates a particularly acute problem in applying the MST algorithm to the BCPM results, however, because there are a much larger number of BCPM quadrants with only one MST node than there are HAI Model clusters. Before relying on the results of *any* of the MST analyses, therefore, we would recommend that the Commission require Sprint to determine the cause of this problem, explain how the problem can be remedied, and provide the parties an opportunity to re-evaluate Sprint's findings.

We encountered two additional problems performing the MST analysis. First, for the selected wire centers in Order 16 and 17, the BCPM had three wire centers that had multiple 11-digit switch CLLI codes for the same 8-digit wire center CLLI codes. Because of the limited time to perform studies for this filing, we have not had the opportunity to evaluate how this affects the MST analyses and have, therefore, eliminated these three wire centers from our analyses of both the HAI Model and the BCPM[7].

In addition, the data we were provided by Sprint includes a "link back" to the wire center and feeder distribution interface code ("FDI Code") in the BCPM. For certain wire centers, however, the FDI Codes in the BCPM are not unique, which made it impossible to reliably match up the microgrid data with the BCPM input data for these wire centers. Again, due to time limitations, we have dropped these eleven wire centers from both the BCPM and the HAI analyses to eliminate any confusion or possible double counting[8].

Finally, the wire center selections that were forwarded to PNR for

[7] These wire centers are DLLSTXME, SNANTXLE, and SNANTXSL.

[8] These wire centers are AUSTTXPF, DLLSTXDA, DLLSTXNM, FTWOTXAT, GRLDTXXA, HSTNTXAL, HSTNTXHO, STFRTXXA, TBLLTXKL, WACOTX01, and WCFLTXTF.

calculation of the MST distances for the HAI Model included the CLLI code "FTHDTXXM." While this is the same wire center as "FTHDTXXA" in the HAI Model, the PNR selection process failed to capture this wire center. As a result, this wire center was excluded from the analyses for both cost proxy models. After this process of data "clean-up," we were left with a total of 79 wire centers remaining from the original 94 identified in Order Nos. 16 and 17[9].

III. MST ANALYSES FOR THE WIRE CENTERS IDENTIFIED IN ORDER NOS. 16 AND 17

Q. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

R. In this section of our testimony, we explain the MST analyses that we undertook of the Texas wire centers identified by the Commission Staff in Order Nos. 16 and 17. In subsection A, we explain that the unsophisticated nature of the BCPM customer location approach renders *any* attempt to calculate MST distances problematic, describe the approach we have taken to do so, and explain why we believe it is a reasonable way to proceed.

In subsection B, we provide the results of our MST analyses – using both

[9] While Order No. 16 has 55 wire centers and Order No. 17 has 40 wire centers, one wire center ("COPRTXXA") was included in both orders, leaving 94 unique wire centers.

the HAI Model and the BCPM – for the wire centers identified in the Commission's Order Nos. 16 and 17 (using the Staff's recommended inputs). As we explain in detail below, these analyses demonstrate that using the MST criteria – and ignoring, for the purposes of our analyses, all of the flaws with the MST calculations already identified -- the HAI Model generally provides more than enough cable. In addition, we demonstrate that in the light-density wire centers, the HAI Model performs considerably better than does the BCPM.

A. The BCPM Model Does Not Locate Customers, Making MST Analyses Problematic

Q. HOW DO THE BCPM CUSTOMER LOCATION ASSUMPTIONS AFFECT THE MST ANALYSES?

R. The Commission is well aware that the BCPM Model does not actually locate customers. Instead, it allocates Census Block population data to arbitrarily-designated "microgrids" that are overlaid on each wire center, based on relative road distance. As Sprint's witness Staihr candidly admitted during the hearing on June 17, conducting a MST analysis of the BCPM Model under these circumstances forces the analyst to "wing it," because the model itself produces no physical customer locations that can be "connected" by a MST algorithm.

The problems caused by the BCPM customer location assumptions are particularly acute in low density areas. Because population is sparse, CBs are geographically large, covering numerous microgrids (which are 1,500 feet by 1,700 feet in size). Under the BCPM approach, in which a CB's customers are distributed to *all* microgrids that have qualifying road types traversing them, the small number of customers in a CB is allocated to a large amount of road mileage, resulting in many microgrids with *fractional* customer allocations. Even microgrids that are allocated more than a single customer contain fractional customers, and these customers are not physically located at any point within the microgrid. Thus, if a MST analysis is to be conducted at all, the analyst must determine (1) how to include microgrids with only a *fraction* of a customer, and (2) where to geographically locate whatever customers the BCPM has allocated to each microgrid.

With regard to microgrids containing only a fraction of a customer, we have developed an algorithm that totals all fractional customers in the microgrids comprising a quadrant, and then allocates this number of customers to a portion of the quadrant's microgrids from which these fractional customers are drawn. Our approach is conservative. Other components of the BCPM process for calculating the amount of

distribution plant that must be constructed are based on a 500-foot buffer on either side of *all* road feet in each microgrid, *even if that microgrid is occupied by only a fraction of a customer*. The total area generated by this road buffer ultimately is divided by the number of customers in these microgrids to generate the average lot size, which in turn determines the drop length that is calculated by the model. Comparing the amount of distribution plant generated by the BCPM model – including drop lengths – to MST distances that implicitly assume *smaller* lot sizes (and, therefore, smaller drop lengths)[10] is quite conservative, because it improves the chances that the BCPM will pass the MST test.[11]

Having made that decision, we then had to address *where* in the microgrid we would locate the allocated customers. Our decision was to assume, for MST purposes, that *all* customers assigned to a microgrid are evenly distributed throughout a road-reduced area of the microgrid. This approach is consistent with the assumptions made by the BCPM in designing distribution plant within quadrants. These assumptions are that (1) the area served equals 1,000 feet times the amount of road distance

[10] The approach most consistent with the BCPM Model would be to include *every* occupied microgrid in the MST analyses of the BCPM results for each wire center. This would have substantially increased the MST distances for the BCPM.

[11] The MST analyses that we have undertaken for the BCPM data for each of the Order Nos. 16 and 17 wire centers focuses on microgrids, because these are the geographic entities to which the BCPM model allocates customers for basic local exchange service. *BCPM 3.0 Model Methodology* at 26-27.

in the microgrid, with a maximum area equal to the area of the microgrid, (2) lots are square, (3) housing units are located in the center of lots, and (4) customers are evenly distributed throughout the area served.

Q. PLEASE EXPLAIN HOW THE MST DISTANCE CALCULATIONS WERE MADE, AND HOW THEY WERE COMPARED TO THE ACTUAL HAI MODEL AND BCPM RESULTS FOR THE ORDER NOS. 16 AND 17 WIRE CENTERS.

R. For both models, the MST analyses were conducted for each distribution area within a wire center, and the resulting MST distances for all distribution areas in a wire center were added together to generate the total MST distance for that wire center.[12] Because the HAI Model actually determines a physical location for each customer, while the BCPM does not (as discussed above), the MST distances for each wire center in the HAI Model are different than the MST distances for the BCPM. For each wire center, the HAI Model MST distance was compared to the amount of cable within the HAI Model clusters in that wire center, including backbone, branch and drop cable.[13]. Similarly, the BCPM MST distances for each wire center were compared to the amount of backbone, branch,

[12] For the HAI Model, each distribution area is generally a cluster. For the BCPM, each quadrant in an ultimate grid is a distribution area.

[13] For outlier clusters in the HAI Model, only cable *within* each cluster was included in the MST analyses -- the distance of the T1 connecting cable required to reach the outlier clusters was excluded. Thus, the amount of HAI Model cable compared to the MST distance is limited to the route distance of cable *within* the clusters.

and drop cable installed by the BCPM for that wire center – the cable actually within the distribution areas.[14] This permits each model's distribution plant algorithms to be evaluated *assuming* that the model's customer locations are accurate.[15]

Q. IN YOUR BCPM COMPARISONS, HAVE YOU INCLUDED THE CONNECTING CABLE THAT THE BCPM BUILDS?

R. No, that would not be appropriate. As we noted earlier, the analyses that Sprint has performed are designed to determine the MST distances required to connect *only* the customer locations in each distribution area. In both models, it is the backbone, branch, and drop cable that serves this function. To reiterate what we said earlier, including the connecting cable in the BCPM comparisons would necessitate including the DLC and FDI locations in the MST calculations. And to be comparable, of course, one would have to modify the HAI Model analyses to include the DLC/FDI locations *and* the outlier clusters in the HAI Model MST calculations and comparisons.

[14] In Attachment RAM/JCK-A, we compared only backbone and branch cable produced by the two models, because we sought to determine which of the two cost proxy models provides access to the largest number of customer locations. Inclusion of drops would have distorted that analysis, because drop length is a function of assumptions about lot shape, lot size, and dwelling location. In the MST analyses, however, the "dots" being connected are the actual dwelling locations, and the drop is part of the cable each model employs to connect these locations.

[15] Of course, the BCPM customer "locations" were based on the assumptions described in response to the prior question.

B. Comparison of Output from the HAI and the BCPM Models to MST Distances Reveals that the HAI Model Is Superior

Q. HAVE YOU SUMMARIZED THE RESULTS OF YOUR MST ANALYSES?

R. Yes. Attachment RAM/JCK-C is a five-page exhibit that displays the results of our analyses for all of the analyzed wire centers from Order Nos. 16 and 17. For the HAI Model, the overall MST distance for all of the selected wire centers is 16,711 miles. For these same wire centers, the HAI Model constructs a total of 30,263 miles of backbone, branch and drop cable -- 80 percent more cable than the MST distance. For the BCPM, the overall MST distance for all of the selected wire centers is 23,890 miles, yet the BCPM model constructs only 24,141 miles of backbone, branch and drop cable – a margin of only 1.1 percent.

Attachment RAM/JCK-C displays results (1) by density zones across *all* companies, (2) by individual company, and (3) by individual wire center. These various ways of viewing the MST results all demonstrate the superiority of the HAI Model. For example, the HAI Model installs less backbone, branch and drop cable than indicated by a MST analysis in only 14 of the 79 wire centers analyzed, while the BCPM installs less backbone, branch and drop cable than the MST distance in 41 of the 79 wire centers.

If one examines results by density zone, the HAI Model installs less cable than the MST distance *only* in the lowest density zone (installed backbone, branch and drop cable is 19 percent less than the MST distance). In contrast, the BCPM falls short in three density zones - - the lowest and the two highest - - with "shortfalls" of 46 percent, 14 percent, and 9 percent, respectively.

On a company-by-company basis, the HAI Model installs backbone, branch and drop cable in excess of the MST distance for each of the five companies (by margins of 20 percent or more). In contrast, the BCPM installs less backbone, branch and drop cable than the MST distance for the three smallest companies (*i.e.*, Centel, Contel, and United).

The MST analyses also provide insights into the customer location assumptions in each Model. While the HAI Model geocodes customers and, as a result, takes into account the economies of density that actually exist, the BCPM does not actually locate customers, and disperses these customers to the maximum possible along the included road network. This can be observed by examining the MST distances by wire center shown on pages 3, 4 and 5 of Attachment RAM/JCK-C. For all but the lowest density zone, where the HAI Model has the lowest geocoding

success rate, the BCPM MST distances are substantially higher than the HAI Model MST distances. Because a large portion of the actual customer locations can be identified for these more populated areas, one can conclude that the BCPM customer location methodology is fundamentally flawed.

In the lowest density zone, however, the HAI Model has substantially *more* MST distance than does the BCPM. This illustrates the conservative nature of the HAI Model procedure for selecting surrogate locations. In fact, while both the HAI Model and the BCPM do not produce as much cable as the MST in this lowest density zone, the HAI Model produces more cable than *either* the BCPM MST or the BCPM. Obviously, the BCPM sponsors assertion that the HAI Model does not provide enough cable to reach customers is without merit.

C. *Summary*

For the reasons described in Sections I and II of this testimony, the MST distance is not a reliable indicator of the minimum amount of backbone, branch and drop cable that must be installed by the cost proxy models. For the purposes of our analyses, however, we have accepted these frailties and developed MST distances for most of the wire centers

identified in Order Nos. 16 and 17. These analyses conclusively demonstrate that the HAI Model passes the MST test advocated by Sprint with far greater frequency than does the BCPM.

IV. COST PROXY MODELS FOR THE PURPOSE OF CALCULATING UNIVERSAL SERVICE SHOULD NOT BE LIMITED TO 12,000 FEET OF COPPER

Q. DURING THE HEARING ON JUNE 17, MR. KLICK OFFERRED TO PROVIDE STAFF WITH THE NUMBER OF BCPM LOOPS CONTAINING MORE THAN 12,000 FEET OF COPPER. HAS THAT ANALYSIS BEEN PERFORMED?

R. Yes. On June 26, 1998, AT&T and MCI advised the Commission that the BCPM results for Texas included more than 12,100 loops that had more than 12,000 feet of copper (and 15 loops with more than of 18,000 feet of copper). For the Commission's convenience, these results are displayed in Attachment RAM/JCK-D, which is a histogram reflecting the range of copper loop lengths by company from the BCPM results for Texas.[16]

Q. CAN THE BCPM EASILY BE MODIFIED TO ENSURE THAT NO LOOP HAS A COPPER DISTANCE IN EXCESS OF 12,000 FEET?

[16] Loop length calculations reported to the Commission on June 26 reflect DLC placement assumptions made in the BCPM's preprocessor and used as input to the BCPM model.

R. No. As Mr. Klick explained at the hearing on June 16 and 17, the BCPM preprocessor checks to see if the most distant customer in an "ultimate grid" is more than 12,000 feet from the wire center. If it is, then the model assumes that *fiber* feeder will be installed between the wire center and the DLC. However, the BCPM preprocessor makes no subsequent check to ensure that copper distances between the DLC and individual customer lots are less that 12,000 feet. In contrast to the HAI Model, these long copper loops cannot be eliminated from the BCPM merely by modifying a user-adjustable input. Instead, the BCPM preprocessor would have to be altered to ensure that no loops have copper distances in excess of 12,000 feet. The most direct way of doing so would be to place the DLC at the geographic center of the ultimate grid, rather than at the road centroid of the grid as the BCPM does now. As the Commission staff undoubtedly recognizes, this would represent a fundamental change in the BCPM approach.

Q. GIVEN THAT THE BCPM CANNOT BE MODIFIED TO ELIMINATE LOOPS WITH COPPER LENGTHS IN EXCESS OF 12,000 FEET, WHAT DO YOU RECOMMEND TO STAFF?

R. In order to put this issue in perspective, we also are providing Attachment RAM/JCK-E. This is a histogram of copper loop lengths for the HAI Model for Texas, assuming that the HAI Model *default value* of 18,000 feet is

used for the Maximum Analog Copper Total Distance, rather than the 12,000 foot value being considered by Staff. This diagram reveals that even when the default value is used, only 1 percent of the loops produced by the HAI Model have copper distances in excess of 12,000 feet (and, unlike the BCPM, *none* of the loops have copper distances in excess of 18,000 feet). Furthermore, the *average* copper distance produced by the HAI Model, with the default input, is 15 percent shorter than the average copper distance produced by the BCPM.

These results confirm that the HAI Model design, using the default 18,000 foot Maximum Analog Copper Total Distance, rarely produces copper loop lengths in excess of 12,000 feet. To put the two models on a comparable basis, the *only* feasible approach is to utilize the default assumption in the HAI Model.

Q. DURING THE HEARINGS, THERE WAS A DISCUSSION OF THE ABILITY OF THE HAI MODEL AND BCPM LOOP DESIGNS TO SUPPORT ADSL. DO YOU HAVE COMMENTS ON THIS DISCUSSION?

R. Two key points arose from the discussion. First, the Staff expressed the view that to provide ADSL, the copper loop length must be limited to 12,000 feet. Second, GTE witness Murphy stated that the HAI Model did

not provide cables to outlier areas with sufficient capacity to support ADSL, and that it was therefore defective compared to BCPM.

Our comments concerning ADSL are as follows. First, if 12,000 feet is the appropriate maximum copper distance, then – as we have demonstrated above -- the HAI Model meets this criterion when the Maximum Analog Copper Total Distance parameter is set to 12,000 feet, but the BCPM does not and cannot meet the criterion. Second, it is our opinion that 18,000 feet is a more appropriate criterion for the maximum analog copper loop length. The HAI Model, with default inputs, meets this criterion, whereas BCPM does not. Third, neither the HAI Model *nor* the BCPM has provided sufficient capacity to support ADSL in rural areas, nor is it appropriate for them to do so.

Q. YOUR PREVIOUS ANSWER REFERS TO THE MAXIMUM *ANALOG* COPPER DISTANCE. PLEASE DIFFERENTIATE BETWEEN ANALOG AND DIGITAL COPPER LOOPS.

R. When parties talk about maximum copper distances with respect to ADSL, they are referring to the distance over which *analog* voice signals travel presently, and over which the composite ADSL and voice signals will travel when such a system is deployed.[17] Existing *digital* systems, such

[17] The ADSL and voice signals are combined into a composite analog signal with high-frequency components above the voice range that carry the ADSL downstream and bi-directional signals.