ORIGINAL

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September 2, 1998

Mrs. Blanca S. Bayo
Director, Division of Records and Reporting
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399

RE: Docket No. 980696-TP

Dear Mrs. Bayo:

Enclosed for filing in the above referenced dockets on behalf of AT&T of the Southern States, Inc.'s (AT&T) and MCI Telecommunications Corporation is the Rebuttal Testimony of Catherine Petzinger, John Hirshleifer, Michael Majoros, Art Lerma, and Don Wood/Brian Pitkin. Please note that the Rebuttal Exhibit CEP-1 attached to Catherine Petzinger's Rebuttal Testimony may contain proprietary confidential business information and is being filed separately in accordance with Rule 25-24.006(5), Florida Administrative Code.

Copies of the foregoing are being served on all parties or record in accordance with the attached Certificate of Service. Thank you for your assistance in this matter.

Sincerely,

Tracy Hatch

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CERTIFICATE OF SERVICE
DOCKET 980696-TP

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ATTORNEY

BEFORE THE ORIGINAL

FLORIDA PUBLIC SERVICE COMMISSION

REBUTTAL TESTIMONY OF

DON J. WOOD

AND

BRIAN F. PITKIN

ON BEHALF OF

MCI TELECOMMUNICATIONS CORPORATION and

AT&T COMMUNICATIONS OF THE SOUTHERN STATES, INC.

Docket No. 980696-TP

September 2, 1998

REBUTTAL TESTIMONY OF

DON J. WOOD AND BRIAN F. PITKIN

ON BEHALF OF AT&T COMMUNICATIONS OF THE

SOUTHERN STATES, INC. AND

MCI TELECOMMUNICATIONS CORPORATION

DOCKET NO. 980696-TP

Q. PLEASE STATE YOUR NAMES, BUSINESS ADDRESSES AND DESCRIBE YOU BACKGROUNDS.

A. My name is Don J. Wood. My business address is 914 Stream Valley Trail, Alpharetta, Georgia. I am the same Don J. Wood who prefiled direct testimony in this proceeding on August 3, 1998, and my background and experience are described in Exhibit: _____ (DJW/BFP-1) to that testimony.

My name is Brian F. Pitkin. My business address is Klick, Kent & Allen, Inc. ("KK&A"), 66 Canal Center Plaza, Suite 670, Alexandria, Virginia 22314. After graduation from the University of Virginia, I joined Peterson Consulting, L.P., where I was involved in developing and analyzing large databases and performing economic analyses. In 1994, I joined KK&A. Since joining the firm, I have been involved in cost analyses for the telecommunications and railroad industries. Many of the analyses that I have worked on have been submitted in regulatory and court proceedings.

During the past two years, I have had extensive experience with the cost models and underlying databases that have been submitted in proceedings arising out or the Telecommunications Act of 1996. I have analyzed models sponsored by AT&T and MCI and various other parties, examining both the model assumptions and techniques that were utilized. Most recently, I have submitted critiques of the Benchmark Cost Proxy Model Release 3.1 in Alabama, Minnesota, Mississippi, Montana, South Carolina, Tennessee, Texas, Washington and Wyoming

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

A. We have been asked by MCI Telecommunications Corporation ("MCI") and AT&T Communications of the Southern States, Inc. ("AT&T") to review and comment on the relative merits of the HAI Model Release 5.0a -- sponsored by AT&T and MCI in this proceeding -- and the Benchmark Cost Proxy Model Release 3.1 ("BCPM") sponsored by Bell South, Sprint, and GTE in this proceeding.

Q. **HOW IS YOUR TESTIMONY ORGANIZED?**

A. Our testimony is divided into eight sections. In Section I, we summarize the principle deficiencies of the BCPM. In Section II, we address central costing issues that separate the parties in this proceeding. In Section III, we describe a major problem with the BCPM that prevents the model from serving customers with the network that the BCPM constructs. In Section IV, we critique the BCPM switching module, transport module and signaling costs. In Section V, we address, in more detail, the BCPM methodology for calculating the cost of the loop -- the largest cost component of universal service. In Section VI, we critique the BCPM input values. In Section VII, we address several claims that the BCPM sponsors make regarding comparisons between the HAI Model and the BCPM. In Section VIII, we summarize our findings and conclusion that the BCPM cannot provide a reliable estimate of the costs associated with providing basic local exchange service in the state of Florida. In contrast, the HAI Model sponsored by AT&T and MCI (and presented in Don Wood's direct testimony) does provide a reliable estimate of universal service costs.

Q. **ARE THERE EXHIBITS TO YOUR TESTIMONY?**

A. Yes. Our testimony includes 21 exhibits, as follows:

DJW/BFP-1: The BCPM serving area design is arbitrary

DJW/BFP-2: Associated Press article titled "Assessment Sought on Bell Rates"

DJW/BFP-3: FCC Public Notice titled "Common Carrier Bureau Seeks

Comment on Model Platform Development," Released August 7, 1998

DJW/BFP-4: Maps illustrating that the BCPM does not serve all customers

DJW/BFP-5: BCPM output reports showing the investment and cost generated by the BCPM using the BCPM's "default switching method" and the "SCM switching method"

DJW/BFP-6: HAI geocoding success rate by state and density zone

DJW/BFP-7: AT&T and MCI June 10, 1998 Ex Parte filing with the FCC titled "HAI Model 5.0a – Why it Engineers the Appropriate Amount of Distribution Plant"

DJW/BFP-8: BCPM ultimate grids vary in size across the United States

DJW/BFP-9: Bellcore comparison of bush v. branch design

DJW/BFP-10: Graphical comparison of the BCPM and HAI Model approaches to customer location and outside plant design

DJW/BFP-11: Illustration of MST Analysis on the BCPM

DJW/BFP-12: Graph of HAI Model Copper Analog Distribution Loop Lengths

DJW/BFP-13: The BCPM does not build cable to reach modeled customer locations

DJW/BFP-14: Square lots are inefficient and result in increased developer costs

DJW/BFP-15: Comparison of the number of serving areas and lines by company in the HAI Model and the BCPM

DJW/BFP-16: Comparison of route miles by company in the HAI Model and the BCPM

DJW/BFP-17: Per-foot structure costs for distribution and feeder plant

DJW/BFP-18: Comparison of HAI Model and BCPM estimated distances to minimum spanning tree distances, by wire center

DJW/BFP-19: Comparison of HAI Model and BCPM estimated distances to minimum spanning tree distances, by density zone

DJW/BFP-20: Letter from Metromail detailing geocoding success rate

DJW/BFP-21: Comparison of annual charge factors in the HAI Model and the BCPM

I. EXECUTIVE SUMMARY

Q. PLEASE SUMMARIZE YOUR CRITICISMS OF THE BCPM METHODOLOGY.

A. The BCPM's greatest flaw is its failure to model a basic local exchange network using most-efficient, forward-looking costs based on the most recent commercially available technology and equipment and generally accepted design and placement principles, as required by F. S. 364.025 (4) (b).

While all cost proxy models must make simplifying assumptions (in order to complete processing in reasonable time), these assumptions should reflect, to the maximum extent feasible, the real world decision-making that engineers use to design outside plant efficiently. The BCPM does not make reasonable assumptions in estimating the costs that an efficient provider would incur for providing basic local telecommunications service.

As we will demonstrate in detail below, the BCPM suffers in comparison with the HAI Model on each of the critical design characteristics of the network. First, the BCPM takes no advantage of the large amount of actual customer location information that is currently publicly-available in the marketplace, nor does it rely upon any such data that is presumably in the possession of BellSouth or the other incumbent local exchange carriers ("ILECs"). Instead, the BCPM relies upon a series of unsupported assumptions to *allocate* all customer locations to microgrids -- areas of approximately 1,500 feet by 1,700 feet (a process discussed in greater detail later in this testimony) -- that the BCPM arbitrarily overlays on the state of Florida. Because the BCPM does not use actual customer location information that is available in designing its carrier serving areas and, instead, evenly-distributes customers along roads, it cannot reflect the concentration of customers that exist in the real world. The BCPM approach of dispersing customers as much as possible on a subset of roads in each CB tends to overstate costs. In short, a cost proxy model that does not employ the most accurate demand information available in its algorithms cannot efficiently design facilities to serve these customers.

Second, the way in which the BCPM methodology employs these road surrogate locations results in customers not being located at all. As we describe below, the BCPM does not serve all households -- a requirement for cost proxy models that are to be used to calculate universal service.

Third, the BCPM relies upon this same arbitrary grid structure to establish the physical boundaries of its carrier serving areas. As we explain in more detail below, the largest grid size employed by the BCPM is too small to take full advantage of the digital loop carrier ("DLC") technology that is currently available for concentrating customer calls. As a result, the BCPM models too many serving areas in the state, requiring excessive amounts of concentration equipment (*i.e.* serving area interface -- SAI -- and Digital Loop Carrier -- DLC) and too much subfeeder to connect these carrier serving areas to main feeder cable routes. In addition, because the geographic location of the grid system is arbitrary -- ignoring actual customer locations -- it often subdivides groups of customers that could (and, in the real world, would) be served together, violating both common sense and accepted outside plant engineering practice. Exhibit: _____ (DJW/BFP-1) illustrates that the BCPM will treat 4 customers differently depending on the location of these customers relative to the arbitrary grid location.

Fourth, while the BCPM employs too much DLC and too much subfeeder, it still fails to provide sufficient distribution plant to actually reach the customer locations that it hypothesizes. This arises because of two additional assumptions made by the BCPM, *i.e.*, (1) to build distribution plant only within a "road-reduced" quadrant (the area of which is set equal to the road mileage in the quadrant, multiplied by 1,000 feet), and (2) to "limit" the amount of connecting, backbone, and branch cable constructed in that quadrant to no more than the road distance in that quadrant. As we demonstrate below, the effect of these assumptions is to underestimate the amount of distribution cable required and, in most cases, to construct *even less* cable than the model estimates is required. As a result, the HAI Model builds approximately 18 percent more backbone and branch cable -- the portion of the outside plant network that actually runs down streets and connects to customers -- than does the BCPM.

The shortcomings in the BCPM result in the worst of all worlds -- substantially overstated costs for a basic local exchange network that fails to reach many of the Florida customers that it is intended to serve. The carrier serving area design employed by the BCPM -- which fails identify accurately customer locations and serve them efficiently -- is its most critical design flaw, one that affects virtually every other calculation in the model.

Q. HAVE OTHER STATES REACHED CONCLUSIONS SIMILAR TO YOURS REGARDING THE DEFICIENCIES IN THE BCPM AND THE SUPERIORITY OF THE HAI MODEL?

A. Yes. Specifically, the Louisiana Public Service Commission Staff concluded that:

> Staff recommends that the Commission select the Hatfield model with the input assumptions set forth below for submitting a forward-looking cost proxy model to the FCC. Staff believes that it more accurately locates customers in the more urban areas and that it is as accurate or more accurate at locating customers in the more rural areas than the BCPM. In addition, Staff believes that the engineering design standards used in the Hatfield model are superior to the ones used in the BCPM. In this regard, the Hatfield model better meets the FCC's criteria number one than the BCPM that "the technology assumed in the cost study or model must be the least-cost, most-efficient, and reasonable technology for providing the supported services that is currently being deployed." For example, the BCPM uses Carrier Serving Areas and Distribution Areas that divide logical customer groups and force the installation of small SAIs and DLC equipment. The Hatfield model in contrast, allows for natural groups of customers and uses larger more cost effective SAIs and DLCs.[1]

"On motion of Commissioner Field, seconded by Commissioner Dixon, and unanimously adopted, the Commission voted to adopt the Staff's Final Recommendation utilizing the Hatfield method and staff's input on costs."[2]

In addition, the Kentucky Public Commission found that:

> In the Commission's opinion, the HAI Model reflects more appropriate

> network costs. Moreover, the HAI Model more accurately locates customers and is more open to public review. Therefore, the Commission adopts the HAI Model to establish the Kentucky USF and determines that the HAI Model complies with the FCC's criteria as discussed below.[3]

The Minnesota Public Utilities Commission also found that:

> In his report, the ALJ favored the HAI model over the BCPM, and over a "blending" of the models. However, the ALJ also favored certain modifications of inputs and other changes. Having reviewed the record and considered the arguments, the Commission agrees with the ALJ that the HAI provides the more accurate and reliable method for estimating the costs of serving Minnesotans living in rural, insular and high costs areas. Therefore the Commission accepts, adopts and incorporates herein by reference the findings and recommendations of the ALJ's Report.[4]

The report of the Administrative Law Judge in Minnesota states that:

> The Department strongly endorses the HM because it believes the HM will better accomplish the FCC's goals for two principal reasons. First, it has a more accurate system for locating customers than BCPM and it minimizes reliance on surrogate location techniques. Second, the HM's switching module generates more accurate switching costs than BCPM's SCM module. For both these reasons, the Department believes that the HM will generate a more accurate prediction of the distribution network and its associated costs. Moreover, the

> HM meets the FCC's ten criteria in 250. DPS at 54-55. (page 44, para 186).
>
> The ALJ concludes that the HM, with the modifications of inputs and other changes recommended in this report, should be selected as the cost study to be submitted to the FCC. It meets the requirements of 250 better than the BCPM. In particular, and most importantly, it best reflects "the least-cost, most-efficient, and reasonable technology currently being deployed," and "long-run, forward-looking, economic costs." Compliance to these standards is apparent throughout the model's design, logic, and inputs. (Page 44, para 189).

The states of Hawaii and Nevada also have concluded that the HAI Model is superior to the BCPM.

Q. HAS THE FCC PROVIDED ANY INSIGHT INTO WHICH MODEL'S METHODOLOGY IT PREFERS?

A. Yes. On August 7, 1998, the FCC released a Public Notice titled "Common Carrier Bureau Seeks Comment on Model Platform Development" (this FCC Public Notice is included as Exhibit: _____ (DJW/BFP-3) to our testimony), in which it states:

> [i]n the Further Notice, the Commission comments on the availability, feasibility, and reliability of using geocoded data to determine the distribution of customers in the federal mechanism. Many commenters from across the spectrum of the industry agree that geocoded data that

> identify the actual geographic locations of customers are preferable to algorithms intended to estimate customer locations based on information such as census block data.

In addition, the FCC notes that:

> in this public notice, we consider a model platform that groups customers using a clustering approach because it appears to have advantages over gridding approaches HAI has placed the computer code for its clustering algorithm on the record in this proceeding.

Thus, it appears that for virtually all aspects of the customer location process, the HAI Model uses (or has been adjusted to incorporate) an approach that is endorsed by the FCC. The BCPM does not geocode customers, and does not use a clustering approach to identify serving areas.

II. PRELIMINARY ISSUES TO BE ADDRESSED BEFORE EVALUATING COST MODELS

Q. THE PROPONENTS OF THE BCPM TYPICALLY RAISE A NUMBER OF "RED HERRING" CRITICISMS OF THE HAI

MODEL IN AN EFFORT TO IGNORE SUBSTANTIVE ISSUES THAT DISTINGUISH THE TWO MODELS. WHAT ARE SOME OF THE ISSUES THAT ARE *NOT* CENTRAL TO THIS PROCEEDING?

A. Issues that do not constitute significant differences between the models should not be the primary focus of these proceedings. For example, there is little point in a conceptual discussion concerning the need for or the extent of preprocessing, because both models require extensive preprocessing in order to get the information into useable format (it is important to recognize, however, that substantive cost calculations dealing with feeder and subfeeder are contained in the BCPM preprocessing, which makes it effectively impossible to modify these assumptions in the BCPM; the corresponding HAI Model calculations are contained in the HAI Model itself, making them easier to review and modify). Other examples of "red herrings" include:

X *Should a model contain loops with copper distances in excess of 12,000 feet?* In fact, both models construct a small percentage of loops in Florida with copper distances in excess of 12,000 feet. As a result, the feasibility of this design feature should not be an issue in this proceeding.

X *In estimating costs, is it appropriate for a model to assume an even* *distribution of customers within the defined distribution areas created by the models?* Here again, both models assume an even distribution of customers within the distribution areas that the models design. This modeling assumption permits the models to remain open and process within a reasonable amount of time. A key distinction between the models, however, is that the HAI Model accurately sizes and locates these distribution areas, while the BCPM does not.

X *Does the HAI Model place too little cable within its clusters to reach customer locations?* In Florida, the HAI Model places more backbone and branch cable - the cable that is assumed, by both models, to run down streets and to serve customers - than does the BCPM. Therefore, the HAI Model does a more complete job of serving customers than does the BCPM.

The Models Sometimes use Identical Terms to Refer to Somewhat Different Circumstances. These Distinctions Must Be Kept In Mind In Comparing The Models

Q. HOW ARE CUSTOMER LOCATIONS DEFINED IN THE TWO MODELS?

A. Although business locations generally are defined identically in the HAI Model and the BCPM, residential locations are defined differently. The HAI Model defines a customer location as a location likely to require basic local telephone service, and uses a *household* count (from either the Census data or the Metromail database, whichever is greater). A "household" generally reflects an occupied housing unit, or one that has recently been occupied. In contrast, the BCPM methodology defines a customer location as a *housing unit* -- which includes both occupied and unoccupied residential locations. Defining residential customer locations in terms of *households*, as is done in the HAI Model, is consistent with the FCC's Universal Service Order, criteria No. 6, which states: "[t]he cost study or model must estimate the cost of providing service for all businesses and *households* within a geographic region." [emphasis added]

The New Mexico State Corporation Commission found that "the use of housing units, rather than households, results in a cost estimate that reflects the assumption that plant is built in areas where no one lives and for which the local exchange company has not constructed facilities." This Commission ultimately concluded that "the use of housing units is a significant shortcoming in BCPM."[5]

Q. HOW ARE FEEDER, AND DISTRIBUTION CABLE DEFINED IN THE TWO MODELS?

A. The HAI Model uses a consistent definition -- defining all cable on the "customer side" of the feeder distribution interface ("FDI" -- the term used in the BCPM) or serving area interface ("SAI" -- the term used in the HAI Model) as distribution plant, and all cable on the "central office side" of the FDI or SAI as feeder plant. This definition is generally accepted in the industry (*see*, for example, page 47 of the BCPM 3.1 documentation, which defines the FDI as "the cross connect where copper feeder facilities are connected with copper distribution facilities").

The BCPM proponents have adopted non-standard definitions of feeder and distribution facilities. The BCPM output actually classifies *all* connecting cable constructed by the model as feeder plant, even when some of this cable is on the customer side of the FDI. This non-standard classification is explicitly recognized in the BCPM 3.1 documentation, which states the "while this is typically considered distribution cable, the Model has fixed the classification of this cable as feeder. In a future release of the BCPM, this cable will be classified differently." (BCPM 3.1 Methodology, Section 6.7, footnote 37).

In the comparisons that we make below, we use a consistent definition of feeder and distribution plant for cable installed by *both* models. All plant on the central office side of the FDI or SAI is classified as feeder cable; all plant on the customer side of the FDI or SAI is distribution cable. As noted earlier, this convention is consistent with standard practice in the industry.

Q. SHOULD EMBEDDED DATA BE USED TO VALIDATE THE COST PROXY MODELS?

A. No. In this proceeding, neither cost proxy model is attempting to model the existing network. Instead, the cost proxy models submitted in this proceeding purportedly are designed to be forward-looking, reflect use of the best, currently-available technology and engineering design standards, be economically efficient, and reflect the long-run. Obviously, embedded networks do not meet these conditions, so comparisons of model outputs to embedded network characteristics can be misleading.

This fact has been recognized by the Kentucky Public Service Commission, which found that:

> The HAI Model was developed to estimate the costs incurred by an efficient carrier building a network using current technology and costs. The consulting group designing the model used long-run forward-

> looking costs. The model correctly applies a long-run assumption by treating the ILECs' embedded cost structure, except for the location of wirecenters, as variable and avoidable.[6]

In addition, it is appropriate to be extremely skeptical regarding the relevance and accuracy of embedded and historic data, especially when the support for the data has not been provided. While the ILEC's have provided proprietary inputs into the BCPM, they have not produced the sources to these inputs. A recent article titled "Assessment Sought on Bell Rates," attached as Exhibit: _____ (DJW/BFP-2), reveals that "an audit by the Federal Communications Commission show that some of the equipment the Bells have on their books cannot be accounted for."[7]

Again, F. S. 364.025 (4) (b) rejects the use of embedded characteristics and historic information and requires that the cost model use total forward-looking costs based on the most recent commercially available technology and equipment and generally accepted design and placement principles.

III. A SERIOUS FLAW IN THE BCPM DESIGN ASSUMPTIONS RENDERS THE MODEL'S NETWORK INCAPABLE OF PROVIDING UNIVERSAL SERVICE

Q. SINCE BOTH THE HAI MODEL AND THE BCPM START WITH CENSUS DATA AT THE CENSUS BLOCK LEVEL, WHY DO YOU CONTEND THAT THE RESULTING BCPM NETWORK IS NOT CAPABLE OF PROVIDING UNIVERSAL SERVICE?

A. It is true that both the HAI Model and the BCPM use, as their original sources of customer counts, data at the Census Block level (from the Bureau of the Census). For the BCPM, this data includes both occupied and unoccupied housing units which are allocated to microgrids based either on land area (for locations in dense urban areas) or on relative road distance (for all locations other than those in dense urban areas). This method of allocating customers results in microgrids that are allocated fractional customers. Although the documentation provided in the BCPM Methodology does not describe how these fractional customers are treated within the BCPM preprocessing, it is clear that some of these customers are dropped from the process (perhaps when the sum of the customers in an ultimate grid is fewer than one-half of a customer).

Q. YOU STATE THAT IT IS CLEAR THAT CUSTOMERS ARE DROPPED FROM THE BCPM PREPROCESSING. HOW DO YOU KNOW THIS?

A. In order to conduct the minimum spanning tree ("MST") analyses described later in this testimony, we received from BellSouth the detailed microgrid data for BellSouth's service territory in Florida. This information was compared to the ultimate grid data that is part of the input file passed from the BCPM preprocessing to the BCPM, itself. We identified several geographic locations where the BCPM data showed *no* occupied ultimate grid -- which caused the BCPM model to conclude that no subfeeder, DLC, or distribution plant was required -- but where the more detailed data for the microgrids comprising the allegedly unoccupied ultimate grid are occupied (because they have been allocated customers by the BCPM preprocessing).

Exhibit: _____ (DJW/BFP-4) contains examples of this phenomenon. In each case, we have shown the customers allocated to the microgrids within each ultimate grid, even where those microgrids are located within supposedly unoccupied ultimate grids. For the sake of comparison, we have shown three maps for each wire center (one Florida wire center and two Texas wire centers). The first map shows the number of households reported by the Census data for each Census Block. The second map shows the distribution areas to which the BCPM actually builds facilities, illustrating that the BCPM network built in each of these wire centers does not serve all of the households located in the wire center. The last map shows the HAI Model clusters, and demonstrates that the network built by the HAI Model *does* serve all of these households.

The bottom line is that the BCPM fails to build *any* outside plant to some of these occupied locations, even though the BCPM preprocessing demonstrates that there are customers in these locations (this situation is most likely to occur in a large census block with relatively few customers and a substantial amount of road distance -- in such circumstances, the BCPM preprocessing will allocate a fractional customer to the microgrid). When these microgrids are aggregated into a single ultimate grid, this process could result in an ultimate grid with only a fractional customer. Although it is difficult to be sure (because the BCPM preprocessing is not easily reviewed), some portion of these fractional ultimate grids are dropped before data is passed to the BCPM itself. This error within the BCPM preprocessing clearly violates criteria number six of the FCC's Universal Order, which requires that, "[t]he cost study or model must estimate the cost of providing service for *all* businesses and *households* within a geographic region." (emphasis added)

IV. THE BCPM DEFAULT SWITCHING METHOD OVERSTATES COSTS AND THE TRANSPORT AND SIGNALING

COSTS ARE BASED ON EMBEDDED DATA

BellSouth and Sprint Have Elected to Use the ABCPM Default Method≅ for the Development of Switching Costs, Which Leads to a Significant Overstatement of Switching Costs

Q. THE BCPM RUNS FILED BY BELLSOUTH AND SPRINT IN THIS PROCEEDING RELY ONLY ON THE "BCPM METHOD" FOR CALCULATING SWICHING COSTS. DOES THIS CONCERN YOU?

A. Yes. It appears that the switching costs resulting from the "BCPM method" are significantly overstated. In Florida, GTE filed the BCPM using SCM inputs for its wire centers while BellSouth and Sprint used the "BCPM method". Overall, running the BCPM switching module for GTE's Florida service territory using the "BCPM method" would generate switching investment 28% higher than the switching investment that was generated by GTE using the SCM inputs for the same territory.

Similarly, in Washington state, U S WEST filed the BCPM with SCM inputs for 106 wire centers. Overall, running the BCPM switching module for these U S WEST wire centers using the "BCPM method" generated switching investment that was more than twice as high as the switching investment generated using U S WEST's SCM inputs for the same wire centers (the BCPM output reports illustrating the significant difference between the two BCPM switching methods for both GTE's Florida wire centers and for U S WEST's Washington wire centers are included as Exhibit: __ ___ (DJW/BFP-5) to this testimony).

These results are significant, because BellSouth's and Sprint's reliance on the "BCPM method" to produce switching estimates in this proceeding are also likely to overstate switching costs.

However, it is also important to recognize that GTE's application of the "SCM method" produced much higher switching costs than did U S WEST's application of the "SCM method." While this might reflect greater economies of scale in U S WEST's switching than exist in GTE's Florida switching, it is difficult to know with any confidence because the ILEC SCM inputs used in various BCPM runs that we have observed around the country are essentially a "black box" that are inaccessible for review and validation.

While Ms. Petzinger is providing a detailed evaluation of the BCPM switching process, it is important for us to point out that U S WEST -- one of the BCPM developers -- has elected to rely on another method (the "SCM method") which yields switching costs that are approximately one-half of the switching costs produced by the default "BCPM method."

Q. **HAVE OTHER STATE COMMISSIONS BEEN CRITICAL OF THE BCPM SWITCHING COSTS?**

A. Yes. The Minnesota Public Utilities Commission found "that the BCPM's use of existing switch design is not consistent with what an efficient carrier would put in place today and tends to overstate costs." (Page 23, para 97) This conclusion is largely based on the analysis of Mr. Legursky, a consultant to the Minnesota Department of Public Service:

> Both models can use the FCC switch cost as inputs, but both use their own defaults. Mr. Legursky analyzed the HM and BCPM switching modules to determine whether either module produced results in line with his knowledge of actual switching costs. (Tr 974) He concluded that the HM's results were "much better, but still conservative." (Tr 954)
>
> Mr. Legursky acknowledged that the HM derived switch costs from a regression curve calculated

from just four data points. (Tr 973) His concern however, was not with the derivation of the cost curve, but rather with whether the curve generated accurate cost estimates. He testified: "I have absolute confidence in the results that are produced by the regression curve." (Tr 975) Mr. Legursky described the results of the BCPM methodology as "terrible" and as "way out of line with current industry practice" (Tr 953-54)

The BCPM Transport and Signaling Calculations are Based on Embedded Design, Not Forward-Looking Design

Q. DO YOU HAVE ANY COMMENTS ON THE BCPM TRANSPORT AND SIGNALING COSTS?

A. Yes. The BCPM transport and signaling modules are based on embedded network configurations. Because these embedded configurations were built incrementally to serve demand as demand has risen over time, they most likely are not optimal. In addition, new technology has outdated much of the old technology and can now serve the same purpose more efficiently (*i.e.*, with both lower initial costs and lower maintenance costs).

While the BCPM signaling module "[u]ses the existing SS7 signaling network as the basis for the SCPM network" (based on embedded data), review of the BCPM signaling calculations indicates that no explicit modeling of signaling costs is performed at this time, which conflicts with one of the FCC's requirements for cost proxy models and F. S. 364.025 (4) (b). Instead, the user must employ an input table that is based on results produced by the "Signaling Cost Proxy Module" for parts of U S WEST's operating region.

V. CALCULATION OF LOCAL LOOP COSTS

The Accurate Calculation of Local Loop Costs is Based on a Series of Essential Steps

Q. **WHAT ARE THE CRITICAL STEPS IN MODELING THE COST OF THE LOCAL LOOP?**

A. The critical steps in this process are:

1) identifying residential and business customer locations in each wire center;

2) aggregating these customers into efficient carrier serving areas and distribution areas (distribution areas may be subsets of carrier

serving areas);

3) designing an efficient system of feeders and subfeeders to connect each of the serving areas to the wire center, consistent with current outside plant engineering practices;

4) locating properly the serving area interface ("SAI") and/or digital loop carrier ("DLC") equipment in each serving area; and

5) designing an efficient system of distribution plant (backbone, branch, and road cable) to connect customer locations to the SAI/DLC equipment.

The remainder of this Section critiques the BCPM in each of these areas.

In Direct Contrast to the HAI Model, The BCPM Fails to Accurately Identify Customer Locations

Q. **HOW DOES THE BCPM DETERMINE THE PHYSICAL LOCATION OF CUSTOMERS FOR THE LOCAL LOOP?**

A. As noted earlier, the BCPM makes no attempt to determine the physical location of customers in designing its network. Instead, it relies upon a series of allocations in order to distribute all customers in a Census Block ("CB") to a grid network that is arbitrarily overlaid on each CB. The BCPM allocation rules assume that customers should be assigned to each grid in proportion to the amount of a CB's road mileage (for selected road types) that traverses each grid (the BCPM assumes that road types such as US highways, State highways, neighborhood roads, and city streets are equally likely to serve basic local exchange customers).

The BCPM customer allocation assumptions are flawed for several reasons. First, there is no reason to assume -- and no evidence to support an assumption -- that each of the road types selected by the BCPM developers for inclusion in the calculations has an equal probability of serving basic local exchange customers. Logic suggests that neighborhood streets are more likely to serve telephone customers than are roads through national parks.

Second, except in neighborhood streets, it is unlikely that customers would be evenly-distributed along the selected roadways. Our own day-to-day observations tell us that customers tend to be clustered, rather than evenly-dispersed along roadways. As is the case in any network industry, it is more efficient (*i.e.*, less costly) to provide basic local exchange service to customers that are grouped together than to serve customers that are evenly dispersed. Thus, the BCPM base-line assumption that all customers can be allocated to grids based upon road mileage is unreasonable.

Q. ASIDE FROM "OUR OWN DAY-TO-DAY OBSERVATIONS," DO YOU HAVE ANY EVIDENCE TO SUPPORT YOUR SUGGESTION THAT THE BCPM ROAD SURROGATE APPROACH OVERSTATES COSTS BY ARTIFICIALLY DISPERSING CUSTOMERS?

A. Yes. It is possible to use a minimum spanning tree ("MST") to estimate the amount of dispersion between customer locations. Essentially, the MST is the shortest distance required to connect a set of points, assuming no additional "intersection" points are added, which may shorten this distance. In other words, the shortest distance to connect a group of points when the connecting link must go directly from one point to another, and not intersect itself at some additional location. Thus, the MST is also a measure of dispersion or how far apart the points are from each other.

AT&T and MCI have provided us with MST results for two different HAI Model datasets. The first dataset uses the actual geocoded locations from the HAI Model, but uses the BCPM road surrogate approach for non-geocoded locations (rather than that CB boundary assumption normally employed in the HAI Model). The second dataset applies the BCPM road surrogate approach to *all* customer locations. This was done to identify the extent to which the BCPM road surrogate assumption overstates the true customer dispersion. In the lowest density zone (0 - 5 lines per square mile), the first dataset generated a MST distance of 1,188 miles, while using the second dataset (employing road surrogates for all customer locations) generated a MST distance of 1,234 miles -- an increase of about 4%. For the second lowest density zone (5 - 100 lines per square mile), the first dataset resulted in a MST distance of 9,310 miles, while using road surrogates for all customer locations results in a MST distance of 10,102 miles -- an increase of approximately 9%. For the lowest two density zones combined, using the BCPM assumption that all customers are located along roads yields a MST result that is about 8% greater than if actual geocoded data were incorporated.

The above percentages are a conservative estimate of the amount of overstatement caused by the BCPM customer location assumptions, because they reflect the effect of using road surrogates for only those locations that originally were physically geocoded in the HAI Model. In other words, changing the 34% of customer locations that were successfully geocoded in the lowest density zone of the HAI Model to road surrogate locations increases the MST distance by over 4%. We anticipate that use of the road surrogate approach for the other 66% (non-geocoded locations) also exaggerates customer dispersion. Similarly, if changing the 62% of geocoded locations in the second lowest density zones yields a MST increase of 9% then the road surrogate approach for the other 38% is also likely to overstate true dispersion. Thus, overall dispersion in the lowest two density zones is likely overstated by substantially more than 8%.

Based on this analysis, we conclude that the assumption implicit in the BCPM customer location process -- *i.e.* that it yields a useful estimate of customer locations within a wire center -- is incorrect, because the BCPM customer location process does *not* yield a reliable estimate of the dispersion of customers within a wire center.

Q. HOW DOES THE HAI MODEL LOCATE CUSTOMERS?

A. The HAI Model uses geocoding to assign precisely a large proportion of basic local exchange customers to their actual physical location. In Florida, 70% of the residence customer addresses have been geocoded with a latitude and longitude to within 50 feet of their actual locations (Exhibit: _____ (DJW/BFP-6) shows the residential geocoding success rate by density zone for each state and the national averages). The remaining customer locations are assumed by the HAI Model to be evenly-distributed along the perimeter of the CB in which the customers are located. Because it identifies actual physical locations for the majority of the Florida telephone subscribers, the HAI Model is clearly superior to the BCPM, which identifies no actual physical locations for any of these customers.

Q. **IS THE HAI MODEL APPROACH OF PLACING NON-GEOCODED CUSTOMERS ON THE PERIMETER OF CENSUS BLOCKS REASONABLE?**

A. Yes, it is reasonable -- evidence suggests that the resulting customer dispersion (for *non-geocoded* customers only) is similar to the dispersion that occurs if the BCPM road surrogate approach is used for non-geocoded locations in the lowest two density zones of Florida.

The MST distance for the lowest two density zones using the default HAI Model methodology (*i.e.*, geocoding locations and using CB surrogates only for the remaining, non-geocoded customers) is 10,737 miles. The MST distance for the same two density zones using the road surrogate modified dataset (*i.e.*, geocoded locations and using road surrogates for the remaining customers) is 10,498 miles. Based on this analysis, we conclude that there is no substantial difference in dispersion using CB surrogates or road surrogates in the lowest density zones in Florida, although the HAI Model CB surrogates are slightly more conservative than using road surrogates for estimating customer locations.

Q. DO YOU CONCLUDE THAT BOTH THE CB SURROGATE METHODOLOGY USED BY THE HAI MODEL AND THE ROAD SURROGATE METHODOLOGY USED BY THE BCPM EXAGGERATE ACTUAL DISPERSION?

A. Yes. The evidence presented above demonstrates that road surrogates overstate dispersion. In addition, AT&T and MCI filed an *ex parte* presentation to the FCC on June 10, 1998, attached as Exhibit: _____ (DJW/BFP-7), that addressed these surrogate methodologies for several study areas around the country, including Florida (in summary, this presentation shows that for Florida and Kansas study areas, using road surrogates yields distribution route distances that are 5% shorter than using CB surrogates for all density zones and 5.5% shorter in the lowest two density zones). Because the CB surrogates and the road surrogates appear to result in similar dispersion (based on MST analyses), we believe that CB surrogates also overstate true dispersion. In fact, this is what one would expect from a methodology that places customers as far apart as possible from each other within a network. The most critical thing to be remembered, however, is that the HAI model applies a surrogate methodology *only* to non-geocoded locations, while the BCPM applies a surrogate methodology to *all* locations. Thus, the potential for cost overstatement is much more severe with the BCPM.

Q. IS THE RURAL UTILITIES SERVICE SUPPORTIVE OF THE HAI MODEL APPROACH TO LOCATING CUSTOMERS?

A. It appears so. In its September 2, 1997 filing before the FCC, the Rural Utilities Service ("RUS") appears to endorse the approach that the HAI Model takes in modeling outside plant, *i.e.*, geocoding to the extent possible and then approximating the location of *only* the non-geocoded customers by using a surrogate approach at the CB level of detail. The BCPM, on the other hand, makes no attempt to use actual customer locations. Furthermore, as geocoding of customer locations in less-populated areas becomes more complete, the HAI Model will become more accurate -- an advantage cited by the RUS. The BCPM, on the other hand, will always be forced to rely on its roadway-based allocation approach, no matter how complete geocoding becomes.

The Assumptions Underlying the Process Used by the BCPM to Estimate Customer Locations are Counter-Intuitive and Have Not Been Validated

Q. **HAVE THE BCPM SPONSORS PROVIDED ANY VALIDATION OF THEIR CUSTOMER ALLOCATION ASSUMPTIONS?**

A. No, the BCPM developers have not attempted to explain, justify, or support their assumptions that customers tend to be (1) evenly distributed to each mile of all included road types, and (2) evenly distributed along all included roads. While the HAI Model sponsors have made available granular statistical information about the success of their customer geocoding in over 468 different state/density zone geographical units across the U.S., we are unaware that BCPM has made public any analogous information about the success of its customer location process.

It certainly would be useful for BCPM to state (1) the number and percent of actual customer locations that are located along the road types that are mapped in the BCPM model; (2) a statistical measure indicating how evenly these actual customer locations are dispersed along each of these road types; (3) the number and percent of actual customer locations that are located within the "road-reduced square," i.e., the quadrants in which the BCPM models its distribution plant; and (4) the percent of all road mileage mapped in the BCPM model that falls within the "road-reduced square" in which the BCPM models its distribution plant. The provision of these statistics on a national basis, by state, and by density zone within each state would add immensely to an informed debate over the relative merits of the BCPM's approach.

Q. TO WHAT SORT OF VALIDATION HAS THE HAI MODEL CUSTOMER LOCATION METHODOLOGY BEEN SUBJECTED?

A. The geocoding methodology utilized by the HAI Model is the result of a process that has been validated in the marketplace. The HAI Model uses Metromail's direct mail address lists for residence locations and Dun and Bradstreet's ("D&B") database for business locations. Both of these databases are commercial products that have been used in the marketplace. These databases are obtained by an independent vendor, PNR and Associates, through agreements with Metromail and D&B. PNR uses these two commercially available databases, along with a commercially available geocoding software program known as Centrus® Desktop (distributed by QMS Software) that converts addresses into latitude and longitude coordinates. In short, all of the data used by PNR to geocode is commercially available and has been tested, and validated in the marketplace.

The HAI Model uses Metromail and D&B data to determine actual customer geocodes because the HAI Model developers believe these to be the best current publicly available data. To the extent that BellSouth, GTE, Sprint, or other ILECs, maintain lists of addresses of the locations to which they provide telephone service -- or the actual geocodes of these locations -- one could substitute these customer geocodes into the HAI Model as alternatives to the sources it now uses. Indeed, ILECs seeking to be eligible to receive universal service support should be required to make available any data that they might have in this regard to improve the accuracy of the cost modeling process. Similarly, to the extent that the ILECs have data on the number of lines by type that are demanded by customers in each specific CB and/or wire center, ILECs that seek to be eligible to receive universal service support should be required to make any such data available to the parties to improve the accuracy of the cost modeling process.

The BCPM Results Presented by the ILECs in this Proceeding Underscore the Importance of the Process Used by the HAI Model to Accurately Determine Actual Customer Locations

Q. IN OTHER PROCEEDINGS, WITNESSES FROM INDETEC -- THE BCPM DEVELOPERS -- SEEM TO SUGGEST THAT ALTHOUGH GEOCODING MAY BE SUPERIOR CONCEPTUALLY, THIS IS OF LITTLE RELEVANCE IN USF PROCEEDINGS BECAUSE THE GEOCODING SUCCESS RATES IN RURAL AREAS ARE SO LOW. HOW DO YOU RESPOND?

A. There are several respons s to this issue. First, current geocode success rates are not strictly a function of urban versus rural. Instead, they tend to be higher in medium to high density areas than they are in extremely low density areas. Thus, even in rural areas, a relatively high proportion of customers that live in towns can be successfully geocoded. This means that the HAI Model does a better job of locating clusters of customers as they occur naturally, even in rural areas.

Second, of course, is that the HAI Model's ability to locate one-third of the customers in the lowest density area of Florida is clearly superior to the BCPM, which locates no customers; and as we noted earlier, as geocoding success rates improve in lower-density areas, overall customer location in the HAI Model also will continue to improve.

As the following table demonstrates, the HAI Model geocoding success rate is relatively high in all density zones in Florida.

Geocode Success Rates
In Florida (Residence Lines)

Density Zone	Geocode Pct.
0 – 5	34%
5 – 100	62%
100 – 200	80%
200 – 650	85%
650 – 850	84%
850 – 2550	78%
2550 – 5000	64%
5000 – 10,000	46%
10,000 +	50%

See Exhibit: ____ (DJW/BFP-6)

In its Order, the Louisiana Public Service Commission adopted the Staff's Final Recommendation which reached a conclusion that is consistent with our analysis:

> It is interesting that while according to Dr. Duffy-Deno's definition of rural, i.e., fewer than 20 housing units per square mile, 104 of BellSouth's Louisiana wire centers would be classified as rural, BellSouth's calculation of universal service support shows support for every wire center it operates in Louisiana. (Tr. 135, Martin Late-Filed Exhibit 1, BellSouth Telecommunications, Inc. Response to FCC Data Request DA 97-1433 CC Docket 96-45, August 15, 1997, Questions 9 and 19.) Thus, to the extent that the Hatfield model more accurately locates customers in other high cost areas, which according to BellSouth's USF calculations all wire centers are, the Hatfield model would produce a better cost estimate of

> serving these areas than the BCPM that estimates the location of customers in nonrural areas.
>
> Based upon the evidence presented in the proceeding, Staff believes that the Hatfield approach to locating nonrural customers is superior to the BCPM's method that makes basic, but reasonable, assumptions regarding customer location. Nevertheless, the BCPM does not locate customers. The Hatfield model's preprocessing process uses Metromail data which contains addresses for 67.5% to 76% of the housing units in Louisiana as of January 14, 1998. (BST Exhibit 4, Duffy-Deno, Rebuttal, p. 6, AT&T Exhibit 1, Klick Rebuttal, p. 28, and BellSouth Comments, p. 3.) Clearly, a model that actually locates customers is more accurate than one that estimates customer locations. Louisiana Public Service Commission Staff's Final Recommendation at 7-8, March 30, 1998, footnotes deleted.

The HAI Model Accurately Identifies Actual Groupings of Customers, While the BCPM, By Using an Artificial "Grid" Overlay, Completely Fails to Do So

Q. HOW DOES THE BCPM DETERMINE THE INDIVIDUAL GEOGRAPHIC AREAS THAT THE NETWORK WILL SERVE?

A. The BCPM relies upon an artificial "grid" approach in its design of serving areas. These grids are established based on degrees of latitude and longitude and, therefore, bear no relationship to the way in which customer population in Florida actually is clustered. As a result, the BCPM's use of these grids creates arbitrary network design constraints, particularly in sparsely-populated areas (again, Exhibit: _____ (DJW/BFP-1) shows how the BCPM's arbitrary process could split up a natural cluster of customers, substantially overstating the amount of DLC equipment and subfeeder). This "cookie cutter" approach to serving area design - -which artificially prohibits a serving area from straddling the boundary between two ultimate grids -- cannot take actual population clustering properly into account. This fact was recognized at page 13 of the Louisiana Staff's March 30, 1998 Final recommendation (which subsequently was adopted by the Louisiana PSC Commission): "staff agrees with AT&T that the BCPM artificially constrains the size of the Carrier Serving Areas."

Similarly, the Minnesota Commission found that

> A more significant problem is that the grid system that the BCPM uses in designing distribution areas has the effect of breaking up clusters of customers that could be served as a group. This is because that grid system is driven by lines of

> longitude and latitude rather than by principles of efficient design. Thus, BCPM would serve a hypothetical group of four adjacent households very differently depending on where those households happen to be situated in relation to the arbitrary gridlines that BCPM imposes. If entirely included in one grid, all households in the group might be assigned to a single Carrier Serving Area served by a single DLC terminal and a single placement of subfeeder cable. If, however, the same group of households "straddles" the BCPM gridlines, that group would be assigned to as many as four different CSAs, requiring four DLC terminals and four subfeeder placements. Such an anomalous result does not reflect the efficient, forward-looking design required by the FCC. (Report of the Administrative Law Judge on Selection of Cost Study, April 2, 1998, page 16, para 69)

In contrast, the HAI Model imposes no artificial geographic constraint on its serving area design within wire centers. After customers are located, the Model identifies groups of customers that can be served together logically (consistent with technological constraints) and builds efficient serving areas and outside plant to serve them. By using this approach, the HAI Model incorporates engineering judgment and economic decision-making in a manner that is fully-consistent with widely-accepted outside plant engineering standards, while the BCPM permits its artificial grid structure to "trump" these considerations.

The superiority of the HAI Model approach was recognized by the Kentucky Commission which stated that "the Commission determined that the nature of the design of the HAI Model aligns itself with current technology which is least-cost, most efficient and reasonable. The HAI Model engineers the complete network, including the loop."[4]

Q. DOES THE BCPM'S ARBITRARY GRID APPROACH TO SERVING AREA DESIGN LEAD TO INEFFICIENT PLACEMENT OF DLC EQUIPMENT?

A. Yes. The BCPM grid approach to serving area design is arbitrary and does not consider the underlying customer location data. For example, the BCPM models 223 digital loop carriers in the state of Florida that would serve only a single household. In addition, because the BCPM bases its locations on unoccupied housing units -- not occupied households -- the BCPM models 145 additional digital loop carriers in Florida that serve *no* households. In total, the BCPM builds 368 digital loop carrier systems that serve one or fewer customers. According to Mr. Wells, outside plant engineers would not install digital loop carriers to a single occupied household. Instead, they would use more cost-effective technology to reach these customers -- technology such as the T1 technology incorporated into the HAI Model.

Q. DOES THE BCPM UNDERTAKE ADDITIONAL MODIFICATIONS TO CUSTOMER LOCATIONS BEFORE IT BEGINS TO PERFORM ITS ENGINEERING DESIGN?

A. Yes. Once customers have been allocated to various microgrids in a CB, based upon each grid's proportion of the CB's selected road mileage, the BCPM then (1) aggregates microgrids into ultimate grids which are constrained by macrogrids, (2) divides the ultimate grid (unless it is a microgrid) into as many as four quadrants that are centered at the road centroid of the ultimate grid, (3) calculates the total area comprised within a 500-foot buffer along each side of the specified road types in each quadrant, (4) creates a square distribution area in the quadrant, with an area identical to that created by the 500-foot buffer, (5) centers the square on the "road centroid" of the quadrant, and (6) calculates the amount of required distribution plant by assuming that the quadrant's customers are evenly-distributed throughout the quadrant in square lots. Finally, the amount of connecting, backbone, and branch cable actually constructed by the BCPM process is further constrained to be no longer than the total road mileage (for selected road types) in the quadrant.

These data manipulations can effectively "move" customers far from their originally assumed locations and create additional discrepancies between the BCPM's modeled customer locations and their actual physical locations.

Q. DO YOU HAVE OTHER CONCERNS ABOUT USE OF THE GRID STRUCTURE IN THE BCPM?

A. Yes. The BCPM developers state that the BCPM macrogrid is approximately 12,000 by 14,000 feet (1/25th degree of latitude by 1/25the degree of longitude), which represents an area of approximately 6.0 square miles. A serious problem with the BCPM grid definition is that because they are defined in terms of degrees of latitude and longitude, the grids are different sizes in different parts of the country due to the curvature of the earth. The distance represented by 1/25th of a degree of latitude is 1.88 miles in Washington, compared to 2.44 miles in southern Texas, a 30 percent discrepancy. More relevant, the maximum size of the BCPM serving areas varies by more than 6% in the state of Florida alone. By defining grids in terms of degrees of latitude, the BCPM creates carrier serving areas that are substantially larger in the south than they are in the north. This is particularly troubling because MapInfo has the option of specifying a grid overlay in feet rather than in degrees. While this would not make the underlying assumptions about "grid" design correct, it would at least permit the BCPM to be consistently applied around the country (Exhibit: _____ (DJW/BFP-8) shows this variance in grid size).

Our understanding is that a serving area can be as large as 18,000 by 18,000 feet without violating the engineering requirement that every customer in the carrier serving area be within 18,000 feet of the DLC. Of course, this would require that the DLC be placed at the geographic center of the serving area, rather than at the "road centroid" of the serving area (as currently is done in the BCPM). Enlarging the serving area to these dimensions would result in a serving area that is approximately 11.6 square miles -- 90 percent larger than the size of the average serving area utilized by the BCPM. Thus, modification of the BCPM grid structure from 1/25th of a degree of latitude and longitude to a grid structure set at 18,000 by 18,000 feet would permit a single carrier serving area (and, therefore, a single DLC) to serve more than twice as much area and, on average, twice as many customer locations in Florida.

Q. WHILE EXPANDING THE SIZE OF THE SERVING AREA WOULD THEORETICALLY ALLOW DLC EQUIPMENT TO SERVE MORE CUSTOMERS, IS THERE A CONSTRAINT ON

THE TOTAL NUMBER OF LINES THAT CAN BE SERVED BY A SINGLE PIECE OF DLC EQUIPMENT?

A. There is a constraint on the number of lines that a single piece of DLC equipment can support, and that limitation is the subject of dispute between the parties. In rural areas that are subject to universal service support, however, that constraint does not affect our assertion that the BCPM's serving areas are too small -- in fact, it helps to illustrate our point.

The BCPM developers assume that a single piece of DLC equipment can handle as many as 1,000 customer locations, based on an assertion that DLC equipment can handle a maximum of 1,344 lines. In our BCPM run for the state of Florida, however, the average serving area contains 493 lines, only 50% percent of the figure that the BCPM developers assert is the number of lines that can be served by a single piece of DLC equipment. Furthermore, the BCPM results for Florida show 11,202 ultimate grids that serve fewer than 400 lines, or 48%. This is significant, because a figure of 400 customers supposedly is used, in the BCPM preprocessing, as a minimum threshold for microgrid aggregation. Limiting the DLC equipment to a maximum of 1,000 lines also imposes unrealistic restrictions on the engineering design and many efficiencies which we understand can be realized by utilizing a 2,016 line DLC (although the BCPM apparently was designed with the option to use a 2,016 line DLC, this option has been disregarded in the preprocessing stages of the ultimate grid development).

The combination of these flawed design criteria within the BCPM preprocessing creates serving areas that are too small and, therefore, that serve an artificially small number of customers. The number of lines in these serving areas could easily be doubled, thereby reducing the number of serving areas. This would result in lower investment in DLC electronics, feeder distribution interface ("FDI") equipment, and subfeeder cable. The HAI Model run for Florida has only 11,280 serving areas -- fewer than one-half the number of ultimate grids in the BCPM (23,156 ultimate grids) -- without violating any of the outside plant constraints required to provide basic local service. As a result, the BCPM places twice as many DLC units than does the HAI Model, significantly overstating costs to serve Florida customers.

The BCPM is Based on an Inefficient Design for Feeder and Subfeeder Facilities, Which Leads Directly to a Significant Overstatement of Costs

Q. DOES THE BCPM DESIGN ITS FEEDER PLANT IN AN EFFICIENT MANNER?

A. No. One obvious reason is that by overstating the number of serving areas (or grids), as discussed above, the BCPM creates an artificial need for subfeeder to run from the main feeder routes to this overstated number of serving areas. This overstatement of required subfeeder plant is not so obvious if one looks solely at the average feeder distance required to reach each customer. However, if one looks at the total amount of route mileage -- which affects the need for structure investment -- it becomes clear that the feeder route miles estimated by the BCPM are overstated.

Q. ARE THERE OTHER PROBLEMS WITH THE BCPM APPROACH THAT OVERSTATE THE AMOUNT OF FEEDER BUILT BY THE BCPM MODEL?

A. Yes. In addition to the extra subfeeder required to reach the inflated number of serving areas, overstatements are caused by two interrelated changes that have been incorporated into the BCPM feeder/subfeeder design, *i.e.*, (1) a decision to "split" main feeder when the population in the center of a particular north-south-east-west feeder quadrant is below a hard-coded threshold, and (2) a decision to "point" main feeder -- whether or not it is "split" according to the criteria in step 1 -- toward population concentrations once main feeder distance from the wire center exceeds 10,000 feet.

Q. WHY IS IT NOT MOST EFFICIENT TO DIRECT MAIN FEEDER TOWARD CONCENTRATIONS OF POPULATION?

A. The cost of feeder and subfeeder is driven by two principal factors, *i.e.*, the amount of cable and wire (for metallic cable, this is measured in pair feet) and the amount of structure that must be installed to support the cable and wire. For copper cable, it is clear that directing main feeder toward population clusters should reduce total pair-feet of cable (however, because the main feeder split and the 'pointing' of main feeder both occur only beyond 10,000 feet from the central office, almost all of the affected cable is fiber, not copper -- as a result, very little cost savings for material is generated by pointing main feeder). For structure, however, this approach can require *more* investment than rectilinear routing.

That these can be more than mere hypothetical concerns is obvious from even a cursory review of the limited number of the BCPM maps that have been produced by the model's developers. These maps are rife with examples in which (1) the BCPM runs main feeder on a diagonal to cross a series of right-angle subfeeders, when a north-south/east-west main feeder would intersect the same subfeeder routes while traversing a shorter distance, and (2) the BCPM splits main feeder that requires numerous extremely long subfeeder runs in order to reach each of the grids. In the Minnesota USF proceeding, Mr. Morrisette -- an economist in the Minnesota Residential and Small Business Utilities Division of the Office of the Attorney General -- testified that "feeder cost in the BCPM as a percentage of the total loop cost is significantly higher than in the HM or U S WEST's RLCAP." (OAG Ex. 110 (Morrisette 1/23/98) at 8). This was part of the ALJ's rationale for concluding that "the BCPM path design methodology again tends to increase costs."[9]

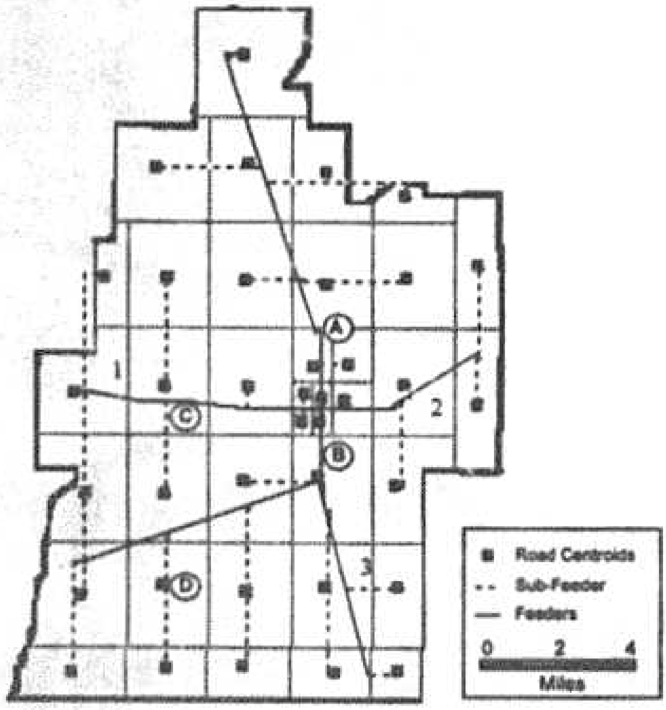
These anomalies in the BCPM's feeder design arise from what we believe is a fundamental flaw in the BCPM's feeder pointing logic. In the BCPM, structure must be built to each occupied grid, whether that grid contains a single customer or thousands of customers. Unlike investment in copper cable, feeder structure investment is not (with minor exceptions) significantly affected by the number of customers in a grid or the distribution of customers between grids (unless, of course, some grids are entirely empty). As a result, attempting to minimize structure costs using a process that takes into account the assumed customer population within each grid effectively mis-specifies the optimization analysis. The result is diagonal main feeders that would require more structure expense than would a vertical or horizontal main feeder serving the same bisecting subfeeder network.

Q. APPARENTLY IN RESPONSE TO THIS CRITICISM, THE BCPM NOW SOMETIMES USES RECTILINEAR ROUTING FOR ITS FEEDER CONFIGURATION. DOES THIS SOLVE THE PROBLEM?

A. No. The BCPM still does not employ an efficient design. It simply compares two potentially inefficient designs, on a wire center basis, and chooses between them. In addition, even in situations in which the main feeder might be split efficiently, the BCPM often employs extremely long subfeeder runs in order to reach quadrants inside the "open jaw" created by splitting the feeder. This feeder plant design -- sometimes referred to as the "bush" design (to distinguish it from the tree and branch design created by rectilinear routing) -- has been found by Bellcore to be generally less-efficient than the rectilinear routing of feeder. (See Exhibit: _____ (DJW/BFP-9)).

Although the BCPM developers claim that the current version of the model selects the most efficient feeder/subfeeder routing, Figure 6.1 in their own documentation suggests otherwise. Below, we have reproduced Figure 6.1 from page 36 of the BCPM 3.0 documentation (it is our understanding that the feeder design has not changed between the BCPM 3.0 and the BCPM 3.1, and the figure of the feeder plant for Red Oak, Iowa has been removed from the BCPM 3.1 documentation -- even though all of the other illustrations in the documentation still use Red Oak, Iowa), and superimposed three numbers indicating inefficiencies in the feeder/subfeeder routing that we wish to discuss.

Figure 6.1
Feeder Plant - Red Oak, Iowa



At location 1, the BCPM constructs westbound main feeder on a slight angle, even though main feeder moving directly west would be shorter while still crossing all of the vertical subfeeders. The same thing occurs with the eastbound main feeder at location 2. At location 3, the BCPM constructs a long southbound subfeeder off of the eastern leg of the main feeder, even though the road centroids of the two grids it serves could be reached much more efficiently by shorter horizontal subfeeder segments.

In short, the problem is that the BCPM's feeder pointing algorithms should be (1) modified to eliminate their sensitivity to customer concentration and to consider, instead, the concentration of carrier serving areas and the distance of serving areas that must be reached by the feeder, (2) modified to eliminate the "bush" feeder design when a decision is made to split main feeder, and (3) modified to determine the most efficient design on a feeder-by-feeder basis, rather than a wire center basis.

In contrast, the HAI Model appropriately (1) lets the user select whether or not to steer feeder, (2) seeks to optimize the steering by taking the cluster's distance from the central office into account, and (3) allows the user to specify an air-to-route ratio.

Because it Lacks the Necessary Customer Location Information, the BCPM Fails to Design the Necessary Distribution Facilities

Q. DOES THE BCPM APPROPRIATELY DESIGN ITS DISTRIBUTION PLANT?

A. No, the BCPM does not design its distribution plant to serve customers where they actually are located. As previously discussed, the BCPM fails to serve all customer locations because some of those locations are dropped from the preprocessing. This occurs because the BCPM does not actually locate customers, but merely approximates their location through a series of unsupported assumptions.

After allocating customers on the basis of relative road mileage for selected road types, the BCPM determines the serving areas (ultimate grids) through the "cookie cutter" approach described earlier. Before designing distribution plant, however, the BCPM further subdivides ultimate grids into one to four quadrants (depending on where the roads are located), with the area of each quadrant set equal to the area created by a 500-foot border on either side of the selected roads in that quadrant (normally, these quadrants have a combined area substantially smaller than the ultimate grid, particularly in rural areas; as a result, they are likely to be geographically located far away from actual customer locations). The BCPM then builds backbone and branch cables *only within* each road-reduced quadrant assuming that all customer locations are evenly-distributed throughout the quadrant (it is important to note that the BCPM assumes that all customers -- including outlier customers that are actually located sequentially along rural roads outside of towns -- are relocated into quadrants in which they are served by backbone and branch cable, as though these customers were located in urban or suburban "tracts"; in contrast, the HAI Model identifies these outlier customers, and recognizes that road cable must be installed by the model to provide service to these customers -- just as it is in the real world). Exhibit: _____ (DJW/BFP-10), which is a graphical depiction of this process, demonstrates that the BCPM approach results in distribution areas that are too small and that can be far removed from the customer locations that are initially assumed by the BCPM.

In contrast, the HAI Model constructs its distribution plant in geographic areas that resemble the actual physical locations of customers. To facilitate modeling, the HAI Model converts each serving area into a rectangle. In doing so, however, it preserves the basic area, shape and location of the physical cluster of customers, thereby preserving the appropriate relationship between customers and between customers and the wire center. Exhibit: _____ (DJW/BFP-10) also displays a graphical depiction of the HAI Model approach to establishing distribution areas, and contrasts the HAI Model results with those generated by the BCPM. As is obvious from Exhibit: _____ (DJW/BFP-10), the HAI Model approach results in distribution areas that match current customer demand much more closely than does the BCPM approach.

Q. IN YOUR OPINION, ARE THE HAI MODEL CLUSTERS A MORE REASONABLE DEPICTION OF WHERE CUSTOMERS ARE ACTUALLY LOCATED THAN THE BCPM ROAD-REDUCED DISTRIBUTION QUADRANTS?

A. It is clear to us that the HAI Model clusters more closely depict locations where customers are than do the BCPM square, road-reduced distribution quadrants. While it is true that the HAI Model could be modified to ensure that the underlying cluster characteristics are not limited to a North-South, East-West orientation, AT&T's and MCI's FCC filing (attached as Exhibit: _____ (DJW/BFP-7)) shows that (1) for any given study area, the maximum change in basic local service cost that would result from eliminating the North-South, East-West orientation requirement would be -0.84%, (2) the maximum upwards adjustment for the 17 study areas would be 0.57%, (3) the average effect for all 17 study areas would be a *reduction* in basic local service cost of 0.07%. As shown in Chart 1, this change has minimal effect in Florida (less than 0.15% for any study area) with a *reduction* for all Florida companies in the lowest density zone.

In other proceedings, the BCPM proponents have claimed that the HAI Model convention of employing an aspect ratio to estimate cluster shape is appropriate only for those clusters whose longest axis is nearly North-South or East-West.[10] While we agree that limiting cluster orientation in the HAI Model to North-South, East-West is not ideal, we disagree with this assessment that use of an aspect ratio is not reasonable -- it is far superior to the distribution areas created by the BCPM, which always are square and may be geographically located far from the underlying customer locations, particularly in rural areas most likely to require USF support.

In this proceeding, one must keep in mind that the Commission must choose between two competing cost models. There are a number of reasons why we conclude that the HAI Model approach to distribution area design is superior: (1) its rectangular clusters are based on actual customer locations, while the BCPM's road-reduced distribution areas are not; (2) its rectangular cluster area is based on the actual area of the cluster, while the BCPM limits the size of its *square* distribution areas to an area equal to an arbitrary 1,000 feet times the road distance; and (3) its rectangular cluster is located over the underlying cluster, while the road-reduced distribution area is then centered on the road-centroid of the BCPM quadrant. As Exhibit: _____ (DJW/BFP-11) illustrates, it is entirely possible that the resulting BCPM road-reduced distribution area may not contain *any* of the original BCPM customer locations (this exhibit actually provides a visual overview of the process by which we calculated the BCPM minimum spanning tree; however, it is based on an actual BCPM distribution quadrant in Texas, and illustrates that the BCPM road-reduced distribution areas often do not resemble the underlying customer locations)

Q. IS IT CORRECT, AS THE BCPM PROPONENTS OFTEN CLAIM, THAT THE HAI MODEL DATABASE DOES NOT CONTAIN ANY OF THE SPECIFIC HOUSEHOLD AND BUSINESS LOCATIONS ORIGINALLY USED IN THE HAI MODEL PREPROCESSING TO FORM THE CLUSTERS?

A. Yes, that is correct. It is equally true, however, that the BCPM does not provide or use any information about where customers are located within its microgrids. Both models in this proceeding assume that once distribution areas are defined, customers are evenly distributed within these areas. This is necessary to ensure that the models can run in a reasonable amount of time using software that is widely available. In short, both models summarize data at the distribution area level as input to the models.

While modeling assumptions may result in some of the HAI Model locations falling outside of the rectangular clusters, and some of the BCPM locations falling outside of the BCPM road-reduced distribution areas, the HAI Model does a better job of establishing realistic distribution areas because it centers the distribution areas on customer locations and its distribution areas equal the area comprised of the actual customer locations.

Q. **DOES THE BCPM SOMETIMES BUILD MORE THAN 18,000 FEET OF ANALOG COPPER CABLE BETWEEN THE CUSTOMER AND THE DIGITAL LOOP CARRIER?**

A. Yes. The BCPM input data (a comma separated text, or "CSV," file that contains one record per ultimate grid) shows that the BCPM serves customers over 18,000 feet from the DLC -- meaning that under the BCPM assumptions, the customer must be served by more than 18,000 feet of copper cable. The BCPM data for Florida contains such customers. For example, the DELDFLMADSO wire center contains an ultimate grid with a feeder/distribution interface code of 2011178 (an ultimate grid within a wire center can best be identified by its "FDI Code," which is a BCPM code describing the feeder/distribution interface from which the ultimate grid is served). The lower left quadrant of this ultimate grid requires over 18,000 feet of copper distribution connecting cable, which can be verified in the BCPM input data (which shows that the horizontal and vertical connecting cable is 19,128 feet and serves six lines -- meaning that at least 19,128 feet of analog copper cable is required to connect the DLC location to the housing units in the road-reduced distribution area). In fact, the BCPM models copper analog loops in excess of 18,000 feet for Florida customers of BellSouth, Sprint and GTE. In contrast, the HAI Model has no copper analog loops over 18,000 feet, and a very small percentage of copper loops above 12,000 feet (less than 1%). Attached as Exhibit: _____ (DJW/BFP-12) is a graph illustrating the analog copper distribution loop lengths produced by the HAI Model.

Q. **HOW DOES THE BCPM MODEL ACTUALLY SERVE THE CUSTOMERS IN THE LOWER LEFT QUADRANT OF THE ULTIMATE GRID IDENTIFIED WITH A FDI CODE OF 2011178?**

A. Ultimately, the BCPM methodology moves the customers closer to the DLC, rather than serving the locations where the BCPM originally placed these customers. For example, the customers in Florida described above would require over 19,128 feet of copper analog connecting cable, but the BCPM actually serves these customers with only 506 feet of copper analog connecting cable. This 97 percent reduction in the amount of cable required is achieved as a result of the BCPM's approach of limiting the amount of cable in any quadrant to the number of road feet in the quadrant. In other words, the BCPM ends up constructing only 3 percent of the cable that the model previously calculated could be required to reach these customers. If one were to draw a diagram of this ultimate grid, one would observe that customers in this quadrant would not be connected to the rest of the network by the small amount of connecting cable actually built by the BCPM.

This example highlights a serious and significant problem with the BCPM -- this "capping" methodology prevents the BCPM from constructing enough plant to serve customers at the road-reduced quadrant locations where prior analytical steps in the model have placed them. In other words, the BCPM methodology does not place plant to serve these customers *either* (1) on the road to which they were originally allocated, or

(2) in the smaller road-reduced quadrants to which these customers are moved. In Florida (as shown in Exhibit: _____ (DJW/BFP-13)) the BCPM builds insufficient cable to serve the customers that are assigned to those road-reduced quadrants for about 55 percent of the road-reduced quadrants (or distribution areas). This occurs because the road mileage in these road-reduced quadrants is less than the amount of connecting, backbone and branch cable that the BCPM initially calculates is necessary to reach from the DLC location to the customers in these quadrants. This is yet another in a series of flawed BCPM assumptions that effectively "undo" the model=s initial customer assignment approach.

Q. **ARE THERE OTHER FEATURES OF THE BCPM'S DISTRIBUTION DESIGN THAT ARE PROBLEMATIC?**

A. Yes, the BCPM assumes that customer lots are square, rather than rectangular. This is unrealistic and leads to an overstatement of the costs for distribution plant and drops.

Q. **WHY IS ASSUMING A RECTANGULAR LOT MORE APPROPRIATE THAN ASSUMING A SQUARE LOT?**

A. Lot shapes generally are determined by property developers who are seeking to maximize the value of the land available for development.

Subdividing a parcel into rectangular lots, with the depth greater than the width -- as is assumed in the HAI Model -- reduces a developer's road, sidewalk, and driveway expenditures and increases the amount of salable acreage. Subdividing a parcel into square lots, as is implicit in the BCPM, would increase a developer's pavement costs, reduce the average homeowner's land area, and generate lots that would have undesirable shallow front and rear yards.

Just as square lots would require a developer to install more road feet and driveway feet per household, as shown in Exhibit: ____ (DJW/BFP-14) assuming square lots in the BCPM requires more outside plant to be installed to reach these households. Because the real estate developers should have the same incentives as the telecommunications providers, *i.e.*, to reduce infrastructure costs, the HAI Model's use of rectangular lots is the more logical modeling assumption than the BCPM's use of square lots which is not supported by any evidence and serves to overstate costs (the HAI Model does not assume rectangular lots for outlier clusters, but recognizes that these customers are located along roads).

Q. CAN YOU SUMMARIZE THE DEFICIENCIES IN THE BCPM'S OUTSIDE PLANT DESIGN?

A. Yes. The BCPM's approach to outside plant design consists of (1) disaggregating CB data by arbitrarily assigning business and residential lines to artificial "microgrids" based on road mileage (not telephone or network engineering criteria, or any other characteristics of the data that exist at the "microgrid" level of detail), and (2) reaggregating the data in variably-sized "ultimate grids" that cannot exceed the bounds of the "macrogrids" (again, not based on telephony or network engineering criteria). Unfortunately, not even this convoluted process apparently prevents small groups of "microgrids" from being isolated, thereby forcing the model to assign them to "those ultimate grids of equal or larger size, located closest to the road centroid."

The process does not stop there. The BCPM then segments each "ultimate grid" into one to four quadrants, which are converted into square distribution areas based on the non-empty quadrants established. After all these layers of disaggregation into "microgrids," reaggregation into "ultimate grids" (bound by the "macrogrid"), disaggregation into square distribution areas with customers evenly distributed throughout the distribution area, and moving the distribution area closer to the DLC by capping the distribution distance, the Model developers claim that this approach allows them to accurately locate customers and to design appropriately-sized serving areas. Finally, the BCPM developers assume that all customer lots are square. Obviously, there are serious deficiencies in this portion of the BCPM, even assuming that this above process does not drop any customers, which it apparently does.

Q. CAN YOU SUMMARIZE THE EFFECTS THAT THESE DESIGN DEFICIENCIES IN THE BCPM HAVE ON THE MODEL'S OUTSIDE PLANT COSTS?

A. Yes. The BCPM creates too many serving areas (ultimate grids) by virtue of (1) a grid process that is arbitrary, and not based on the BCPM assumed customer locations; (2) its use of grid sizes that are too small to take full advantage of the ability to serve customers at up to 18 kft using copper technology; and (3) its assumption that the SAI/DLC should be placed at the road centroid of the grid, rather than at its geographic center. This, in turn, requires too much SAI/DLC equipment and too much subfeeder plant to reach the SAI/DLC in each of these undersized serving areas.

Feeder/subfeeder distances also are overstated by the BCPM's criteria for pointing main feeder and its use of the inefficient "bush" design for configuring subfeeder.

On the other hand, the amount of distribution plant needed by the BCPM can either be overstated or understated. While the "road reduction" assumptions used to create the square area within each grid where distribution plant actually is constructed in the Model may understate costs in some areas, the square lot design substantially overstates distribution costs in other areas. The combined effect of these inaccuracies is the worst of all worlds – overstating required outside plant while still failing to reach a large number of basic local exchange customers in Florida. Clearly, the sum of these "wrongs do not make a right."

The following table shows how these general concerns manifest themselves in the BCPM run for Florida.

Table 1
Comparison of Outside Plant Statistics
For HAI Model and BCPM
For the State of Florida

	HAI Model	**BCPM**
1. Number of Digital Loop Carriers	10,785	18,897
2. Route Miles		
Outlier Road	183	N/A
Outlier Connectors	3,138	N/A
Branch Cable	86,981	70,635
Backbone Cable	11,794	13,182
Distribution Connecting Cable	N/A	14,374
Total Distribution	102,096	98,190
Feeder Connecting Cable	1,116	11,346
Subfeeder Cable Part 2	N/A	3,035
Subfeeder Cable	15,295	17,016
Main Feeder Cable	8,655	9,992
Total Feeder	25,066	41,390
Total Route Miles	**127,162**	**139,580**

As Table 1 indicates, the BCPM has substantially overstated the amount of DLC equipment required to efficiently reach Florida's consumers of local telecommunications service, and overstated the amount of feeder and subfeeder. However, the backbone and branch cable components of the distribution plant are significantly understated by the BCPM, demonstrating that the BCPM fails to build enough of this cable to reach all of the customers. Overall, the BCPM has overstated the total route miles of cable and structure required by approximately 10 percent (details supporting these figures are set forth in Exhibit: _____ (DJW/BFP-15) and Exhibit: _____ (DJW/BFP-16), which compare, by company, HAI Model and the BCPM results for the state of Florida for wire centers included in both models).

In addition, the feeder portion of the BCPM network is significantly greater than the HAI Model feeder route miles. As Exhibit: ____ (DJW/BFP-17) illustrates, per-foot structure costs associated with the feeder portion of the network are substantially more expensive than the structure associated with the distribution portion of the network, due largely to the different mix of structure (e.g. aerial, buried, and underground) between feeder and distribution. By using excessively small serving areas in the BCPM methodology, the BCPM developers have overstated investment both by placing excessive DLC equipment and by artificially shifting the mix of structure from distribution to the more expensive structure mix associated with feeder plant.

Q. **WHAT ARE THE IMPLICATIONS OF THESE COMPARISONS?**

A. The obvious implication is that even if comparable inputs were used in the two models, the BCPM would overstate the cost of universal service in Florida. In short, the Commission should not focus exclusively on inputs -- choosing the appropriate cost proxy model does matter, and will affect the costing results.

Q. **HAVE OTHER REGULATORY AGENCIES COMPARED THE CUSTOMER LOCATION AND ENGINEERING DESIGN ASPECTS OF THE HAI AND THE BCPM MODELS?**

A. Yes. The Louisiana Public Service Commission, the Kentucky Public Service Commission, and the Minnesota Public Utilities Commission all found the customer location and outside plant engineering assumptions in the HAI Model superior to those employed by the BCPM.

Q. **IN OTHER JURISDICTIONS, THE BCPM SPONSORS HAVE CONTENDED THAT APPLICATION OF A MINIMUM SPANNING TREE 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, this claim is misleading. The BCPM proponents are using the MST distance (which we described earlier) as a validity check on the HAI Model. However, their claims are exaggerated and based on partial information.

The 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 this claim 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. As noted earlier, this approach (placing surrogate locations on the CB boundaries) tends to disperse customers too widely and, therefore, overstates the amount of cable required (*see*, for example, 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). Thus, any MST distance calculated by the BCPM sponsors, based on these overly-dispersed surrogate locations, will likely *overstate* the minimum amount of cable that would be required to serve these customers where they actually are located.

In addition, the BCPM sponsors have conceded in other jurisdictions (*e.g.*, Minnesota and Texas) that the Steiner tree, not the MST, constitutes the minimum distance required to connect a series of points in a network --

that 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 have been undertaken to date by the BCPM sponsors is that they do not include the digital loop carrier ("DLC") and feeder/distribution interfaces 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 required MST distance. However, in order to minimize potential differences between the parties' presentations, the MST analyses that we provide with this testimony also *excludes* the DLC/FDI nodes from the calculations, consistent with the approach used by the BCPM proponents.

Q. **ARE THERE "BOTTOM LINE" WAYS OF DEMONSTRATING THAT THE PROBLEMS CITED BY THE BCPM SPONSORS ARE NOT SIGNIFICANT?**

A. Yes. One 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. In both models, these two components of the distribution network represent the cable that 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 in Florida, this means that it has constructed a more extensive network of plant to reach the individual customer locations than has the BCPM (because the MST analyses conducted by the BCPM proponents in other jurisdictions 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 the BCPM proponents, based on a MST approach that excludes connecting cable, it is entirely appropriate for us to focus only on the relative amounts of cable within distribution areas).

Included as Exhibit: _____ (DJW/BFP-16) are comparisons of route miles produced by the HAI Model and the BCPM for all HAI and BCPM common wire centers in Florida, by company. Statewide, the HAI Model produced approximately 18 percent *more* backbone and branch cable than did the BCPM. The HAI Model produced more backbone and branch cable than did the BCPM for 382 of the 470 wire centers studied (or 81%). 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 cable to "connect the dots" in distribution areas (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 also confirms that the HAI Model constructs sufficient cable. *See* Exhibit: _____ (DJW/BFP-16)).

Q. HOW ARE THE MST ANALYSES THAT YOU ARE PRESENTING ORGANIZED?

A. We have performed a MST analysis for a subset of BellSouth wire centers in Florida -- the wire centers for which we have been provided both the HAI Model MST distances and the BCPM microgrid data. The MST analyses described below are based on 124 BellSouth wire centers (these 124 wire centers represent all wire centers that matched up with BellSouth's initial data response, with the following exceptions: (1) we have excluded wire centers in which the BCPM has multiple switches (11-digit CLLI codes) in the same wire center (8-digit CLLI codes), and (2) we have excluded wire centers in which the BCPM has duplicate FDI Codes).

We have summarized the results presented in this testimony in two ways. First, we summarize the MST distances and modeled distances by wire center -- attached as Exhibit: ____ (DJW/BFP-18). Then, we summarize the same data by density zone -- attached as Exhibit: _____ (DJW/BFP-19). It is important to recognize that there are some differences in the way the HAI Model and the BCPM determine density zones.

For consistency, we have excluded, from both models, all distribution areas with fewer than 2 customers. We have used this threshold for the obvious reason that there should be *no* MST distance for distribution areas with only one customer. Again, we have been as consistent as possible in the way we performed the MST analyses on each of the models. In past studies, the BCPM proponents have used a subset of the HAI Model distribution areas -- those with at least 5 customer locations -- but have failed to exclude the BCPM distribution areas with fewer than 5 customers. If the BCPM proponents intend to focus only on distribution areas with more than 5 customers, they should use this threshold for analyses on both models, not just on the HAI Model analysis.

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

A. As we have discussed above, the BCPM does not actually locate customers. Instead, it allocates CB population data to arbitrarily-designated microgrids that are overlaid on each wire center, based on relative road distance. Unfortunately, this forces an analyst to make assumptions regarding the BCPM's customer location assumptions in order to conduct a MST analysis (which is designed, after all, to connect individual customer locations).

The problems caused by the BCPM customer location assumptions are particularly acute in low density areas because population is sparse and 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 are 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 *none* of these customers are physically located by the BCPM at any specific point within the microgrid. Thus, if a MST analysis on the BCPM 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 employed 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. This approach is conservative, because it tends to concentrate customers that the BCPM would otherwise disperse over a larger number of microgrids. For example, the BCPM process for calculating the amount of distribution plant that must be constructed is based on a 500-foot buffer on either side of all included road feet in all populated microgrids, even if a 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, including drop lengths, to our MST distances -- which implicitly assume smaller lot sizes -- is quite conservative, because it improves the chances that the BCPM will pass the MST test (the MST analyses that we have undertaken for the BCPM data focuses on microgrids, because these are the geographic entities to which the BCPM model allocates customers for basic local exchange service. BCPM 3.1 Model Methodology, Section 5.3.4, at 28-29).

Having made that decision, we then had to address where in the microgrid we would physically locate each of the allocated customers. We decided 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 in the microgrid, with a maximum area equal to the area of the microgrid, (2) customers are evenly distributed throughout the area served, (3) lots are square, and (4) housing units are located in the center of lots. Exhibit: _____ (DJW/BFP-11) provides a visual representation of this process.

Q. HOW DOES YOUR MST ANALYSIS COMPARE WITH THE MST ANALYSES PREVIOUSLY PERFORMED BY THE BCPM

PROPONENTS?

A. Prior MST analyses on the HAI Model -- and criticisms made of the HAI Model based on these analyses -- were performed at the distribution area level. In other words, comparing the MST distance for customer locations *within* a given distribution area to the plant estimated by the HAI Model *within* a given distribution area. For reasons we have discussed previously, and will restate below, this is not an appropriate internal consistency check on the HAI Model or the BCPM. However, it is important to recognize that the BCPM proponents have not performed the MST test for the HAI Model at the serving area level or at the wire center level.

In addition, the MST analyses that have been conducted by the BCPM proponents for the BCPM have been inconsistent with the analyses they have undertaken for the HAI Model.

Q. **HOW HAVE THE MST ANALYSES ON THE BCPM CONDUCTED BY THE BCPM PROPONENTS DIFFERED FROM THEIR MST ANALYSES On THE HAI MODEL?**

A. In prior proceedings in Minnesota, Texas and Washington, the MST analyses conducted by the BCPM proponents for the BCPM have included all cable within a *serving area* (*i.e* cable *connecting* the distribution areas within the BCPM serving areas), while the MST analyses that the BCPM proponents have performed for the HAI Model have not included all such cable. To be consistent with the way in which BellSouth asked PNR to conduct the MST analysis of the HAI Model for this proceeding, the MST analysis of the BCPM should compare only the customer locations *within* a distribution area to the distance modeled by the BCPM *within* the same distribution area. We have conducted our MST studies of the two models consistently -- our expectation is that the BCPM proponents will not.

Q. WHAT ARE THE RESULTS OF YOUR ANALYSES?

A. The results of our MST analyses for the 124 Bell South wire centers are summarized by density zone in Exhibit: _____ (DJW/BFP-18) and are summarized by wire center in Exhibit: _____ (DJW/BFP-19). The analyses show that for the lowest density zone, the HAI Model estimated distance falls 24 percent short of the MST distance, while the BCPM estimated distance falls more than 38 percent short of the MST distance.

For the next lowest density zone, the HAI Model distance actually *exceeds* the MST distance by more than 30 percent while the BCPM exceeds the MST distance by only 13 percent. For the lowest two density zones combined -- the locations that are likely to require universal service support -- the HAI Model builds 13,514 miles of cable, and has a MST distance of only 10,736 miles (*i.e.*, the amount of cable built by the HAI Model is 25 percent greater than the MST distance). For the same two density zones, the BCPM builds 12,813 miles of cable and has a MST distance of 11,812 miles (resulting in a margin of only 8.5 percent over the MST distance). Across all density zones, the HAI Model, in total, builds almost 70 percent more route miles than its MST distance, while the BCPM builds only 5 percent more route miles than its MST distance (in the highest two density zones, the BCPM also builds 22 percent *less* cable than the MST distance).

Q. WHAT CONCLUSIONS CAN YOU DRAW FROM THE RESULTS YOU DESCRIBED ABOVE?

A. Two things appear obvious. First, if the HAI Model constructs too little distribution plant -- as the BCPM proponents have implied -- then the BCPM performs even more poorly. Second, the only density zone in which the HAI Model fails this theoretical MST test is in the lowest density zone -- where geocoding is the least successful. As we have explained previously, the surrogate location approach used in the HAI Model is conservative, and most likely overstates the true MST distance.

Importantly, the MST is not a validation (because it is not based on actual data) but a check on the assumptions within a model. If one recognizes that the MST distance is likely to be overstated in the lowest density zone -- due to the use of the HAI Model surrogate location approach -- then one may nevertheless conclude that the HAI Model builds sufficient plant in this density zone. When one also considers that the Steiner tree distance, not the MST distance, is the minimum distance necessary to connect a group of points, the relevance of the MST analyses proposed by the BCPM proponents is further diminished.

In summary, all of the evidence we have produced establishes that the HAI Model does a better job of building sufficient plant to reach Florida customers where they are actually located, without overbuilding the subfeeder network and the DLC system required to reach those customers.

VI. THE INPUTS TO THE BCPM USED BY THE INCUMBENT LOCAL EXCHANGE COMPANIES CAUSE A FURTHER OVERSTATEMENT OF THE COSTS THAT WOULD BE INCURRED BY AN EFFICIENT CARRIER

Q. HOW SHOULD THE INPUTS TO A COST PROXY MODEL BE CHOSEN?

A. The determination of the "total forward looking cost... of providing basic local telecommunications service" as required by F. S. 364.025 (4) (b) is a two step process. First, the cost model to be used must be constructed in such a way that generally accepted design and placement principles and the most recent commercially available technology and equipment are used to model the characteristics of a network that would be deployed by an efficient provider of local telecommunications services. The second step is a determination of the investment that will be required and the ongoing expenses that will be incurred to own and operate such a network. In order to complete this second step, assumptions must be made regarding the acquisition costs of material and labor, the level of operating expenses, the level of capital related costs, certain operational characteristics of the network (the level of utilization of investments, for example), and the opportunities that may exist to reduce total costs by sharing investments or expenses with other firms.

Previous sections of this testimony have focused on the first step of determining the characteristics of the network required to provide local telecommunications service in a given geographic area. This section focuses on a fundamental conceptual disagreement between the parties to this proceeding regarding the implementation of this second step in cost determination. This fundamental conceptual disagreement results in the selection of model inputs with significantly different values, which in turn has a direct and significant impact on the total cost of basic local telecommunications service calculated.

Q. DON'T ALL COMPANIES AGREE THAT THE COSTS TO BE CALCULATED ARE THOSE THAT WOULD BE INCURRED BY AN "EFFICIENT CARRIER"?

A. Ultimately, no. While witnesses for BellSouth and Sprint pay lip service to such a standard, they then go on in an attempt to justify model inputs that are based on the historic, embedded characteristics of their existing operations. In order to ascertain the reason for a significant portion of the difference in total cost of basic local telecommunications service calculated by the different companies, it is essential that the Commission look beyond the conceptual labels being placed on model inputs.

BellSouth witness Caldwell, for example, states that the cost model adopted by the Commission in this proceeding should be used "with the appropriate inputs to identify the costs that an efficient provider would incur to provide universal service in Florida," and goes on to argue that "only inputs reflective of forward looking economic costs should be used" when calculating these costs.[11] Sprint witness Dickerson also appears to agree with this position, and states that the inputs used in a forward looking economic cost study "should reflect the costs that an efficient provider of telecommunications service would most likely experience."[12] Sprint witness Staihr devotes a substantial portion of his testimony to a discussion of why forward looking, rather than historic, costs must be used, and concludes at page 9 that "it is important to get the cost right with regard to what costs a new provider would incur on a going-forward basis."

Q. **DO YOU AGREE WITH THE COST STANDARD ARTICULATED BY THE BELLSOUTH AND SPRINT WITNESSES?**

A. Yes. We believe that in order to determine the amount of universal service funding required, the calculation of the total cost of basic local telecommunications service should consider only those forward looking costs that an efficient provider would incur to serve the geographic area in question. Dr. Staihr's stated standard of including only the costs that an efficient new provider would incur on a going-forward basis seems to be a reasonable articulation of this principle.

Q. DO YOU AGREE WITH BELLSOUTH'S AND SPRINT'S APPLICATION OF THEIR STATED COST STANDARD WHEN SELECTING MODEL INPUTS?

A. Absolutely not. Again, this is an area where the Commission must look behind the high-level terminology in order to determine what these companies actually mean.

The first fundamental mistake that BellSouth and Sprint have made is to confuse costs which are specific to a given geographic service area with costs that are constrained by the historic characteristics of the incumbent LEC that serves the area. If properly calculated, costs that are specific to a given area reflect the unique set of characteristics of the area that in turn cause a unique set of costs. Any efficient carrier serving this area would be expected to have a similar experience: the costs would continue to be unique to the characteristics of the geographic area, but would not be expected to vary by carrier (by definition, an efficient carrier would be able to duplicate a comparable low cost "solution" for a given geographic "problem"). As a result, it is not necessary to go beyond a "geographic area specific" cost to a "company specific" cost, unless the objective is to include costs that are currently being experienced by the incumbent LEC that are in excess of those that would be experienced by an efficient carrier.

Q. DO THE BELLSOUTH AND SPRINT WITNESSES ARGUE FOR THE INCLUSION OF SUCH "COMPANY SPECIFIC" COSTS?

A. Yes. After correctly noting that "the primary purpose of the model is to develop deaveraged cost estimates by geographic area," Sprint witness Dickerson goes on to argue that model inputs should be specific to the company currently providing the service.[13] BellSouth witness Caldwell makes a similar flawed argument, stating that input values should be company specific, and that BellSouth's inputs to the BCPM reflect the costs that BellSouth "will incur."[14]

The use of such "company specific" inputs is inconsistent with the objective of including only the costs that an efficient new provider would incur on a going-forward basis to serve a given area. Properly calculated costs are specific to the unique characteristics of the area being served, but it is not necessary to study the historic and embedded costs of the incumbent provider in order to make an objective determination of the costs that an efficient new provider would incur to serve the area. To the contrary, by focusing on the historic operations of the incumbent LEC instead of the characteristics of the area, it becomes more difficult to make the required objective determination of costs.

Q. THE USE OF HISTORIC AND EMBEDDED (I. E. "COMPANY SPECIFIC") INFORMATION AS COST MODEL INPUTS WOULD SERVE TO OVERSTATE COSTS ONLY IF CHANGE IN THE INDUSTRY IS OCCURRING AT A SUFFICIENT PACE TO MAKE PAST CONDITIONS A POOR INDICATOR OF THE FUTURE. IS THIS THE CASE?

A. Yes. First and foremost, the position of the BellSouth and Sprint witnesses completely ignores the development of competition for basic local telecommunications services that is beginning to occur in Florida. Their arguments for the use of "company specific" inputs are nothing more than a thinly veiled attempt to carry costs that were incurred during a period of monopoly operation forward into a competitive environment. Doing so would clearly benefit the incumbent LECs, but would be directly at odds with the interests of Florida consumers of basic local telecommunications services.

The specifics of many of the industry changes are described in the testimony of Sprint witness Dr. Staihr. He correctly points out at page 9 that "historical or book costs reported over many years do not reflect the efficiencies that can be realized today in the provision of basic service. They also do not reflect the realities of today's market with regard to, for example, labor costs, inflation, environmental constraints or a host of other cost affecting factors." Undeterred by the logic of his own argument, Dr. Staihr goes on to support the use of model inputs based on Sprint's historical records.

Q. DO THE INCUMBENT LEC WITNESSES OFFER AN ARGUMENT WHY THE USE OF HISTORIC AND EMBEDDED (I. E. "COMPANY SPECIFIC") INFORMATION AS COST MODEL INPUTS IS EQUIVALENT TO THE OBJECTIVE DETERMINATION OF THE COSTS THAT WOULD BE INCURRED BY AN EFFICIENT NEW ENTRANT?

A. Yes. Incredibly, BellSouth witness Caldwell asks the Commission to assume that the cost model inputs based on BellSouth's historic records are equal to the comparable input values for a efficient carrier, based on her unilateral assessment that BellSouth, as it operates today, exists as a model of efficiency. She argues throughout her testimony that the model inputs that she sponsors, based on BellSouth historic records, are representative of what "an efficient provider would be expected to achieve on a going forward basis."[15]

Ms. Caldwell's claim cannot be given serious consideration for at least two reasons. First, BellSouth operates as a regulated monopoly; it does not yet face effective competition for its services. This Commission has not recently performed an investigation of BellSouth's operations and found the Company to be as efficient as it would be if operated in competitive markets; similarly, competitive market forces have not had the opportunity to act on BellSouth in order to provide market incentives for efficiency. In short, there is no basis for a conclusion that BellSouth could not operate more efficiently than it does today.

Second, while she has had a distinguished career at BellSouth, Ms. Caldwell's professional experience is limited to examinations of the costs of a regulated monopoly; she does not have comparable experience evaluating the costs of a firm operating in competitive markets. As a result, she simply lacks the necessary foundation to reach her oft-stated conclusion that BellSouth's existing cost structure is equal to the cost structure of an efficient provider on a going forward basis.

Q. YOU STATED THAT COSTS SHOULD BE SPECIFIC TO THE GEOGRAPHIC AREA BEING STUDIED. IT IS NECESSARY FOR ALL MODEL INPUTS TO BE CHANGED TO FLORIDA-SPECIFIC VALUES IN ORDER TO ACCOMPLISH THIS

OBJECTIVE?

A. No. In a further attempt to justify the use of historic and embedded (i. e. "Company specific") information as cost model inputs, the incumbent LEC witnesses have attempted to frame the debate as a choice between "state-specific" and "default" input values. In this dichotomy, "state specific" is simply a euphemism for historic information from the Company's records. The objective of the process should be to produce costs that are specific to a given area. In order to do so, it will be necessary to use a mixture of geographic and input data that is highly specific to the geographic area being studied (soil type, for example) and input values that are not specific to the geographic area or even to the state (the purchase price of materials that BellSouth purchases on a regional basis, for example). As Sprint witness Staihr correctly points out at page 13, "just as the values of certain inputs should and will change from location to location, others will not."

As a result, it is necessary to evaluate all model inputs in order to determine whether they are representative of the costs that would be incurred by an efficient provider. Much of this information must be specific to the area being studied. In many cases, however, so-called "default" data represents the most reliable and objective information, while so-called "company specific" inputs are based on high cost practices that would not be sustainable in a competitive marketplace.

ILEC Inputs are Not based on a Long-Run, Forward Looking Environment

Q. HOW DO THE FILL FACTORS, OR PAIRS PER HOUSEHOLD, PROPOSED BY THE ILEC'S IN THIS PROCEEDING OVERSTATE COSTS?

A. The models before this Commission reflect a "snapshot" of the network, calculating the cost per unit of demand (e.g., cost per loop or cost per minute of use) assuming -- as the denominator in that calculation -- today's demand. However, the plant investments (based on the fill factors, or pairs per household, utilized by BellSouth, GTE, and Sprint) are designed to provide service to today's demand plus additional demand in the future. It is important to either (1) remove this spare capacity for growth from the investment calculations by utilizing objective fill factors, or (2) take this growth in demand into account in the denominator of the cost per unit of demand to avoid overstating costs, which would lead to an over-recovery of capital costs by the ILECs. Essentially, the long-run growth implications need to be taken into account in *both* the numerator and the denominator, or removed from *both* the numerator and denominator.

This fact has been noted by the New Mexico State Corporation Commission's Findings of Fact, Conclusions of Law and Order (Docket No. 96-310-TX and Docket No. 97-334-TC, page 15) in which the Commission states that "[f]urthermore, U S WEST's own cost modeling effort implicitly assumes that the number of lines it will be serving would increase due to the growing demand of customers for additional lines."

Q. DO THE ILEC'S STRUCTURE SHARING ASSUMPTIONS ALSO OVERSTATE COSTS?

A. Yes, we believe that the structure sharing percentages in the HAI Model are the most appropriate assumptions. TELRIC requires reflection of the sharing potential that an efficient ILEC could realize today had they been operating for some time in a fully-competitive industry. ILECs seek to shift the discussion on structure sharing away from the required long-run view to a short-run context. The fact is that in competitive industries, substantial levels of structure sharing can and do take place. There is every reason to believe that had the ILECs been disciplined by the forces of a competitive market, such savings would already have been reflected in the basic local exchange portion of the telecommunications industry. Consider the following examples from markets that are competitive:

1) The major U. S. auto makers combine efforts to develop ways of

meeting increasing environmental constraints;

2) U. S. computer chip makers have embarked on a joint effort to create smaller chips by using obsolete U. S. Government bomb facilities (Washington Post, 9/11/97 business section);

3) TeleWest, a joint venture between U S WEST and TeleCommunications, Inc. ("TCI") in the United Kingdom, combines telephone and cable service to achieve substantial cost savings. A discussion of the network structure, on page 3 of U S WEST's January 1993 Investors Report, states that:

> TeleWest is installing an advanced hybrid network that includes twisted copper pairs, fiber optics and coaxial cable. This is a state-of-the-art cable TV network with fiber to nodes serving 2,000 homes and coaxial cable extending beyond to nodes and into the homes. Laid along side the cable TV network is the latest telephone digital loop carrier network, which runs fiber to the nodes serving 500 homes. Copper wire extends beyond the nodes and into the homes. As shown below, the two networks overlay each other, sharing a common power supply, conduit and trench.

4) Airports and ocean ports, in which companies that compete fiercely

with each other share large portions of their fixed investment (Shopping centers and industrial parks are examples of this phenomenon, as well);

5) "Piggybacking," the practice of shipping truck trailers and containers by railroad, enables two very competitive industries - railroads and long-haul trucking (both of these industries are particularly instructive because they, too, have extensive 'networks' and have similarly made the transition from the monopoly to competitive environments) - to reduce costs by sharing infrastructure;

6) Multiple railroads form switching and terminal companies to permit structure sharing in major urban areas. There also is increasing use of trackage rights agreements, haulage agreements, and other arrangements that permit two or more railroads to compete while using the same right-of-way and facilities (the interstate highway system and the air traffic control system are other examples of structure sharing).

These are just a few of the ways in which competitors are pooling resources and sharing facilities and talent to provide better quality services to customers and to lower products' costs.

It is also important to consider how a telephone company can share structure placed today, even if no other party requires such facilities now. First, ILECs routinely place extra conduit, which is a way of sharing today's facilities with itself in the future. According to the FCC regulations, the ILECs must allow competitive local exchange carriers to share those facilities. In addition, an ILEC can lease the conduit to cable, Internet, or other services in the future (or, for that matter, lease structure itself from other network industries). Both of these are forms of sharing that do not require all companies to be ready to share the capacity at precisely the moment it is installed, but serve to substantially reduce the cost of building a network. In fact, ILECs engage in such sharing today, leasing conduit and pole attachments to and from other entities. These revenues are typically - and incorrectly - not included in the ILECs' estimation of costs. From our viewpoint, "cash is cash" and leased facilities reduce costs, improving the firm's competitive position.

VII. THE BCPM SPONSORS TYPICALLY RELY ON A BIASED AND ONE-SIDED CRITIQUE OF THE HAI MODEL

The BCPM Sponsors have Sought to Draw a Series of Misleading and Inaccurate Comparisons Between the BCPM and the HAI Model

Q. WHAT ARE THE INACCURATE STATISTICS RELATING TO THE METROMAIL DATABASE THAT ARE CITED BY THE BCPM SPONSORS?

A. In order to suggest that the HAI Model's customer location algorithm is flawed, the BCPM sponsors claim that Metromail's National Consumer Database ("NCDB") contains only 70 million named and unnamed address records for the 50 states (65 percent of the addresses). This assertion is simply wrong. Attached, as Exhibit: _____ (DJW/BFP-20), is a memorandum from Kevin Wiesep of Metromail refuting the BCPM sponsors statistics. In his memorandum -- which was filed by AT&T/MCI with the FCC in CC Docket No. 96-45 in December, 1997 -- Mr. Wiesep states that "[t]he Metromail database does have over 90% (approximately 91.5%) of the residential addresses in the U.S." Of this 91.5%, the Centrus® Desktop software used in the HAI Model customer location process successfully geocodes approximately 71% of the residences nationally.

In contrast, the BCPM process cannot identify the actual physical location of a single customer. These sorts of statistics are most meaningful only in comparison to comparable statistics for the other models before the Commission. As we noted earlier, it would be useful for the BCPM proponents to provide statistics for Florida identifying (a) the number and percent of actual customer locations that are located along the roads that are mapped in their runs of the BCPM; (b) statistical measures indicating how evenly distributed these actual customer locations are along the road types employed by the BCPM; (c) the number and percent of actual customer locations that are located within the "road-reduced" quadrants that the BCPM uses to represent the areas that must be served by distribution plant; and (d) the percent of all road mileage mapped in the BCPM model that falls within the "road-reduced" quadrants that the BCPM uses to represent the areas that must be served by distribution plant. The provision of these statistics for Florida, and by density zone within the state, would permit a meaningful comparison of the relative merits of the two models.

Q. IN WHAT OTHER WAYS HAVE THE BCPM SPONSORS MADE MISLEADING COMPARISONS REGARDING THE HAI MODEL?

A. In past proceedings, the BCPM proponents have attempted to use satellite observations from only one or two wire centers in an effort to disparage the HAI Model location process. However, there are several threshold problems with the method of validation used by the BCPM proponents. First, the selection of the wire centers analyzed by the BCPM proponents is neither random nor representative. Second, the past analyses by the BCPM sponsors have been based on the BCPM ultimate grids -- a unit of measure biased in favor of the BCPM because it overstates the area in which the BCPM actually locates customers for the purpose of modeling distribution plant (which occurs only within the road-reduced quadrants). Third, satellite observations show all housing units (occupied and unoccupied) while the HAI Model, to which it is being compared, uses only occupied *households* (consistent with the FCC criteria). As a result, any correlation analysis comparing the HAI Model *households* to observed *housing units* is biased, because the estimated value is not intended to yield the expected value.

To my knowledge, the BCPM sponsors have performed the satellite observation analyses in three proceedings (Kentucky, Louisiana, and Tennessee). In Louisiana, the Staff found that:

> in conclusion, Staff believes that there is no conclusive evidence that the BCPM does a better job of predicting customer location in rural areas than the Hatfield model. In fact, the analysis performed by Staff related to the Sicily Island wire center [relied upon by the BCPM proponents for their correlation analysis] suggests that the Hatfield model is more accurate than the BCPM.[16]

In addition, I have restated the correlation analyses for both Kentucky and Tennessee (for proceedings in those states) and found that the HAI Model more accurately locates customers than does the BCPM, even in the wire centers that were hand-selected by the BCPM proponents.

Q. WHAT ARE YOUR CONCLUSIONS ON THE RELATIVE MERITS OF THE COMPETING METHODOLOGIES USED BY THE BCPM AND THE HAI MODEL TO LOCATE CUSTOMERS?

A. The BCPM proponents' main criticism of the HAI Model appears to be that geocoding is not particularly successful in rural areas, and they use a series of misleading statistics in an effort to create the impression that BCPM is superior to the HAI Model, even though the BCPM does not locate any customers at all. In addition, the BCPM proponents claim that the HAI Model does not build adequate plant to reach customers within a distribution area when, in fact, the HAI Model constructs more plant within distribution areas than the BCPM. In short, there is evidence that the HAI Model does a better job than the BCPM at predicting customer locations in rural areas, and the Louisiana Staff is correct when they assert that there is "no conclusive evidence that the BCPM does a better job of predicting customer location in rural areas than the Hatfield Model."[17]

Q. HAVE THE BCPM DEVELOPERS TYPICALLY RELIED ON A ONE-SIDED CRITIQUE OF THE HAI MODEL?

A. Yes. The BCPM proponents only appear to identify corrections to the HAI Model that would serve to increase costs. However, the HAI Model does not account for deferred taxes -- while the BCPM does.

Attached, as Exhibit: _____ (DJW/BFP-21), is a simple comparison of annual charge factors resulting from the HAI Model and the BCPM, using consistent input assumptions for taxes, cost of capital, economic life, and salvage values. This shows that the HAI Model, by not incorporating the benefits of deferred taxes, produces annual capital costs that are more than fifteen percent higher than those produced by the BCPM when consistent inputs are used.

We find it curious that the BCPM developers, after examining the HAI Model in some detail, have never pointed out this discrepancy in methodology -- a discrepancy that would serve to lower the HAI Model estimated costs and the amount of USF support.

VIII. FINDINGS AND CONCLUSIONS

Q. **WHAT CONCLUSIONS CAN BE DRAWN REGARDING THE BCPM AND ITS USEFULNESS IN ESTIMATING THE UNIVERSAL SERVICE FUND REQUIREMENTS?**

A. In choosing a cost model that will be the basis for estimating the universal service fund requirements, it is important that accurate estimates be developed on a geographically deaveraged basis without using excessively small geographic units that would lead to a false sense of precision. To this end, it is essential to use the most accurate data available.

Following is a summary of the problems with the BCPM:

1) The BCPM does not locate any customers.

   a) The BCPM does use geocoded data.

   b) The BCPM drops customers and therefore does not provide universal service.

   c) The BCPM assumes that all customers are evenly distributed along a selected subset of roads without any evidence supporting that assumption -- an assumption that overstates dispersion.

2) The BCPM distribution areas are unrealistic.

   a) The BCPM assumption that all distribution areas are square is overly-simplistic.

b) The BCPM assumption that the area of the road-reduced square equals 1,000 feet times the road length is unsupported and arbitrary.

c) The BCPM road-cap leaves many customers unserved by a workable network.

d) The BCPM assumption that customers live on square lots is unsupported and overstates costs.

3) The BCPM carrier serving area design is inefficient.

a) The BCPM "cookie cutter" approach is arbitrary, and does not take into account actual customer clustering.

b) The BCPM serving areas are too small to efficiently use DLC.

c) The BCPM grid approach inconsistently treats various parts of the country.

4) The BCPM does not use a least-cost feeder plant design.

a) The BCPM mis-specifies the cost-minimizing optimization algorithm by steering feeder toward the population centroid.

b) The BCPM subfeeder cable is not always perpendicular to the main feeder.

5) The BCPM inputs overstate costs.

a) The BCPM inputs are not forward-looking.

b) The BCPM inputs are not long-run.

6) The BCPM does not satisfy the FCC criteria or F. S. 364.025 (4) (b).

a) **The BCPM does not provide universal service because its ultimate grid approach prevents the resulting network from serving all customers in the state of Florida.**

b) The BCPM is not an open model due to its extensive use of proprietary and embedded inputs.

c) The BCPM does not develop accurate costs for signaling, a key component of universal service.

In contrast, the HAI Model:

1) actually physically locates the majority of customers;

2) designs serving areas to reflect the actual physical location of customer clusters;

3) uses accurate and consistent engineering guidelines to design outside plant;

4) is an open Model, with all input values and assumptions fully

documented and readily-adjustable;

5) develops costs for both UNEs and USF on a consistent basis;

6) includes a forward-looking and long-run perspective; and

6) satisfies the FCC criteria and F. S. 364.025 (4) (b).

We urge the Commission to evaluate the cost proxy models proposed by the parties with the understanding that similar inputs generally can be used in either model. Contrary to the past testimony of many ILEC witnesses, which has focused on model inputs, the deficiencies of the BCPM demonstrate that the methodology does matter. The substantive flaws that have been identified in the BCPM overstate costs and are difficult to modify. The HAI Model does not suffer from these same deficiencies, and is clearly the more reliable model.

Q. **ARE THERE OTHER CONSIDERATIONS THIS COMMISSION SHOULD TAKE INTO ACCOUNT WHEN SELECTING A METHODOLOGY FOR THE DETERMINATION OF UNIVERSAL SUPPORT FUNDING?**

A. Yes. In addition to the fact that the HAI Model actually locates customers and designs its outside plant based on the locations of the customers, the HAI Model relies on a process which will only improve as geocoding becomes more complete. The BCPM, on the other hand, currently does not locate customers, does not consider customer location when designing its outside plant, and will not improve as geocoding becomes more universal.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

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[1] Staff's Final Recommendation, March 27, 1998.

[2] Louisiana Public Service Commission Order, Order No. U-20883 (Subdocket-A)-A, The Development of Rules and Regulation Applicable to the Entry and Operations of, and the Providing of Services by, Competitive and Alternate Access Providers in the Local, Intrastate and/or Interexchange Telecommunications Market in Louisiana (Universal Service), April 15, 1998, Page 1.

[3] Kentucky Public Service Commission Order, Administrative Case No. 360, An Inquiry into Universal Service and Funding Issues, May 22, 1998, Page 10.

[4] Minnesota Public Utilities Commission Order Adopting Cost Study, Docket No. P-999/M-97-909, In the Matter of the State of Minnesota's Possible Election to Conduct Its Own Forward-Looking Economic Cost Study to Determine the Appropriate Level of Universal Service Support, June 4, 1998, Page 3.

[5] New Mexico State Corporation Commission, Findings of Fact, Conclusions of Law and Order, Docket No. 96-310-TC and Docket No. 97-334-TC, pages 24-25.

[6] Kentucky Public Service Commission Order, Administrative Case No. 360, An Inquiry into Universal Service and Funding Issues, May 22, 1998.

[7] The Associated Press, "Assessment Sought on Bell Rates," Thursday, August 20, 1998.

[8] Kentucky Public Commission Order, May 22, 1998, Page 10

[9] Commission Order adopting the Report of the Administrative Law Judge on Selection of Cost Study, April 2, 1998, page 19, para. 82.

[10] Response Testimony of Dr. Duffy-Deno, Docket No. UT-980311(a), August 3, 1998, Page 27.

[11] Direct Testimony of Caldwell, Docket No. 980696-TP, August 3, 1998, Page 4.

[12] Direct Testimony of Dickerson, Docket No. 980696-TP, August 3, 1998, Page 4.

[13] *Id.* at 4-5.

[14] Direct Testimony of Caldwell, Docket No. 980696-TP, August 3, 1998, Pages 5, 17.

[15] *Id.* at 5, 10, and 17.

[16] Staff's Final Recommendation, March 27, 1998, page 11.

[17] *Id.*

Exhibit: _____ (DJW/BFP-1)

BCPM Serving Areas Ignore Customer Location

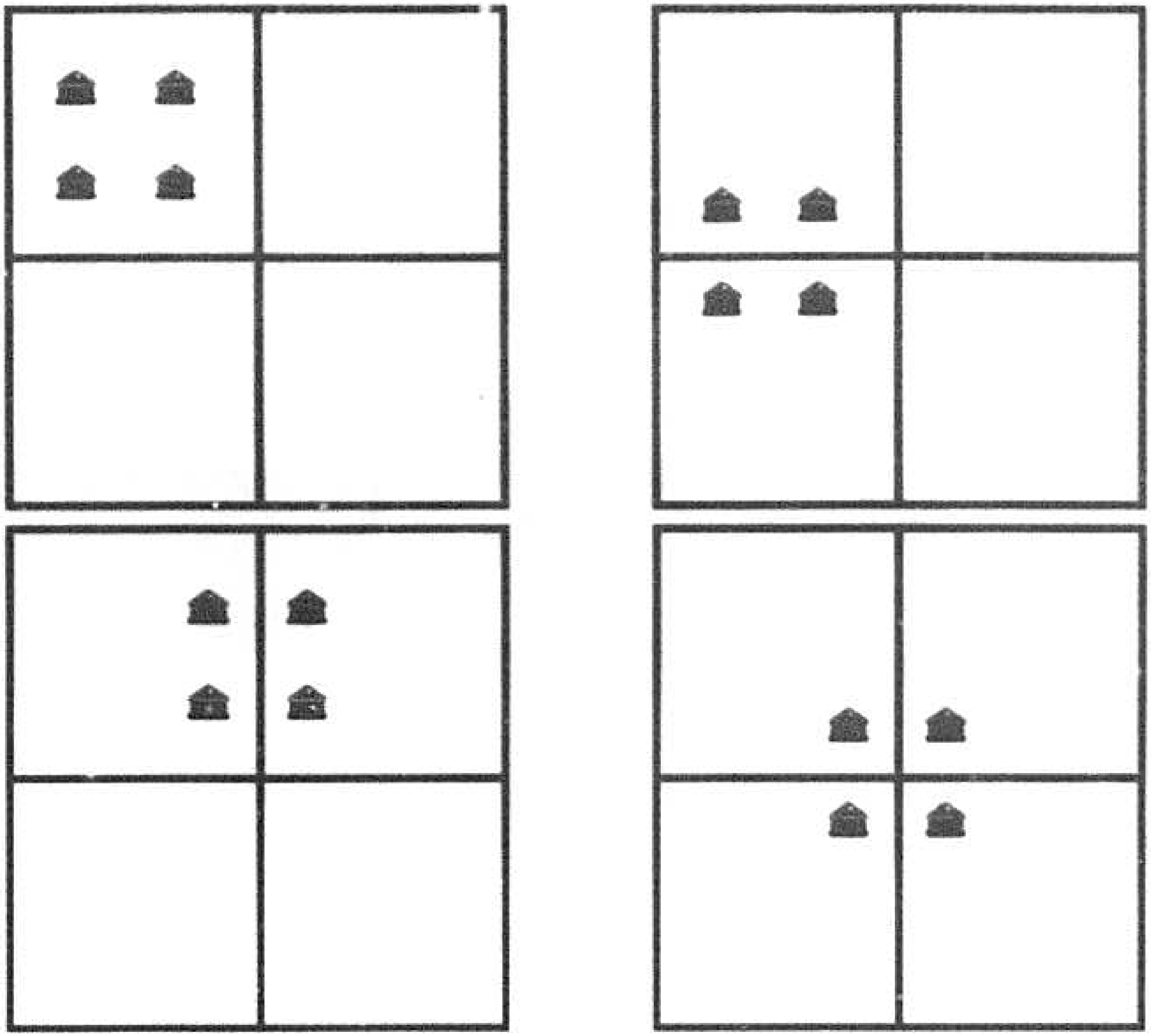

Exhibit: _____ (DJW/BFP-2)

Assessment Sought on Bell Rates

Thursday, August 20, 1998; 6:00 p.m. EDT

WASHINGTON (AP) -- The House's top telecommunications lawmaker asked federal regulators Thursday to look into whether inaccurate accounting by the nation's Bell telephone companies has unfairly inflated local phone rates.

Preliminary findings -- disputed by the Bell companies -- of an audit by the Federal Communications Commission show that some of the equipment the Bells have on their books cannot be accounted for. The FCC doesn't expect to release a final audit until next month at the earliest.

``If ... these carriers did inflate their recorded investments, then consumers may have been overcharged millions of dollars in their monthly telephone bills," House Commerce Committee Chairman Thomas Bliley, R-Va., said in a letter to FCC Chairman Bill Kennard.

Bliley asked Kennard to assess the impact of missing equipment on local rates and requested detailed information about the nature and the scope of the audit.

Equipment costs don't play as much a factor in setting local rates as they once did because regulations have changed over the years.

Exhibit: ______ (DJW/BFP-3)

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Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

DA 98-1587
Released: August 7, 1998

COMMON CARRIER BUREAU SEEKS COMMENT ON
MODEL PLATFORM DEVELOPMENT

CC Docket Nos. 96-45, 97-160

Comment Date: August 28, 1998
Reply Comment Date: September 11, 1998

In the Universal Service Order, the Commission stated that it would select a federal mechanism to calculate the forward-looking economic cost of non-rural carriers serving rural, insular, and high cost areas. The Commission determined that it would select the "platform" (fixed assumptions and algorithms) of the mechanism in one stage, and that it would select other parts of the mechanism, including all input values, in a second stage. Three models have been submitted to the Commission for consideration as the platform for the federal mechanism: the Benchmark Cost Proxy Model (BCPM), the HAI Model (HAI), and the Hybrid Cost Proxy Model (HCPM). These models have been subject to extensive review by Commission staff and outside parties, and thousands of pages of comments have been filed regarding their relative merits and problems. Recent ex parte meetings between Commission staff and the model sponsors suggest that certain areas of agreement now exist on the optimal approach to designing a platform for the federal mechanism. In an effort to move towards a result that combines the best ideas of all parties considering these complex issues, this Public Notice seeks comment on approaches to a model platform that combine specific aspects from the customer location and outside plant modules of the models under consideration.

In a Further Notice of Proposed Rulemaking (Further Notice), the Commission raised the possibility that the platform for the federal mechanism may represent a synthesis of approaches from different sources. Such a synthesis would capitalize on the strengths of the algorithms and approaches of the models under consideration. As the Commission stated in the Further Notice, the goal of this model development process is to determine the platform design components and input values that will most accurately estimate carriers' forward-looking economic costs. With this goal in mind, we note that a synthesis of the approaches taken in the models under consideration may result in a model platform with significant advantages over each of the individual models.

The algorithms that identify customer locations and design outside plant in each of the models under consideration are important in determining the estimated costs for a wire center or study area. One approach that might enhance the accuracy of a model's cost estimate would be a synthesis of HAI's geocoded customer location information, which identifies customer locations by latitude and longitude coordinates, BCPM's assumption that customers that cannot be located precisely are located along roads, HAI's clustering approach, and HCPM's outside plant algorithms, which are able to design outside plant directly, or nearly directly, to latitude and longitude coordinates. This approach could be combined with other aspects of BCPM, HAI, or HCPM to develop a complete model platform. While we seek comment on this possible synthesis and on the specific issues set out below, we note that the Commission may select as part of the federal mechanism other combinations of algorithms not described herein. We therefore also seek comment on any other combinations of algorithms on the record in this proceeding that they believe would most accurately estimate non-rural carriers' forward-looking economic costs of providing the supported services starting July 1, 1999.

Customer Location Data. HAI uses data provided by PNR Associates to identify customer locations by latitude and longitude (actual geocode data) and creates surrogate geocodes for those customer locations that cannot be identified (surrogate geocode data). HAI then uses an algorithm, also provided by PNR, to identify clusters of customers. BCPM and HCPM, on the other hand, identify customer locations using publicly available data about the number of customers in each Census Block. BCPM combines the Census block data about customer location with road network data, and places customers in microgrids based on the assumption that people are more likely to be located along roads. In the Further Notice, the Commission requested comment on the availability, feasibility, and reliability of using geocode data to determine the distribution of customers in the federal mechanism. Many commenters from across the spectrum of the industry agree that geocode data that identify the actual geographic locations of customers are preferable to algorithms intended to estimate customer locations based on information such as census block data. Although comments on this issue have already been received, this Public Notice provides a final opportunity for parties to comment on how a model platform may use the most accurate customer location data available, which in some cases may be geocode data, in the most effective manner. We also seek comment on how the expenses for obtaining geocode data for high cost universal service mechanisms should be recovered.

As many commenters have noted, actual geocode data appear to be incomplete, particularly in low-density areas. A model, therefore, will have to make assumptions about where non-geocoded customers are likely to be located. Currently, the BCPM developers create surrogate geocodes on the assumption that those customers in a census block that cannot be geocoded are distributed along both the internal and peripheral roads in the Census block. HAI believes that a more accurate assumption would place surrogate geocodes along the boundary of that Census block. Another option would be to distribute surrogate geocodes randomly throughout an entire Census block, rather than just along its boundaries or roads. Although comments on this issue have already been received, this Public Notice provides a final opportunity for parties to comment on the algorithm or combination of algorithms that would locate most accurately those customers without actual geocodes, and on the empirical basis for such comments. If commenters propose a different approach than one of those described above, we seek detailed comments on how such an approach should be implemented.

Grouping Customers. After determining where customers are located using actual or surrogate geocodes, a model platform must group customers into serving areas to design feeder and distribution plant efficiently to those customers. In this Public Notice, we consider a model platform that groups customers using a clustering approach because it appears to have advantages over gridding approaches. HAI has placed the computer code for its clustering algorithm on the record in this proceeding. We are also releasing a clustering algorithm and a set of cluster outputs generated from sample, surrogate geocode data. These clusters were generated using a clustering algorithm, developed by Commission staff, that differs somewhat from the clustering algorithm used in HAI. We seek comment on the relative merits of HAI's clustering algorithm and the Commission staff's clustering algorithm described in the "Test Data" section, below. We also intend that parties will use these cluster outputs to test the various algorithms for designing distribution and feeder plant that are discussed herein.

Designing Distribution and Feeder Plant. After identifying groups of customers, a model must design distribution plant from the digital loop carrier (DLC) or serving area interface (SAI) to the customers, and feeder plant from the central office to the DLC or SAI. In order to design distribution plant, both BCPM and HAI create square or rectangular distribution areas and assume that the customers in each group are uniformly spread throughout the distribution areas. While these approaches create a predictable pattern of customer lots to which the models may design distribution plant, both also appear to distort the actual locations of customers when such locations can be identified with specificity. HCPM appears to be capable of designing plant with less distortion to customer locations. By reducing the size of its microgrids, HCPM can associate those latitude and longitude coordinates of each customer with a small microgrid (the version that is currently available uses grids 360 feet on each side). With customers grouped by a clustering algorithm, HCPM can build loop plant directly to individual microgrids in which customers are located. Thus, HCPM could build plant directly to every customer with an error of no more than a few hundred feet from the actual or surrogate geocode specified for any individual customer. We seek comment on a model that synthesizes this approach with the use of geocode data and a clustering algorithm. We also seek comment on the appropriate microgrid size to utilize in building distribution plant to latitude and longitude coordinates, and on the methods used by HCPM to subdivide microgrids into lots.

The feeder modules of both HAI and BCPM use a modified "pine tree" algorithm that deploys main feeder routes in each of four quadrants surrounding the central office switch, with subfeeder routes connecting each serving area interface to the closest main feeder. In effect, HAI and BCPM build an individual subfeeder route to nearly every serving area (or cluster). The feeder module of HCPM allows for more sharing among subfeeder routes by using a modified "spanning tree" algorithm. The spanning tree algorithm finds the minimum distance necessary to connect a set of remote locations to a central point. As applied to feeder plant, this algorithm connects SAIs to the switch. HCPM has modified the spanning tree algorithm to consider explicitly the amount of traffic that must be carried and factors such as the costs of cable and structures. We seek comment on these different approaches to designing feeder plant, including on the feeder algorithm that should be used if the Commission also adopts a model platform that includes HCPM's distribution algorithm.

Test Data. As noted above, to enable parties to evaluate fully the synthesis discussed herein, particularly the HCPM distribution and feeder algorithm, the Bureau has made available on the Commission's World Wide Web site a set of sample geocode data and customer clusters, and the clustering algorithm used to generate those clusters. In addition, an interface that converts the output of the HCPM clustering algorithm to an appropriate input for the HCPM distribution and feeder algorithms has been placed on the public record. These latter algorithms overlay a grid on top of each cluster, and then assign each customer location in the cluster to a microgrid cell within the grid for the purpose of building distribution plant. A similar interface could be used for HAI's cluster data point outputs, or any other set of clustering outputs. The sample geocode data represent points randomly distributed within the census blocks of several wire centers. Groups of the sample geocode data have been identified according to a clustering algorithm developed by Commission staff. By making a set of sample geocode points publicly available and grouping them into clusters, we hope to facilitate evaluation and analysis of this particular synthesis. We note that these data could also be used to evaluate other potential approaches.

Comments. We strongly encourage parties to support their comments and proposals with empirical evidence. Comments from interested parties are due on or before August 28, 1998, and reply comments are due on or before September 11, 1998.

Procedure for Filing:

Comments should reference CC Docket Nos. 96-45, 97-160 and must include the DA number shown on this Public Notice. Interested parties must file an original and five copies of their comments with the Office of Secretary, Federal Communications Commission, Room 222, 1919 M Street, N.W., Washington, D.C. 20554. Parties should send three copies of their comments to Sheryl Todd, Common Carrier Bureau, Federal Communications Commission, 2100 M. St, N.W., 8th Floor, Washington, D.C. 20554. Parties should send one copy of their comments to the Commission's copy contractor, International Transcription Service, 1231 20th Street, N.W., Washington, D.C. 20036.

Commenters may also file informal comments or an exact copy of formal comments electronically via the Internet at <ckeller@fcc.gov>. (The Commission has no established rules at this time for the filing of formal comments via the Internet.) Only one copy of electronically-filed comments must be submitted. A commenter must note whether an electronic submission is an exact copy of formal comments on the subject line. A commenter also must include its full name and Postal Service mailing address in its submission.

Parties that do not file copies of the comments electronically are also asked to submit their comments and reply comments on diskette. Such diskette submissions are in addition to and not a substitute for the formal filing requirements addressed above. Parties submitting diskettes should submit them to Sheryl Todd of the Accounting Policy Division, Common Carrier Bureau, 2100 M Street, N.W., 8th floor, Washington, D.C. 20554. Such a submission should be on a 3.5 inch diskette formatted in an IBM compatible form using WordPerfect 5.1 for Windows or compatible software. The diskette should be submitted in "read only" mode. The diskette should be clearly labelled with the party's name, proceeding, type of pleading (comment or reply comments) and date of submission. Each diskette should contain only one party's comments in a single electronic file. The diskette should be accompanied by a cover letter.

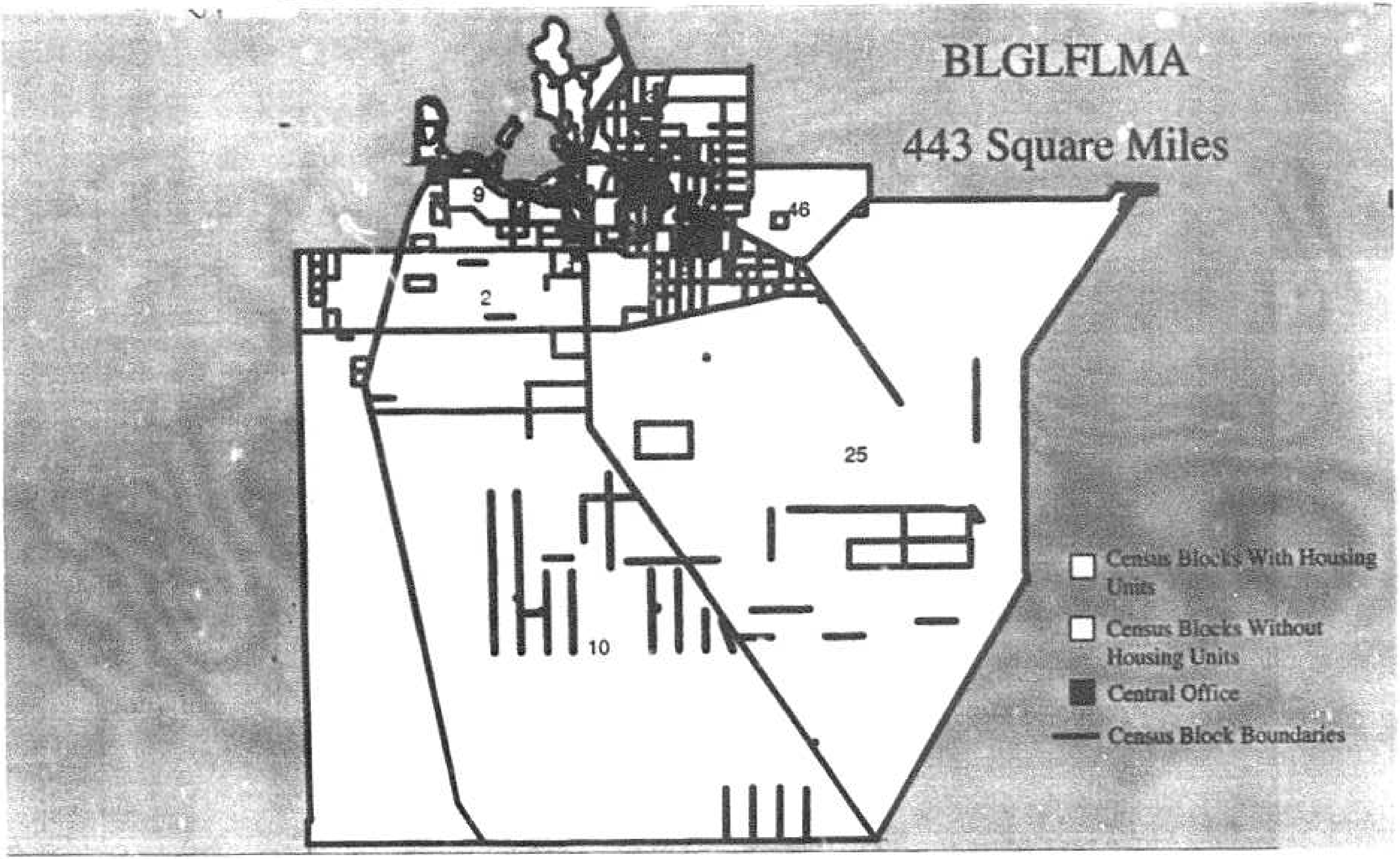
Pursuant to section 1.1206 of the Commission's Rules, 47 C.F.R. § 1.1206, this proceeding will be conducted as a permit-but-disclose proceeding in which ex parte communications are permitted subject to disclosure.

For further information, please contact Chuck Keller or Jeff Prisbrey, Common Carrier Bureau, (202) 418-7400.

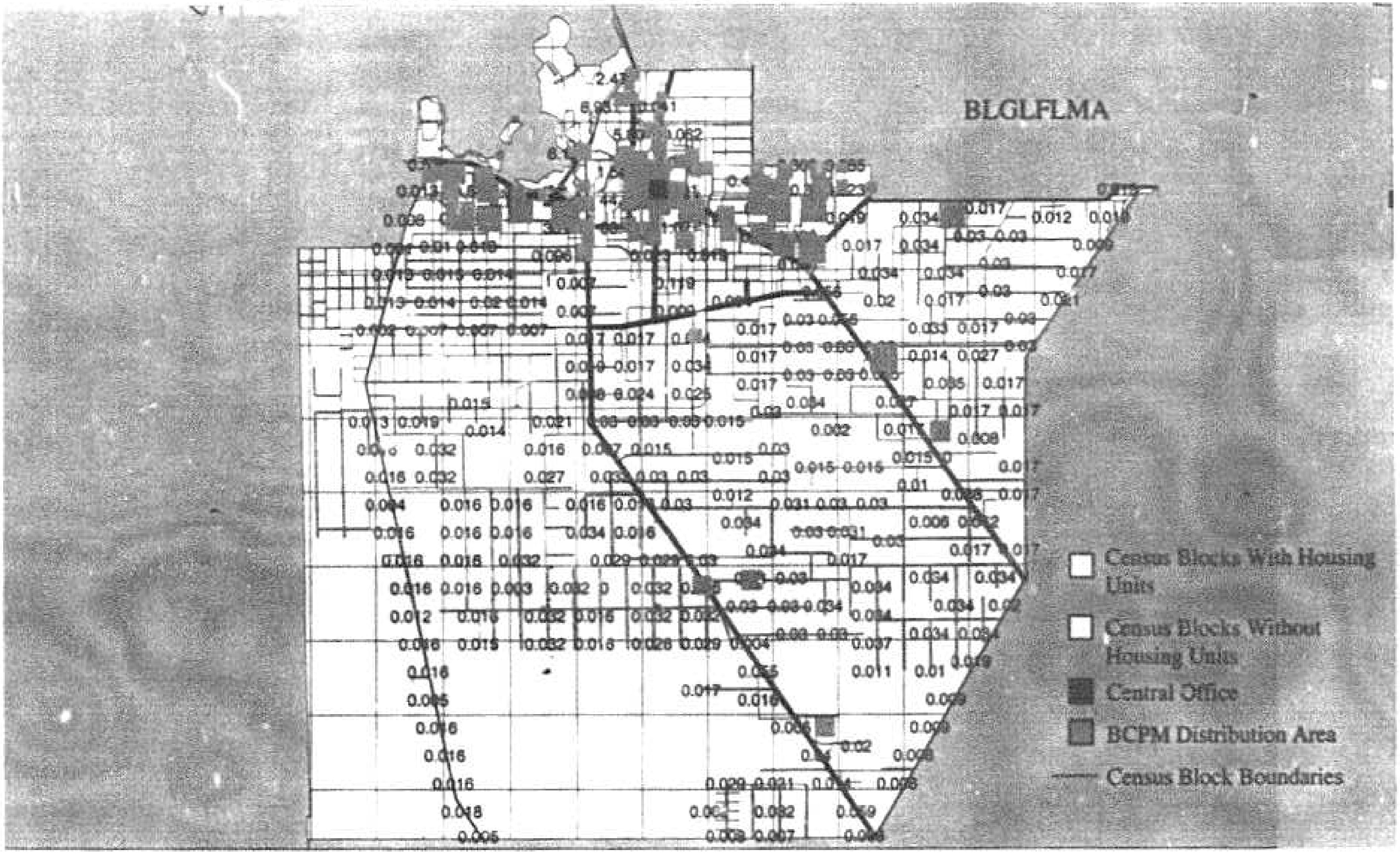
- Action by the Acting Chief, Common Carrier Bureau -

Exhibit: _____ (DJW/BFP-4)

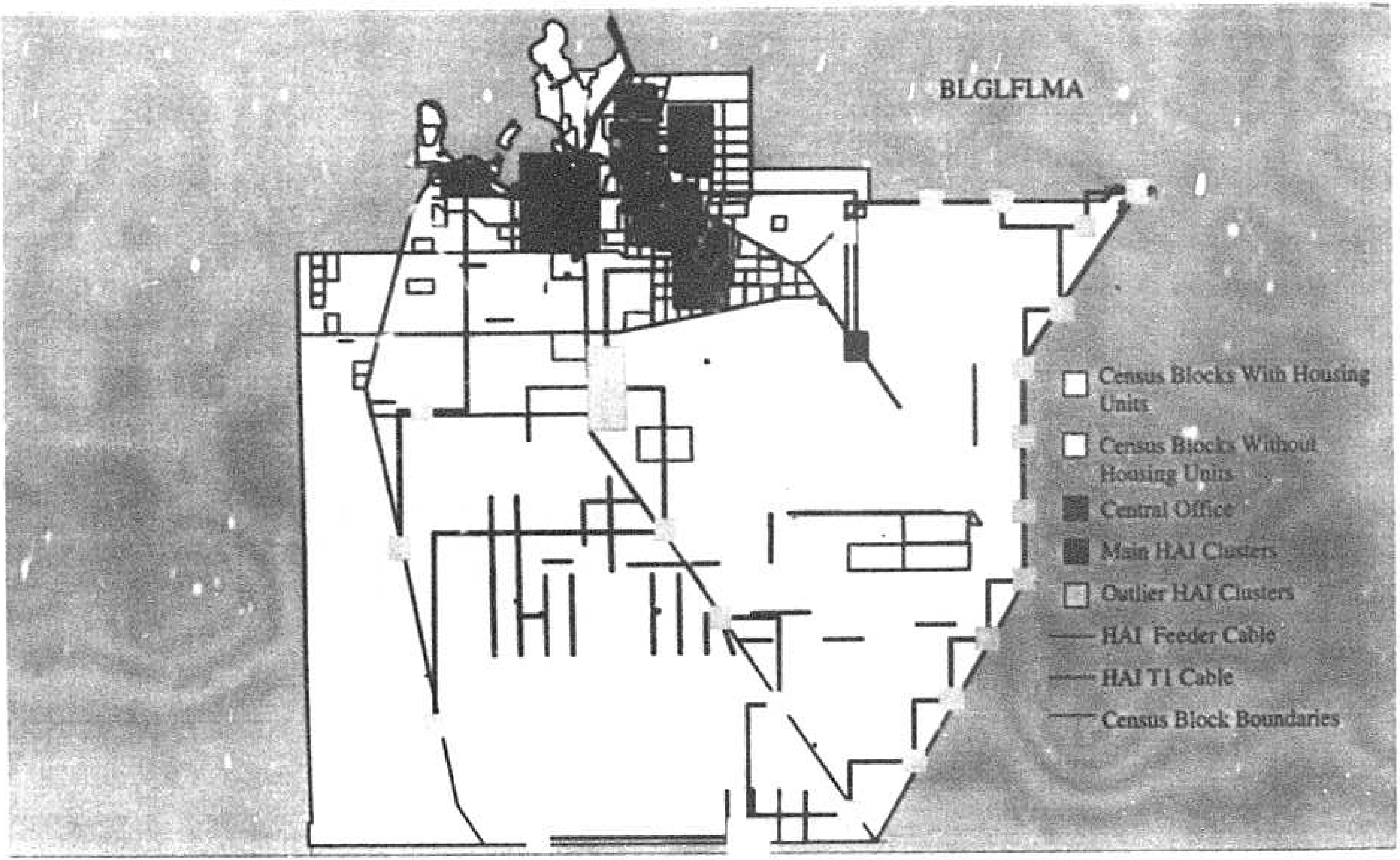
HOUSING UNITS PER CENSUS BLOCK



BCPM MODELED CUSTOMER LOCATIONS



HAI MODELED CUSTOMER LOCATIONS



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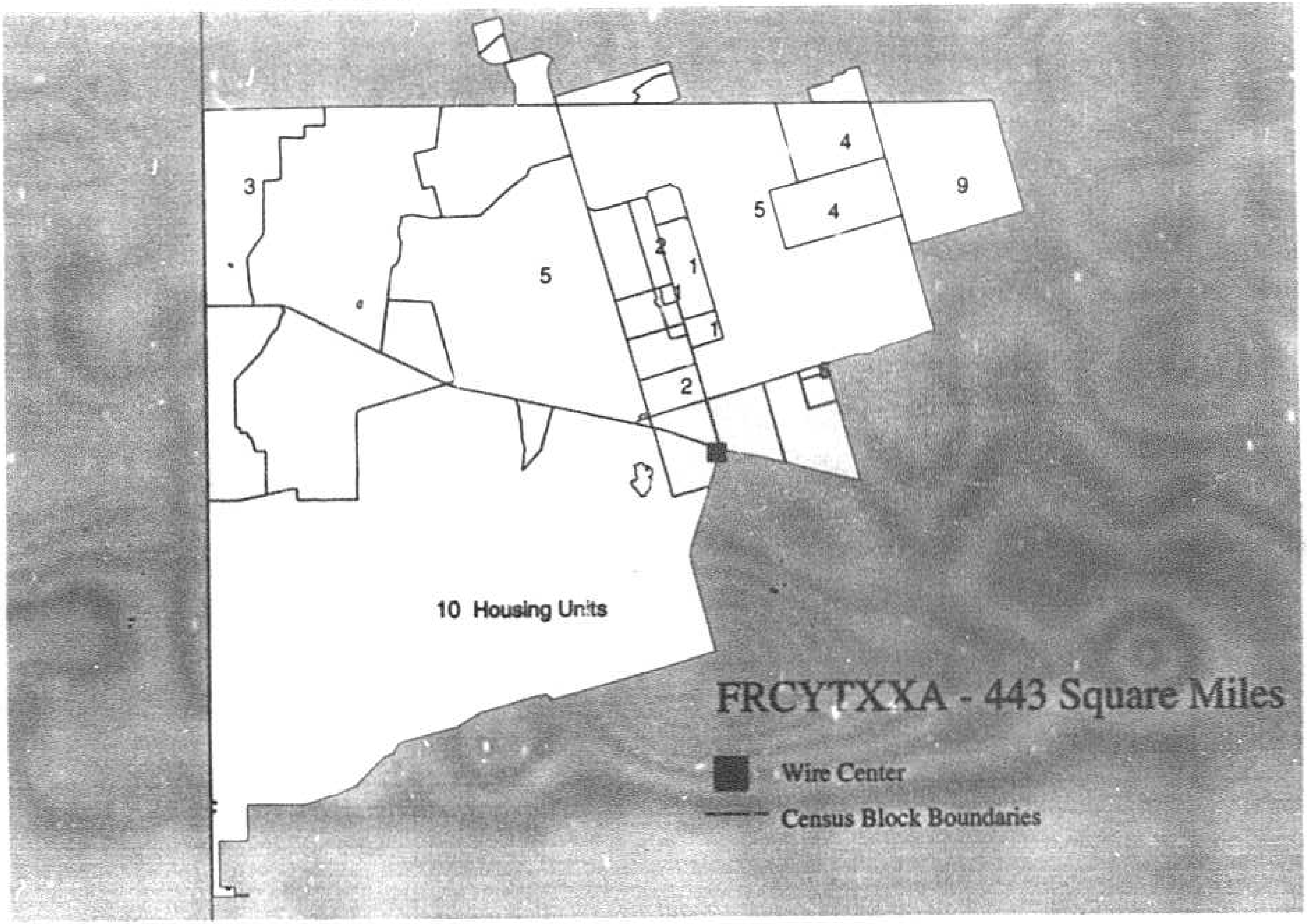
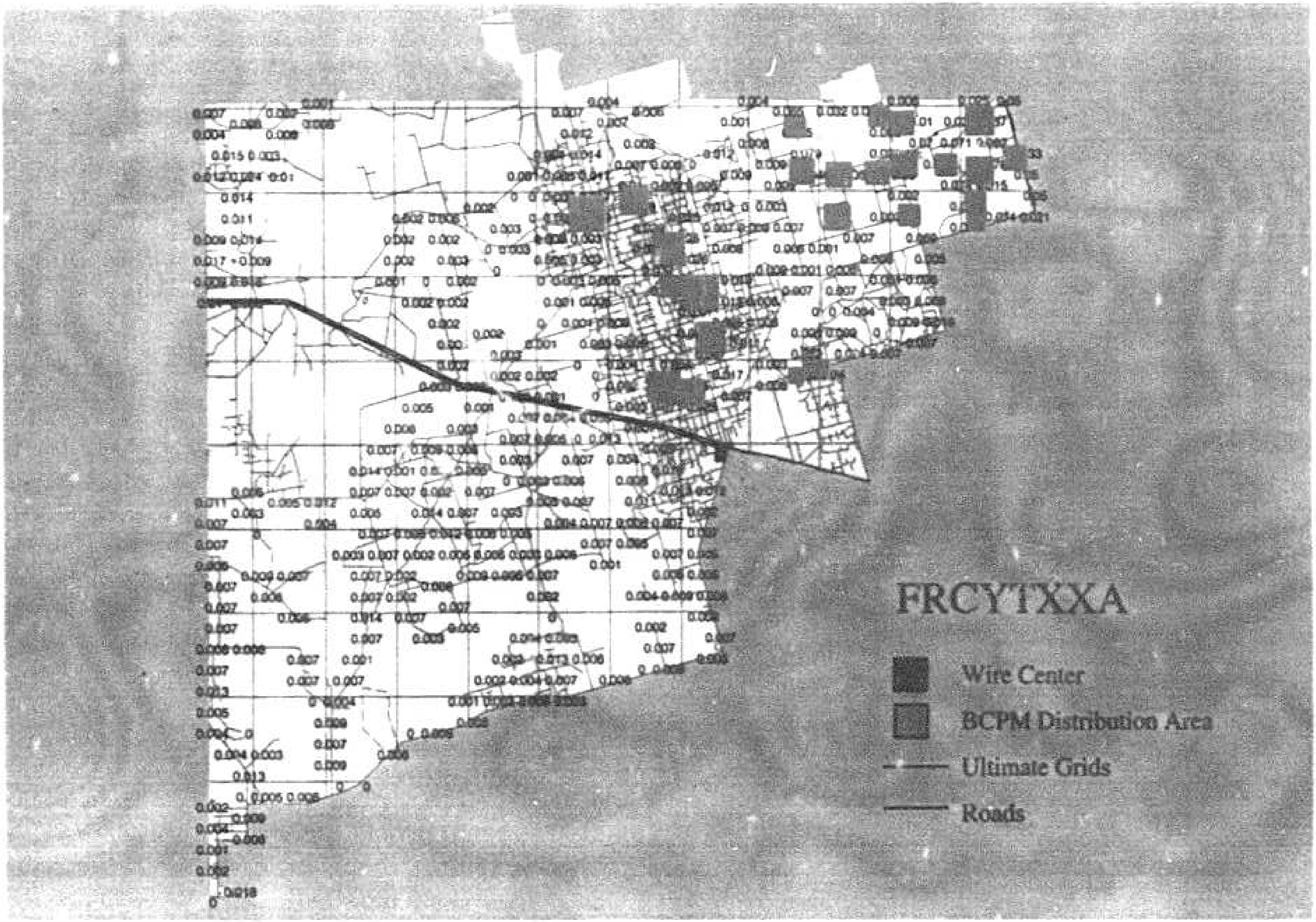


BCPM MODELED CUSTOMER LOCATIONS



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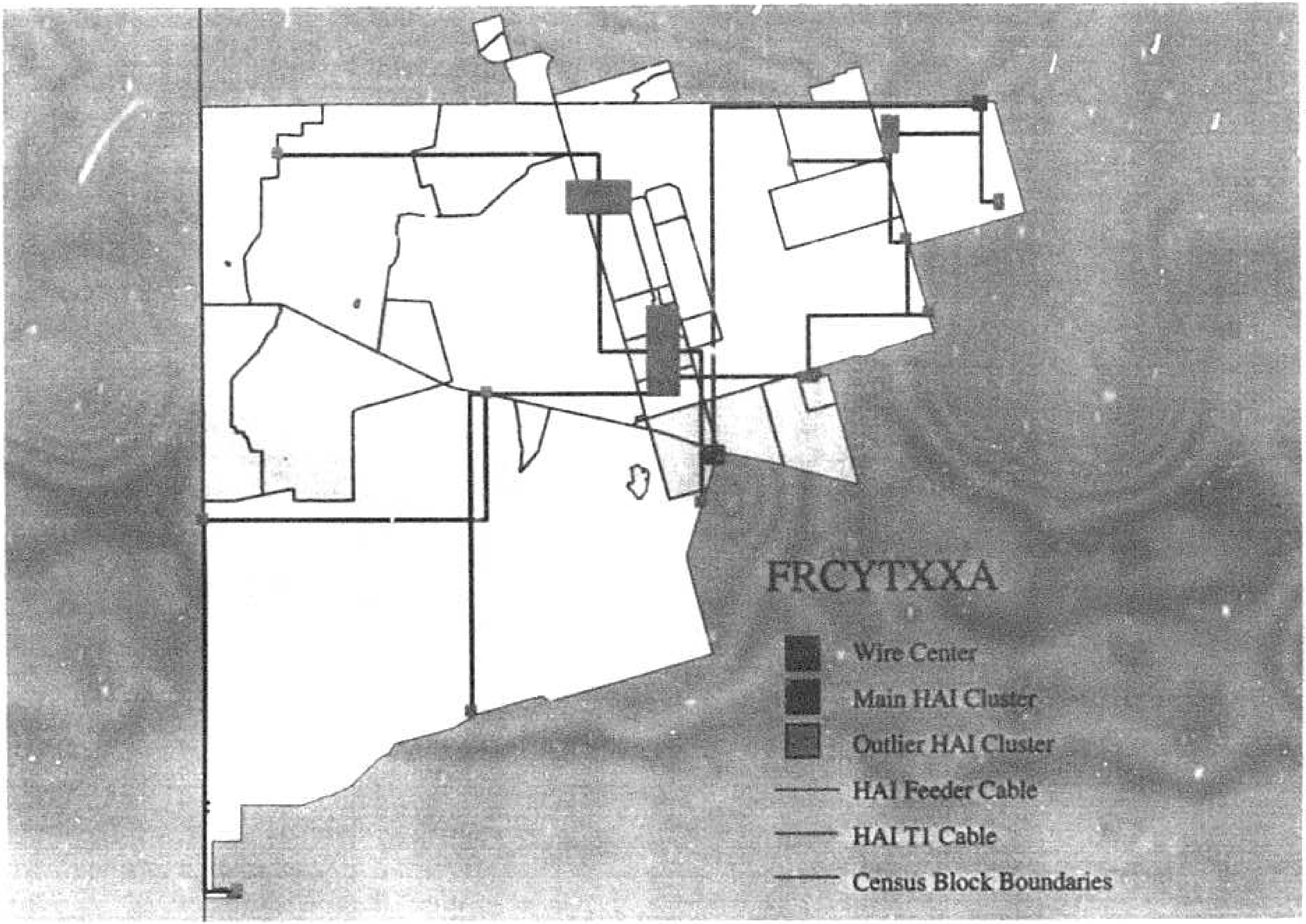

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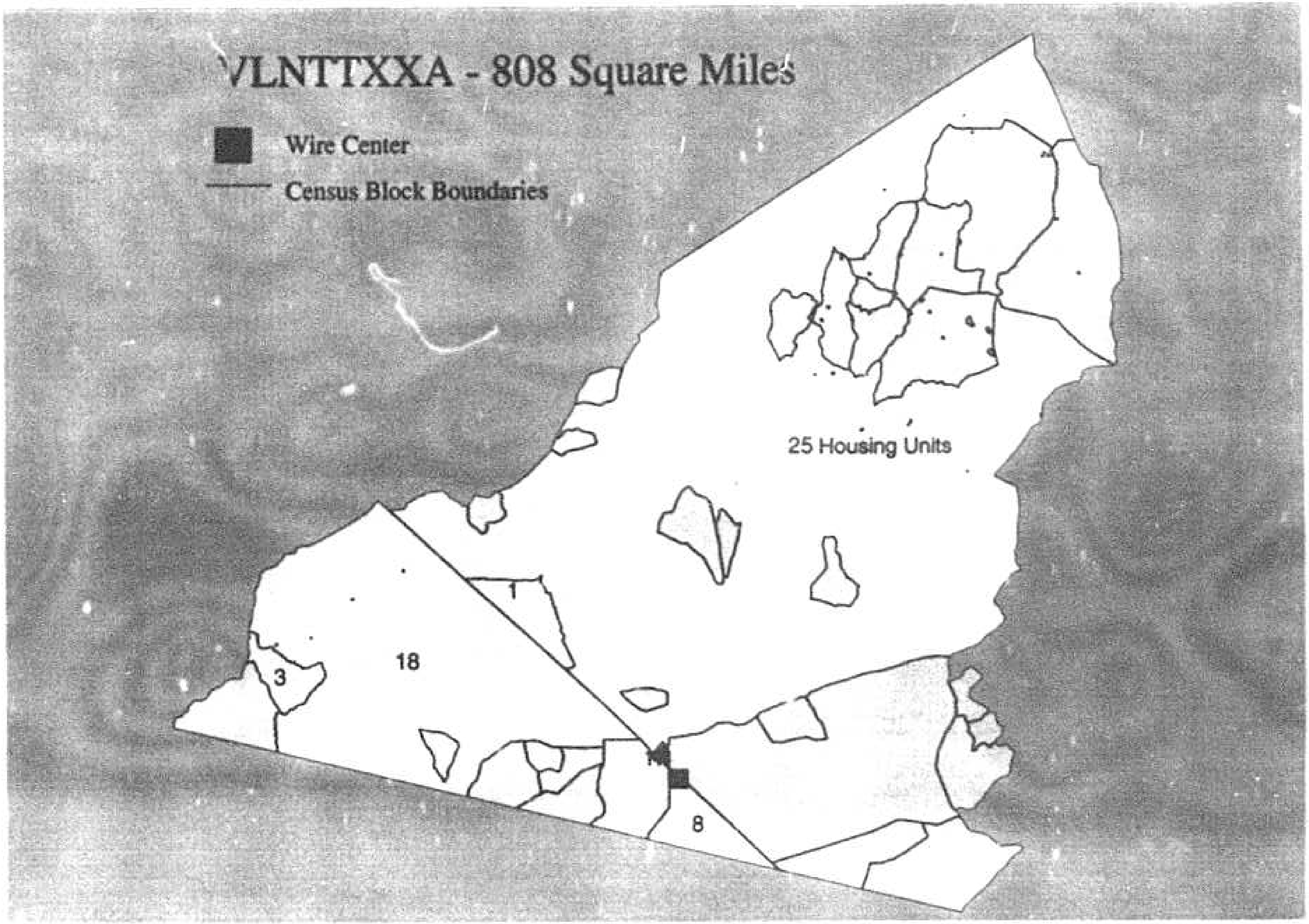
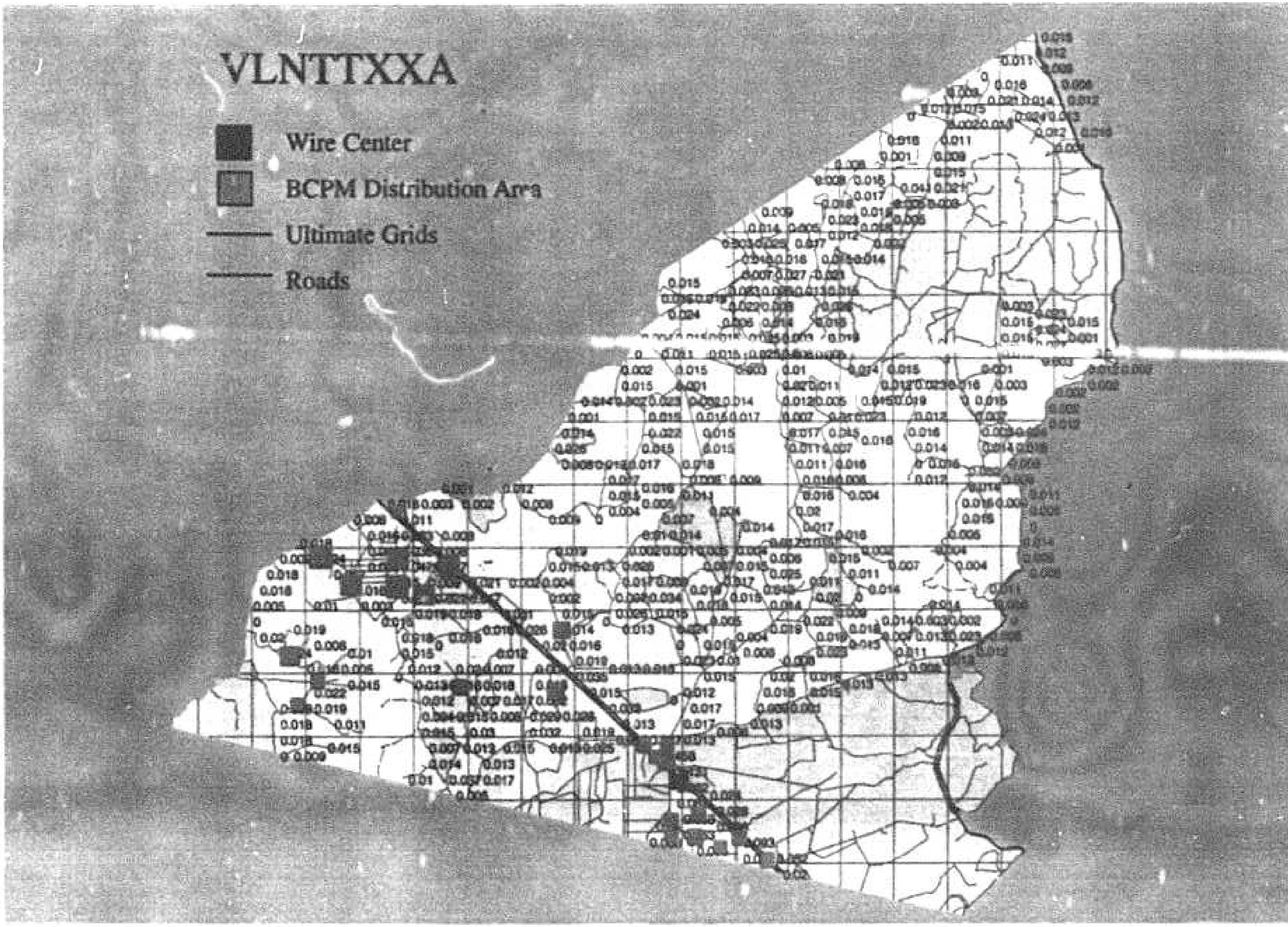


BCPM MODELED CUSTOMER LOCATIONS



HAI MODELED CUSTOMER LOCATIONS

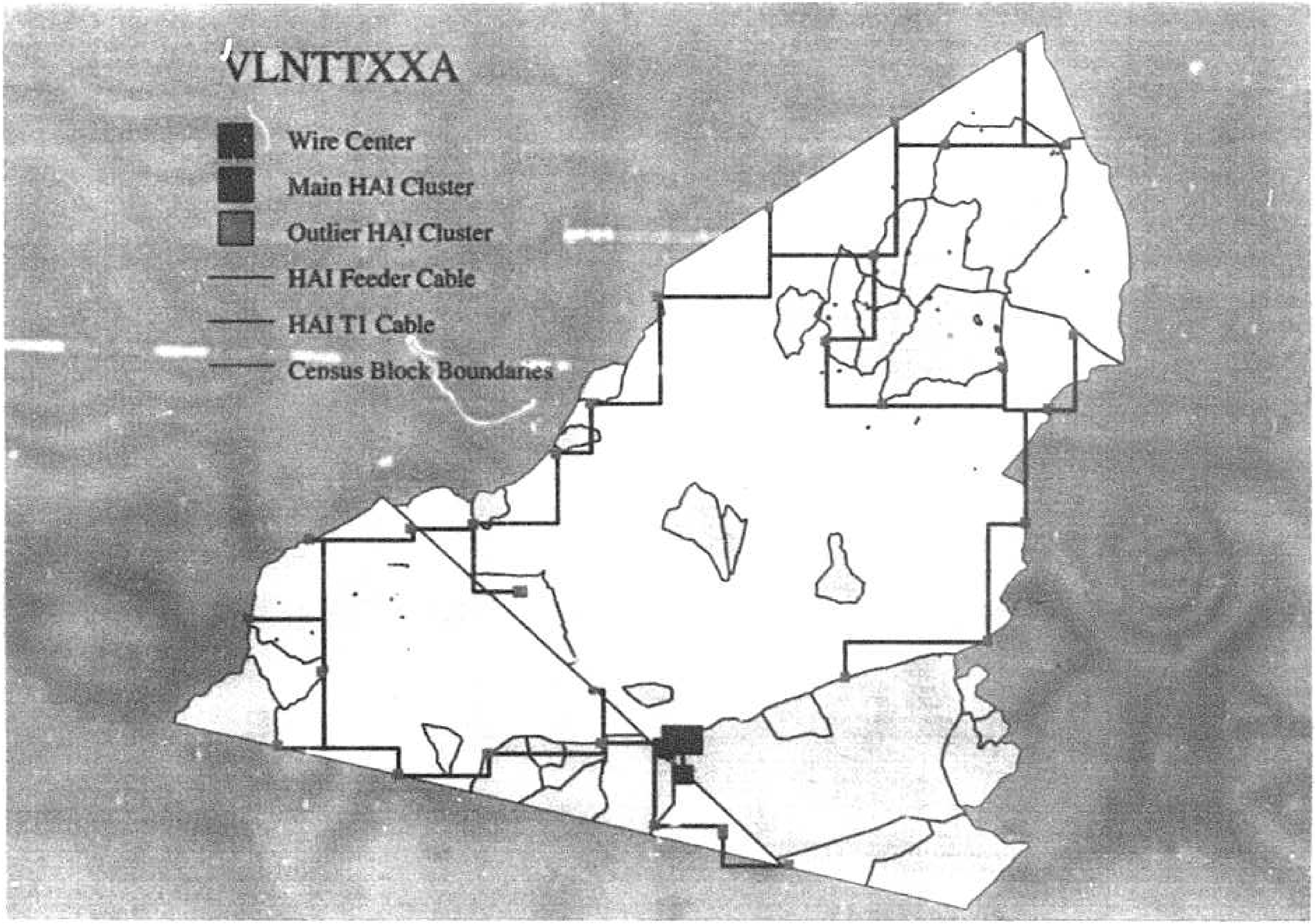


Exhibit: _____ (DJW/BFP-5)

Benchmark Cost Proxy Model Results - GTE Florida
Using SCM Switching Method for Wire Centers with SCM Data
Area Wide Summary Report

TOTAL SUMMARY
GTE CORPORATION
FLORIDA
WIRE CENTERS [90]

	Uncapped Annual Amount		Capped1 Annual Amount	
Investment Per Line Data				
Loop Investment	$	852	$	835
Switch Investment	$	165	$	165
IOF Investment	$	6	$	6
Other Investment	$	142	$	141
Total Investment	$	1,165	$	1,148
Expense Per Month Data				
Total Capital Cost per Line	$	20.09	$	19.83
Total Operating Expense per Line	$	11.99	$	11.98
Total Cost per Line	$	32.08	$	31.81
Gross Receipts Tax2	$	1.00	$	0.99
Line Data				
Average Loop Length in Feet		15,317		
Lines Above $10K Loop Investment		1,216		
Number of Households		1,256,364		
Number of Residential Lines		1,596,232		
Number of Single Business Lines		287,982		
Multiple Business Lines		351,343		
Non Switched Lines		78,508		
Total GRID Lines Served		2,314,065		

1 GRIDs with Average Loop Investment per line over $10,000 are capped at $10,000.

2 Application varies so much on a state by state basis, it is not included in the Monthly Cost.

Assumptions:

[GRID] D:\BCPM310\RESULTS\..\BCPMMIN_BCPMMIN_GRID_REPORT.CSV

PROCESSING - BCPMMIN : CAPCOST - BCPMMIN

Benchmark Cost Proxy Model Results - GTE Florida
Using Default BCPM Switching Method for Wire Centers with SCM Data
Area Wide Summary Report

TOTAL SUMMARY
GTE CORPORATION
FLORIDA
WIRE CENTERS [90]

	Uncapped Annual Amount		Capped1 Annual Amount	
Investment Per Line Data				
Loop Investment	$	852	$	835
Switch Investment	$	211	$	211
IOF Investment	$	6	$	6
Other Investment	$	172	$	171
Total Investment	$	1,241	$	1,224
Expense Per Month Data				
Total Capital Cost per Line	$	21.37	$	21.10
Total Operating Expense per Line	$	12.66	$	12.65
Total Cost per Line	$	34.02	$	33.75
Gross Receipts Tax2	$	1.06	$	1.05
Line Data				
Average Loop Length in Feet		15,317		
Lines Above $10K Loop Investment		1,216		
Number of Households		1,256,364		
Number of Residential Lines		1,596,232		
Number of Single Business Lines		287,982		
Multiple Business Lines		351,343		
Non Switched Lines		78,508		
Total GRID Lines Served		2,314,065		

1 GRIDs with Average Loop Investment per line over $10,000 are capped at $10,000
2 Application varies so much on a state by state basis, it is not included in the Monthly Cost.

Assumptions:
[GRID] D:\BCPM3 1O\RESULTS\..\BCPMMIN_BCPMMIN_GRID_REPORT.CSV
PROCESSING - BCPMMIN : CAPCOST - BCPMMIN

Benchmark Cost Proxy Model Results - U S WEST Washington
Using SCM Switching Method for Wire Centers with SCM Data
Area Wide Summary Report

TOTAL SUMMARY
US WEST
WASHINGTON
WIRE CENTERS [106]

	Uncapped Annual Amount		Capped1 Annual Amount	
Investment Per Line Data				
Loop Investment	$	851	$	795
Switch Investment	$	101	$	101
IOF Investment	$	20	$	20
Other Investment	$	56	$	54
Total Investment	$	1,028	$	969
Expense Per Month Data				
Total Capital Cost per Line	$	11.54	$	10.90
Total Operating Expense per Line	$	9.17	$	9.08
Total Cost per Line	$	20.71	$	19.98
Gross Receipts Tax2	$	0.32	$	0.31
Line Data				
Average Loop Length in Feet		14,993		
Lines Above $15K Loop Investment		6,088		
Number of Households		1,289,062		
Number of Residential Lines		1,571,416		
Number of Single Business Lines		72,490		
Multiple Business Lines		611,628		
Non Switched Lines		198,064		
Total GRID Lines Served		2,453,598		

1 GRIDs with Average Loop Investment per line over $15,000 are capped at $15,000.
2 Application varies so much on a state by state basis, it is not included in the Monthly Cost.

Assumptions:
[GRID] F:\BCPM31\RESULTS_\WAPRBASE_WAPRBASE_GRID_REPORT.CSV
PROCESSING - WAPRBASE : CAPCOST - WAPRBASE

Benchmark Cost Proxy Model Results - U S WEST Washington
Using Default BCPM Switching Method for Wire Centers with SCM Data
Area Wide Summary Report

TOTAL SUMMARY
US WEST
WASHINGTON
WIRE CENTERS [106]

	Uncapped Annual Amount		Capped1 Annual Amount	
Investment Per Line Data				
Loop Investment	$	851	$	795
Switch Investment	$	229	$	229
IOF Investment	$	20	$	20
Other Investment	$	71	$	68
Total Investment	$	1,170	$	1,111
Expense Per Month Data				
Total Capital Cost per Line	$	13.05	$	12.40
Total Operating Expense per Line	$	9.60	$	9.51
Total Cost per Line	$	22.65	$	21.91
Gross Receipts Tax2	$	0.35	$	0.34
Line Data				
Average Loop Length in Feet		14,993		
Lines Above $15K Loop Investment		6,088		
Number of Households		1,289,062		
Number of Residential Lines		1,571,416		
Number of Single Business Lines		72,490		
Multiple Business Lines		611,628		
Non Switched Lines		198,064		
Total GRID Lines Served		2,453,598		

1 GRIDs with Average Loop Investment per line over $15,000 are capped at $15,000.

2 Application varies so much on a state by state basis, it is not included in the Monthly Cost.

Assumptions:

[GRID] F:\BCPM31\RESULTS\.\WAPRBASE_WAPRBASE_GRID_REPORT.CSV

PROCESSING - WAPRBASE : CAPCOST - WAPRBASE

Exhibit: _____ (DJW/BFP-6)

GEOCODE SUCCESS RATES

Density Zone	AL	AR	AZ	CA	CO	CT	DC	DE	FL	GA	HI	IA	ID	IL	IN	KS	KY
0	7%	6%	18%	32%	46%			23%	34%	8%	19%	23%	24%	8%	12%	9%	21%
5	41%	37%	61%	62%	62%	83%	100%	43%	62%	44%	41%	43%	53%	37%	38%	47%	41%
100	70%	69%	70%	68%	74%	90%	100%	56%	80%	82%	59%	68%	65%	71%	69%	67%	69%
200	80%	82%	80%	75%	83%	94%	100%	79%	85%	87%	58%	76%	76%	80%	80%	72%	81%
650	89%	88%	87%	76%	84%	95%	88%	81%	84%	91%	53%	84%	72%	80%	80%	78%	88%
850	89%	86%	85%	75%	86%	93%	91%	88%	78%	88%	67%	84%	80%	84%	83%	79%	89%
2550	83%	81%	81%	71%	85%	91%	92%	84%	64%	84%	62%	84%	82%	82%	81%	75%	85%
5000	77%	83%	76%	59%	91%	83%	80%	78%	46%	82%	64%	79%	74%	76%	75%	77%	80%
10000	98%	77%	71%	45%	70%	74%	85%	68%	50%	78%	47%	81%	69%	70%	76%	87%	63%
Average	66%	60%	77%	65%	80%	90%	86%	73%	70%	76%	56%	66%	67%	73%	70%	65%	66%

Density Zone	LA	MA	MD	ME	MI	MN	MO	MS	MT	NC	ND	NE	NH	NJ	NM	NV	NY
0	14%	25%	38%	0%	31%	6%	3%	6%	18%	12%	5%	1%	4%	25%	9%	35%	9%
5	47%	65%	62%	16%	73%	44%	26%	26%	53%	34%	31%	35%	26%	60%	46%	57%	35%
100	73%	86%	78%	66%	77%	77%	59%	68%	56%	63%	63%	73%	67%	76%	58%	87%	63%
200	83%	91%	83%	80%	81%	84%	75%	78%	75%	73%	83%	83%	76%	87%	73%	88%	81%
650	89%	93%	87%	89%	84%	88%	81%	87%	86%	81%	99%	88%	85%	94%	80%	90%	89%
850	91%	94%	89%	93%	85%	91%	84%	90%	78%	80%	98%	88%	88%	91%	85%	78%	92%
2550	92%	90%	82%	90%	84%	92%	87%	84%	83%	77%	97%	84%	87%	89%	87%	75%	92%
5000	89%	84%	77%	86%	80%	91%	83%	81%	70%	72%	90%	81%	88%	82%	81%	57%	87%
10000	79%	80%	71%	86%	76%	87%	80%	83%	65%	78%	82%	74%	78%	69%	85%	43%	68%
Average	76%	87%	80%	49%	81%	76%	68%	66%	61%	62%	64%	65%	65%	84%	69%	68%	74%

Density Zone	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VA	VT	WA	WI	WV	WY	National Average
0	32%	1%	31%	1%	100%	26%	5%	14%	7%	24%	10%	0%	29%	35%	1%	34%	15%
5	64%	23%	50%	26%	76%	53%	41%	46%	32%	54%	25%	8%	51%	54%	11%	48%	43%
100	80%	57%	45%	58%	91%	78%	69%	71%	63%	61%	64%	35%	54%	70%	40%	67%	69%
200	87%	73%	51%	76%	92%	83%	84%	83%	76%	71%	78%	53%	60%	78%	61%	86%	79%
650	91%	77%	50%	83%	92%	86%	100%	87%	84%	82%	85%	75%	61%	84%	79%	80%	84%
850	89%	73%	44%	85%	91%	82%	86%	89%	87%	82%	88%	82%	62%	87%	88%	84%	84%
2550	89%	65%	31%	84%	89%	81%	78%	90%	85%	82%	84%	88%	63%	87%	92%	77%	80%
5000	84%	76%	16%	82%	84%	77%	68%	82%	71%	78%	80%	78%	63%	87%	88%	65%	72%
10000	78%	62%	18%	87%	79%	83%	61%	79%	70%	83%	75%	83%	75%	84%	75%	95%	66%
Average	83%	64%	40%	72%	88%	72%	84%	73%	73%	74%	68%	35%	60%	78%	43%	68%	71%

Exhibit: _____ (DJW/BFP-7)

June 10, 1998

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
1919 M. St., NW, Room 222
Washington, D.C. 20554

RE: Ex Parte Presentation – Proxy Cost Models
CC Docket No. 96-45

Dear Ms. Salas:

On June 9, 1998, AT&T and MCI met with Craig Brown, Bryan Clopton, Chuck Keller, Katie King, Bob Loube, Jeff Prisbrey, Holly Smith, Richard Smith, Donald Stockdale, Natalie Wales and Brad Wimmer of the FCC; and with Scott Bohler (NY PSC), Rowland Curry (TX PUC), Lori Kenyon (AK PUC), Susan Miller (MD PSC), Brian Roberts (CA PUC) and Tom Wilson (WA WUTC). Richard Clarke and Mike Lieberman represented AT&T, and Chris Frentrup represented MCI.

The purpose of this meeting was to provide an evaluation of the accuracy of analyses performed by Sprint and by Prisbrey. As the attached materials demonstrate, Sprint's analysis of HAI Model distribution plant is deeply flawed, and its conclusions are incorrect. Prisbrey's analysis, while not directly evaluating the sufficiency of HAM Model distribution plant, is incomplete. When properly adjusted to account for the full set of PNR and HAI practices, Prisbrey's analysis suggests that the HAI Model does engineer adequate amounts of distribution plant.

Two copies of this Notice are being submitted to the Secretary of the FCC in accordance with Section 1.1206(a)(2) of the Commission's rules. A revised copy of the the materials transmitted in our ex parte letter of June 8, 1998, and presented at this meeting, is attached.

Sincerely,

Richard N. Clarke

Attachments

cc: Gary Biglaiser, Craig Brown, Brian Clopton
Lisa Gelb, Chuck Keller, Mark Kennet
Katie King, Bob Loube, Jeff Prisbrey
Bill Sharkey, Richard Smith, Don Stockdale
Brad Wimmer, Pat DeGraba, Natalie Wales
Sheryl Todd

Chart 1

Revised Aspect Ratio Relative to Baseline:

Percent Change in Monthly Basic Local Service Cost

State	Company	0 - 5	5 - 100	100 - 200	200 - 650	650 - 850	850 - 2,550	2,550 - 5,000	5,000 - 10,000	10,000+	Weighted Average
FL	Central Tel Co Of Florida	-0.89%	-0.09%	-0.20%	0.98%	1.46%	0.52%	-0.08%	-0.01%	-0.12%	0.13%
FL	Gte Floridainc	-1.08%	-0.01%	-0.17%	0.26%	1.00%	-0.07%	0.13%	0.11%	0.08%	0.09%
FL	Southern Bell-Fl	-1.10%	0.32%	0.20%	-0.13%	0.53%	0.07%	0.04%	0.00%	-0.02%	0.07%
FL	United Tel Co Of Florida	-2.01%	0.10%	-0.73%	-0.05%	0.07%	0.13%	0.05%	0.12%	-0.01%	-0.13%
KS	Southwestern Bell-Kansas	-1.73%	-0.01%	1.36%	0.38%	0.05%	0.13%	-0.04%	-0.02%	-0.11%	-0.16%
MN	Contel Of Minnesota Inc Dba Gte Minnesot	-1.28%	0.09%	0.43%	-1.69%	-0.86%	-0.26%	-1.44%	0.05%		-0.61%
MN	Frontier Comm Of Minnesota Inc	-0.66%	-0.37%	-0.28%	0.04%	4.03%	0.07%	0.04%	-0.01%	-0.03%	-0.04%
MN	Northwestern Bell-Minnesota	-0.77%	0.19%	-0.52%	0.11%	0.30%	0.11%	0.13%	0.13%	0.00%	0.01%
MN	United Telephone Co Of Minn	-0.51%	0.07%	0.05%	-0.35%	1.05%	-0.65%	0.01%	0.01%		-0.11%
NV	Central Telephone Company - Nevada	1.96%	1.70%	1.06%	-0.89%	0.02%	-0.99%	-1.26%	-1.35%	-1.53%	-0.84%
NV	Nevada Bell	1.40%	0.65%	0.05%	0.57%	-0.98%	0.74%	-0.04%	0.05%	0.00%	0.57%
IN	Contel Of Indiana Inc Dba Gte - Indiana	-0.53%	0.15%	0.89%	-2.85%	0.16%	-1.23%	-0.29%	0.07%		-0.22%
IN	Gte Of Indiana	-0.09%	-0.49%	0.12%	0.39%	0.08%	0.26%	0.11%	0.42%	-0.02%	-0.02%
IN	Indiana Bell Tel Co	-0.17%	-0.20%	-0.87%	0.14%	-1.17%	-0.21%	-0.10%	-0.14%	-0.19%	-0.21%
IN	United Tel Co Of Indiana Inc	0.79%	-0.14%	0.35%	-0.11%	0.66%	0.19%	-0.07%	0.05%		-0.04%
TN	South Central Bell-Tn	-0.77%	0.18%	-0.57%	-0.19%	-0.02%	-0.29%	-0.32%	-0.31%	-0.53%	-0.18%
TN	United Inter-Mountain Tel Co-Tn		0.47%	-0.42%	-0.45%	3.79%	0.07%	-0.31%	0.30%	0.00%	0.17%
	Weighted Average	-0.90%	0.07%	-0.16%	-0.03%	0.29%	-0.02%	-0.04%	-0.13%	-0.22%	-0.07%

Chart 2

Effects of Using Surrogate Geocodes on Cluster Size and Cable Distances

Florida and Kansas Study Areas	Distribution Route Distance									
Geocode Scenario	0-5	5-100	100-200	200-650	650-850	850-2550	2550-5000	5000-10,000	10,000+	Weighted Average
A. Actual geocodes and CB boundary surrogates	53,824,007	161,338,079	48,533,791	98,119,208	23,741,532	124,915,586	71,782,388	22,412,618	3,187,173	607,854,382
B. Actual geocodes and "road" surrogates	51,615,104	151,568,046	46,110,529	90,888,595	22,176,030	120,024,791	70,213,555	21,845,927	3,263,839	577,708,416
Impact of substituting "road" surrogates for CB boundary surrogates	-4.1%	-6.1%	-5.0%	-7.4%	-6.6%	-3.9%	-2.2%	-2.5%	2.4%	-5.0%
C. Further replace actual geocode points with "road" surrogates	54,22[illegible]98	165,744,188	54,813,715	102,477,636	25,436,376	139,760,651	84,332,905	24,808,541	3,697,052	655,293,362
Additional impact of substituting "road" surrogates for actual geocodes	5.1%	9.4%	18.9%	12.8%	14.7%	16.4%	20.1%	13.6%	13.3%	13.4%
D. Further substitute all "road" surrogates with CB boundary surrogates	55,070,421	167,900,711	54,092,184	99,820,588	26,473,709	133,104,586	74,601,985	21,594,030	3,324,015	635,982,227
Additional impact of substituting all "road" surrogates with CB boundary surrogates	1.6%	1.3%	-1.3%	-2.6%	4.1%	-4.8%	-11.5%	-13.0%	-10.1%	-2.9%

	0-5	5-100	100-200	200-650	650-850	850-2550	2550-5000	5000-10,000	10,000+	Weighted Average
Percent actual geocode	19.2%	59.0%	78.2%	83.6%	83.5%	78.1%	65.4%	48.7%	54.1%	69.1%
DRD excess due to CB surrogates	12.1%	6.9%	14.7%	2.1%	13.8%	8.4%	6.0%	-7.5%	7.9%	6.7%
DRD excess due to road surrogates	26.3%	15.8%	24.1%	15.3%	17.6%	21.1%	30.7%	27.8%	24.5%	19.4%

Chart 2

Effects of Using Surrogate Geocodes on Cluster Size and Cable Distances

Southwestern Bell-Kansas	Distribution Route Distance									
Geocode Scenario	0-5	5-100	100-200	200-650	650-850	850-2550	2550-5000	5000-10,000	10,000+	Weighted Average
A. Actual geocodes and CB boundary surrogates	31,894 907	31,942,107	6,818,324	10,616,492	1,996,620	14,162,853	9,112,814	1,967,180	356,126	108,867,122
B. Actual geocodes and "road" surrogates	30,883,886	29,790,110	6,353,516	10,088,641	1,694,310	14,391,591	8,986,679	2,024,181	325,723	104,518,636
Impact of substituting "road" surrogates for CB boundary surrogates	-3.2%	-6.7%	-6.8%	-5.0%	-15.1%	1.6%	-1.4%	2.9%	-8.5%	-4.0%
C. Further replace actual geocode points with "road" surrogates	31,459,001	33,046,375	9,167,466	11,981,911	2,347,775	18,164,416	10,857,769	1,941,406	502,207	119,468,326
Additional impact of substituting "road" surrogates for actual geocodes	1.9%	10.9%	44.3%	18.8%	38.6%	26.2%	20.8%	-4.1%	54.2%	14.3%
D. Further substitute all "road" surrogates with CB boundary surrogates	33,17F "37	34,404,773	9,597,680	12,050,464	2,396,606	17,116,440	11,181,578	2,356,943	467,035	122,747,856
Additional impact of substituting all "road" surrogates with CB boundary surrogates	5.5%	4.1%	4.7%	0.6%	2.1%	-5.8%	3.0%	21.4%	-7.0%	2.7%
Percent actual geocode	9.0%	47.0%	67.0%	72.0%	78.0%	78.0%	75.0%	77.0%	87.0%	65.0%
DRD excess due to CB surrogates	44.6%	18.4%	60.8%	18.8%	25.7%	26.4%	30.3%	25.7%	35.8%	19.6%
DRD excess due to road surrogates	20.7%	23.3%	66.1%	26.1%	48.4%	33.2%	27.8%	-5.3%	62.3%	22.0%

Chart 3

Aggregate Results: Revised Aspect Ratio *

Distance Measure	0-5	5-100	100-200	200-400	650-850	850-2550	2550-5000	5000-10,000	10,000+	Total
Strand distance	157,676,946	430,928,496	69,503,235	124,111,287	32,636,403	179,539,859	107,027,161	38,816,635	9,254,090	1,149,496,112
Drop length included in Strand	580,101	24,560,846	17,578,026	52,796,690	18,944,409	126,833,000	95,245,452	37,122,078	12,212,795	385,873,398
DRD	95,791,350	362,354,599	73,080,387	130,420,835	33,260,673	166,922,132	91,761,708	33,031,273	7,205,946	993,828,904
DRD plus effective Drop	96,371,451	386,915,446	90,658,413	183,217,525	52,205,082	293,755,132	187,007,160	70,153,352	19,418,741	1,379,702,301
Pct increase due to Drop	0.6%	6.8%	24.1%	40.5%	57.0%	76.0%	103.8%	112.4%	169.5%	38.8%
DRD / Strand	61%	84%	105%	105%	102%	93%	86%	85%	78%	86%
Drop-adjusted DRD / Strand	61%	90%	130%	148%	160%	164%	175%	181%	210%	120%

* Reflects SB FL, Indiana Bell, SWB KS, NWB MN, NV Bell, Centel NV, and SB TN

Indiana Bell Revised Aspect Ratio

Distance Measure	0-5	5-100	100-200	200-400	650-850	850-2550	2550-5000	5000-10,000	10,000+	Total
Strand distance	2,202,977	67,344,042	10,771,429	19,540,948	4,246,403	27,845,921	18,434,442	4,540,773	1,352,388	154,279,322
Drop length included in Strand	9,392	2,460,610	2,159,498	7,005,860	1,893,479	18,215,030	13,791,332	3,855,608	1,260,380	50,651,189
DRD	1,370,187	55,250,882	11,724,994	21,644,283	4,152,109	26,519,283	14,348,361	3,693,533	992,986	139,696,619
DRD plus effective Drop	1,379,579	57,711,492	13,884,492	28,650,143	6,045,588	44,734,313	28,139,693	7,549,141	2,253,366	190,347,808
Pct increase due to Drop	0.7%	4.5%	18.4%	32.4%	45.6%	68.7%	96.1%	104.4%	126.9%	36.3%
DRD / Strand	62%	82%	109%	111%	98%	95%	87%	81%	73%	91%
Drop-adjusted DRD / Strand	63%	86%	129%	147%	142%	161%	171%	166%	167%	123%

Nevada Bell Revised Aspect Ratio

Distance Measure	0-5	5-100	100-200	200-400	650-850	850-2550	2550-5000	5000-10,000	10,000+	Total
Strand distance	21,143,317	6,391,246	2,000,411	1,307,176	835,030	3,821,905	1,902,111	1,272,286	516,296	39,189,778
Drop length included in Strand	122,755	659,432	504,708	529,006	538,777	1,513,294	1,518,674	970,244	399,021	6,755,910
DRD	18,566,159	6,045,816	2,003,050	1,337,652	804,408	3,808,815	1,526,797	933,446	374,624	35,400,767
DRD plus effective Drop	18,688,914	6,705,247	2,507,757	1,866,658	1,343,185	5,322,109	3,045,471	1,903,690	773,646	42,156,677
Pct increase due to Drop	0.7%	10.9%	25.2%	39.5%	67.0%	39.7%	99.5%	103.9%	106.5%	19.1%
DRD / Strand	88%	95%	100%	102%	96%	100%	80%	73%	73%	90%
Drop-adjusted DRD / Strand	88%	105%	125%	143%	161%	139%	160%	150%	150%	108%

Chart 3

Centel Nevada Revised Aspect ratio

Distance Measure	0-5	5-100	100-200	200-400	650-850	850-2550	2550-5000	5000-10,000	10,000+	Total
Strand distance	3,203,490	1,458,823	1,275,157	1,778,965	1,569,449	4,948,959	4,927,253	3,635,909	700,473	23,498,477
Drop length included in Strand	56,474	258,574	643,650	1,380,283	1,237,269	3,805,256	4,814,683	3,966,449	770,249	16,932,887
DRD	2,710,897	1,621,068	1,385,084	1,853,043	1,649,710	4,637,207	4,181,910	3,334,524	602,434	21,975,876
DRD plus effective Drop	2,767,370	1,879,643	2,028,733	3,233,326	2,886,979	8,442,463	8,996,594	7,300,974	1,372,682	38,908,763
Pct increase due to Drop	2.1%	16.0%	46.5%	74.5%	75.0%	82.1%	115.1%	119.0%	127.9%	77.1%
DRD / Strand	85%	111%	109%	104%	105%	94%	85%	92%	86%	94%
Drop-adjusted DRD / Strand	86%	129%	159%	182%	184%	171%	183%	201%	196%	166%

SWB KS Revised Aspect Ratio

Distance Measure	0-5	5-100	100-200	200-400	650-850	850-2550	2550-5000	5000-10,000	10,000+	Total
Strand distance	66,560,239	41,329,743	6,807,134	11,101,712	2,306,058	17,922,240	12,353,307	2,669,302	486,913	161,526,647
Drop length included in Strand	95,462	2,342,886	1,449,915	3,345,585	1,099,997	10,883,594	9,628,966	2,449,833	593,359	31,889,597
DRD	33,033,660	32,153,069	6,951,435	10,643,649	2,016,040	14,159,255	9,095,989	1,963,114	355,142	110,371,354
DRD plus effective Drop	33,129,121	34,495,955	8,401,350	13,989,234	3,116,037	25,042,849	18,724,956	4,412,947	948,500	142,260,951
Pct increase due to Drop	0.3%	7.3%	20.9%	31.4%	54.6%	76.9%	105.9%	124.8%	167.1%	28.9%
DRD / Strand	50%	78%	102%	96%	87%	79%	74%	74%	73%	68%
Drop-adjusted DRD / Strand	50%	83%	123%	126%	135%	140%	152%	165%	195%	88%

BS FL Revised Aspect Ratio

Distance Measure	0-5	5-100	100-200	200-400	650-850	850-2550	2550-5000	5000-10,000	10,000+	Total
Strand distance	10,318,585	65,799,300	19,350,623	39,652,738	11,919,617	66,912,382	44,323,528	18,348,056	2,893,515	279,518,240
Drop length included in Strand	166,645	7,316,253	6,097,520	19,895,856	7,382,628	48,584,427	37,325,871	15,065,427	3,368,173	145,202,799
DRD	7,266,610	57,056,680	18,669,617	40,320,470	12,317,860	60,815,187	38,515,458	15,791,945	2,122,295	252,876,123
DRD plus effective Drop	7,433,255	64,372,933	24,767,137	60,216,326	19,700,488	109,399,614	75,841,330	30,857,372	5,490,468	398,078,922
Pct increase due to Drop	2.3%	12.8%	32.7%	49.3%	59.9%	79.9%	96.9%	95.4%	158.7%	57.4%
DRD / Strand	70%	87%	96%	102%	103%	91%	87%	86%	73%	90%
Drop-adjusted DRD / Strand	72%	98%	128%	152%	165%	163%	171%	168%	190%	142%

Chart 3

NWB MN Revised Aspect Ratio

Distance Measure	0-5	5-100	100-200	200-400	650-850	850-2550	2550-5000	5000-10,000	10,000+	Total
Strand distance	46,714,352	74,070,515	9,589,177	17,075,041	3,434,202	24,323,785	14,781,865	5,582,587	2,391,562	197,963,068
Drop length included in Strand	95,428	2,942,807	2,502,894	7,061,954	2,099,682	19,221,961	16,194,473	7,370,850	4,548,235	62,038,284
DRD	28,214,404	60,054,247	10,730,186	18,910,578	3,676,684	24,179,503	13,378,726	4,873,962	2,042,056	166,080,340
DRD plus effective Drop	28,309,831	62,997,055	13,2?3,080	25,972,532	5,776,366	43,401,463	29,573,199	12,244,812	6,590,291	228,098,630
Pct increase due to Drop	0.3%	4.9%	23.3%	37.3%	57.1%	79.5%	121.0%	151.2%	222.7%	37.4%
DRD / Strand	60%	81%	112%	111%	107%	99%	91%	87%	85%	84%
Drop-adjusted DRD / Strand	61%	85%	138%	152%	168%	178%	200%	219%	276%	115%

BS TN Revised Aspect Ratio

Distance Measure	0-5	5-100	100-200	200-400	650-850	850-2550	2550-5000	5000-10,000	10,000+	Total
Strand distance	7,543,988	174,534,828	19,709,305	33,654,707	8,327,744	33,764,868	12,304,857	2,769,742	912,943	293,522,582
Drop length included in Strand	33,?"6	8,580,284	4,219,840	13,578,1?7	4,692,577	24,609,439	11,971,452	3,443,667	1,273,378	72,402,732
DRD	4,629,433	150,172,837	21,616,021	35,711,159	8,643,862	32,802,881	10,714,466	2,440,750	716,410	267,447,819
DRD plus effective Drop	4,663,379	158,753,121	25,835,862	49,289,306	13,336,439	57,412,321	22,685,918	5,884,417	1,989,788	339,850,551
Pct increase due to Drop	0.7%	5.7%	19.5%	38.0%	54.3%	75.0%	111.7%	141.1%	177.7%	27.1%
DRD / Strand	61%	86%	110%	106%	104%	97%	87%	88%	78%	91%
Drop-adjusted DRD / Strand	62%	91%	131%	146%	160%	170%	184%	212%	218%	116%

Chart 4

Effects of Using Surrogate Geocodes on Cluster Size and Cable Distances

Southwestern Bell-Kansas	Strand Distance									
Geocode Scenario	0-5	5-100	100-200	200-650	650-850	850-2550	2550-5000	5000-10,000	10,000+	Weighted Average
A. Actual geocodes and CB boundary surrogates	66,550,236	41,329,743	6,807,134	11,101,712	2,306,058	17,922,240	12,353,307	2,669,302	486,913	161,526,647
B. Actual geocodes and "road" surrogates	66,182,125	38,808,174	6,337,955	10,265,111	1,875,905	18,336,195	12,316,256	2,772,953	421,420	157,316,094
Impact of substituting "road" surrogates for CB boundary surrogates	-0.6%	-6.1%	-6.9%	-7.5%	-18.7%	2.3%	-0.3%	3.9%	-13.5%	-2.6%
C. Further replace actual geocode points with "road" surrogates	66,573,347	42,308,366	8,336,914	11,259,676	2,353,932	20,082,384	12,131,623	2,073,205	515,652	165,635,140
Additional impact of substituting "road" surrogates for actual geocodes	0.6%	9.0%	31.5%	9.7%	25.5%	9.5%	-1.5%	-25.2%	22.4%	5.3%
D. Further substitute all "road" surrogates with CB boundary surrogates	68,503,372	44,845,784	9,035,208	11,411,350	2,360,673	18,533,930	12,426,578	2,386,988	439,381	169,943,244
Additional impact of substituting all "road" surrogates with CB boundary surrogates	2.9%	6.0%	8.4%	1.3%	0.3%	-7.7%	2.4%	15.1%	-14.8%	2.6%
Percent actual geocode	9.0%	47.0%	67.0%	72.0%	78.0%	79.0%	75.0%	77.0%	87.0%	65.0%
Strand excess due to CB surrogates	32.6%	18.1%	48.9%	3.9%	3.0%	4.3%	0.8%	-13.7%	-11.2%	8.0%
Strand excess due to road surrogates	6.6%	19.2%	47.1%	13.5%	32.7%	12.1%	-2.0%	-32.8%	25.7%	8.1%

Chart 5

Strand Map Distance Will Commonly Exceed the Required Amount of Distribution Route Distance Because it Includes Some Portion of the Drop

Next-door house geocodes closer than across-street house geocodes

Number of lots:	20	
Lot width:	w	w < 100'
Lot depth:	2w	

Strand Map Distance

Vertical:	2w - 50'	Horizontal:	9w
	100'		9w
Subtotal:	2w + 50'	Subtotal:	18w
Total SMD:	20w + 50'		
Amount of drop distance implicitly included in SMD:	20 * 50'		
	1000'		

Distribution Route Distance Required

Backbone:	2w
Branch:	9w
Required DRD:	11w

Compare Strand Map Distance to Required Distribution Route Distance

SMD		DRD
20w + 50'	>	11w

Thus, SMD generally will exceed the DRD required to connect customer locations.
Note that if the 1000' of drop distance implicitly included in the SMD is also added to the DRD, this augmented DRD will exceed the SMD because w < 100'

SMD		DRD + allocated drop
20w + 50'	<	11w + 1000'

Chart 5

Strand Map Distance Will Commonly Exceed the Required Amount of Distribution Route Distance Because it Includes Some Portion of the Drop

Insert Data

Number of lots:	20
Lot width:	75
Lot depth:	150

Strand Map Distance to Connect Customer Locations

Vertical:	100	Horizontal:	675
	100		675
Subtotal:	200	Subtotal:	1350
Total SMD:	1550		
Amount of drop distance implicitly included in SMD:	1000		

Distribution Route Distance Required to Connect Customer Locations

Backbone:	150
Branch:	675
Required DRD:	825

Compare Strand Map Distance to Required Distribution Route Distance

SMD		DRD
1550	>	825

Thus, SMD generally will exceed the DRD required to connect customer locations. This occurs because the raw DRD does not include the amount of drop distance that is used for it to reach the equivalent geocode locations as reached by the strand distance.

SMD		DRD + allocated drop
1550	<	1825

Chart 5

Strand Map Distance Will Commonly Exceed the Required Amount of Distribution Route Distance Because it Includes Some Portion of the Drop

Insert Data

Number of lots:	20
Lot width:	125
Lot depth:	250

Strand Map Distance to Connect Customer Locations

Vertical:	200	Horizontal:	1125
	1000		0
Subtotal:	1200	Subtotal:	1125
Total SMD:	2325		
Amount of drop distance implicitly included in SMD:	1000		

Distribution Route Distance Required to Connect Customer Locations

Backbone:	250
Branch:	1125
Required DRD:	1375

Compare Strand Map Distance to Required Distribution Route Distance

SMD		DRD
2325	>	1375

Thus, SMD generally will exceed the DRD required to connect customer locations. This occurs because the raw DRD does not include the amount of drop distance that is used for it to reach the equivalent geocode locations as reached by the strand distance.

SMD		DRD + allocated drop
2325	<	2375

HAI Model v 5.0a

Why it Engineers the Appropriate Amount of Distribution Plant

AT&T and MCI

June 10, 1998

Overview

- Several parties have suggested that the HAI Model 5.0a (HM) may not engineer lengths of distribution plant sufficient to reach all customers because:
  - PNR cluster configurations do not match sufficiently closely the distribution area (DA) engineered by the HM
  - HM distribution cable lengths are inadequate to reach to the edges of the PNR clusters
- A correctly executed analysis of these issues demonstrates that the HM engineers:
  - Sufficient distribution plant to reach customers in the lowest density zones, where universal service concerns are most acute
  - Slightly excess amounts of distribution plant in the upper density zones, thus overstating unbundled loop costs in these zones

Overview

- The reasons why these parties' rudimentary analyses may have suggested an opposite conclusion is because their analyses have failed to:
  - account for how PNR customer geocode points are developed
  - account for where these geocode points are located relative to the customer's premises
  - compare HM distribution plant lengths against a correct standard for measuring "sufficient" plant
  - use a comprehensive sample of actual customer locations as the basis for making plant length comparisons -- instead using either:
    - a hand-picked set of clusters, or
    - clusters artificially formed from randomly generated points

How the HM Engineers Distribution

- PNR develops customer clusters based on geocode data specifying the locations of over 100 million customers
- The cluster information that is reported to the HM includes the latitude and longitude of the cluster centroid, its area, and its N-S/E-W aspect ratio (height/width)
- The HM Distribution Module (DM) then engineers distribution cables to "cover" a rectangle that has the same area, centroid and aspect ratio as the cluster
  - for main clusters, this cable is in backbone and branch (BB&B) configuration
  - in outlier clusters, cable is engineered directly based on the distances between individual customer locations

Main Cluster BB&B Calculations

Assume:

Area of distribution area = A

Aspect (H/W) ratio of area = r

Width of distribution area = $(A/r)^{1/2}$

Height of distribution area = $(Ar)^{1/2}$

Number of customer locations = N

Lot depth to width ratio = 2:1

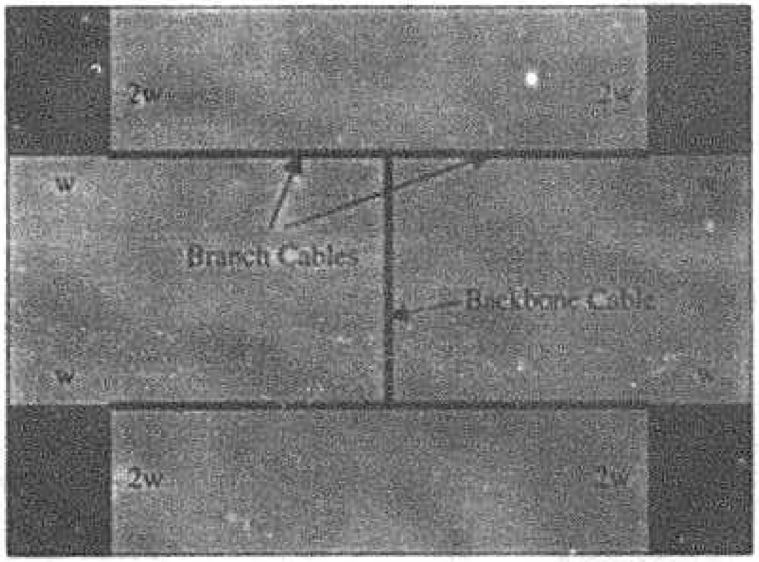
Then:

Area per location = $A/N = w \cdot 2w = 2w^2$

(where w=lot width, and 2w=lot depth)

Lot width = $(A/2N)^{1/2}$

Lot depth = $(2A/N)^{1/2}$



Thus:

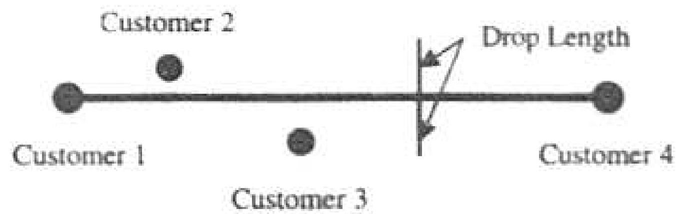
Backbone cable length = $(Ar)^{1/2} - 4w$

$2 \times$ Branch cable length = $(A/r)^{1/2} - 2w$

Outlier Cluster Subscriber Road Cable

Customers are within ±1 drop length of being colinear

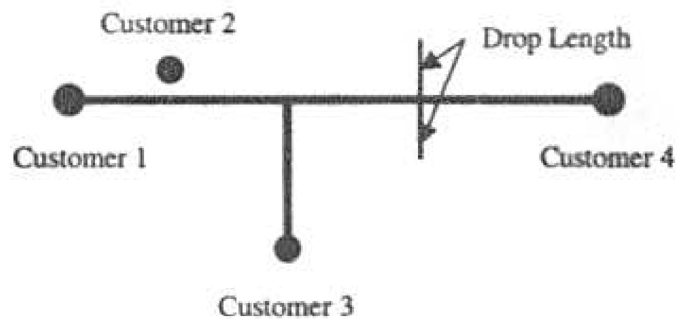
Subscriber road cable length is distance between two locations farthest from each other (major axis of the cluster). Customers 2 and 3 are served by drop wire off of road cable.



Customers are not within ±1 drop length of being colinear

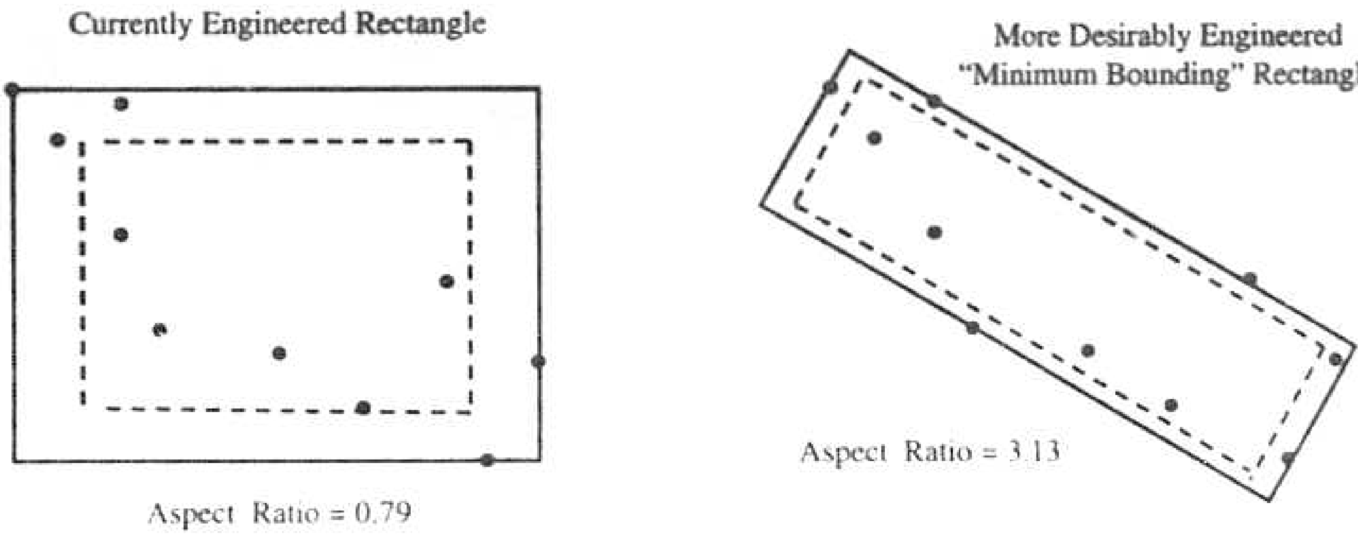
Primary subscriber road cable length is the distance of the major axis of the cluster.

Secondary subscriber road cable are spurs off of the primary with total length equal to the minor axis of the cluster.



Cluster Configuration Issue

- Because PNR reports only the N-S/E-W aspect ratio of the cluster, the rectangular DAs designed by the HM's DM may differ in configuration from the actual configuration of the cluster



Cluster Configuration Issue

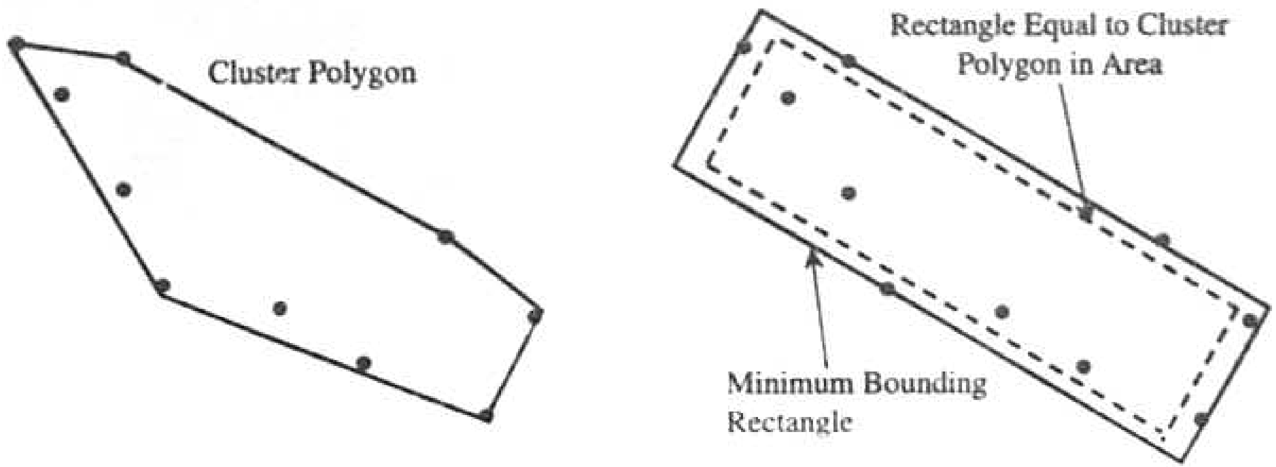
- The difference between the actual cluster configuration and the engineered rectangle will be largest for clusters that are both:
  - extremely long and thin, *and*
  - rotated maximally away from a N-S/E-W orientation
- PNR will now calculate the aspect ratio of the rotated minimum bounding rectangle (shown on the right in the previous slide)
  - this superior aspect ratio will now be used by the HM's DM, and
  - HM DAs will now match more closely all clusters' actual configurations
- The numerical effect of this adjustment on HM-calculated distribution distances is negligible (see Chart 1)

Cluster Configuration Issue

- Sprint's focus on this issue is surprising because even the current HM practice of engineering DAs as properly located N-S/E-W rectangles is superior to the BCPM's practice of engineering DAs as arbitrarily located *squares*
- With the engineering of optimally rotated rectangles, the HM's superiority over the BCPM becomes even larger
- Furthermore, because the BCPM makes use no use of actual customer location data, it cannot be improved to have its DAs comport to actual customer clusters

Cable Length Issue

Sprint suggests that because the HM engineers BB&B cable to cover a rectangular area equal to the cluster polygon's area (which lies within the cluster's minimum bounding rectangle), HM cable lengths may be inadequate to reach customers located at the polygon's vertices



Cable Length Issue

- Sprint appropriately focuses its theoretical concerns over cable lengths to HM main clusters
- In outlier clusters (the most rural clusters considered by the HM), cable already is engineered more directly to link customer locations
- The following analysis will demonstrate that the HM DM engineers adequate distribution plant

Effect of Surrogate Dispersion

Concept:

If PNR clusters are larger than real-world clusters due to their inclusion of surrogate geocodes, the amount of distribution plant engineered to serve the PNR cluster may well be adequate to serve all customers in the real-world cluster -- even though this plant may not reach all the way to the PNR cluster's vertices

Demonstration:

The following empirical analysis determines the amount of excess cable that the HM engineers because it designs to PNR clusters that include surrogate geocode points

Effect of Surrogate Dispersion

- Compare distribution route distances (DRDs) generated by PNR clusters formed from placing customers at:
  - actual geocode points plus CB-boundary surrogates
  - actual geocode points plus Road surrogates
  - only Road surrogate locations
  - only CB-boundary surrogate locations
- Differences in DRD generated by substituting surrogate points for actual points indicate the magnitude of DRD excess resulting from the HM's use of surrogate points

(See Chart 2 and Slide 22)

Effect of Surrogate Dispersion

- This analysis confirms that either surrogate methodology generates points that display less clustering than actual geocode points
- Thus, if all customer locations were based on actual geocodes, roughly 12% less DRD would be required in DZ1 in this real-world situation than is otherwise modeled by the HM DM

Effect of Actual Geocode Offsets

Concept:

- A loop distribution network should have enough plant so that all customer locations within a cluster may be linked to that DA's Serving Area Interface
- This is accomplished in the HM through an integrated combination of:
  - Backbone cable
  - Branch cable (cable that runs along a street abutting customer's house)
  - Drop cable (cable that connects from the street to the house)

Effect of Actual Geocode Offsets

- Thus, depending on the particular customer location point mapped to by an alternative cable distance measure, total cable lengths calculated by the HM must be pulled from as many of its cable "budgets" (BB, B and drop) as are appropriate for this cable to reach to the same customer location point
- Other comparisons, such as those performed by Sprint are "apples to oranges"

Effect of Actual Geocode Offsets

- If the alternative distance measure maps only to the street abutting the customer's house, the appropriate comparison is against the HM BB&B cable distance
- If the alternative distance measure maps beyond the street and into the customer's lot, then a portion of the HM drop cable sufficient to reach an equivalent distance into the customer's lot needs to be added to the HM BB&B cable distance before making the comparison

(Alternatively, one could subtract the appropriate drop cable from the alternative distance measure before comparing it to HM BB&B cable distances)

Effect of Actual Geocode Offsets

Demonstration:

- Because the actual geocode points used by PNR in creating clusters are offset by 50 feet from the road centerline, any alternative distance measure that maps to these geocode points includes an implied 50 feet of drop cable per customer location
- Thus, either 50 feet per actual customer location must be subtracted from the alternative distance measure before comparing it with the HM BB&B cable length, or 50 feet of drop cable length per customer location must be added to the HM BB&B cable length before comparing it with the alternative distance measure

Effect of Actual Geocode Offsets

Empirically, the effect of adding 50 feet of drop cable length to HM BB&B cable lengths raises the implied HM DRD by 38.8% overall

(See Chart 3 for fuller results)

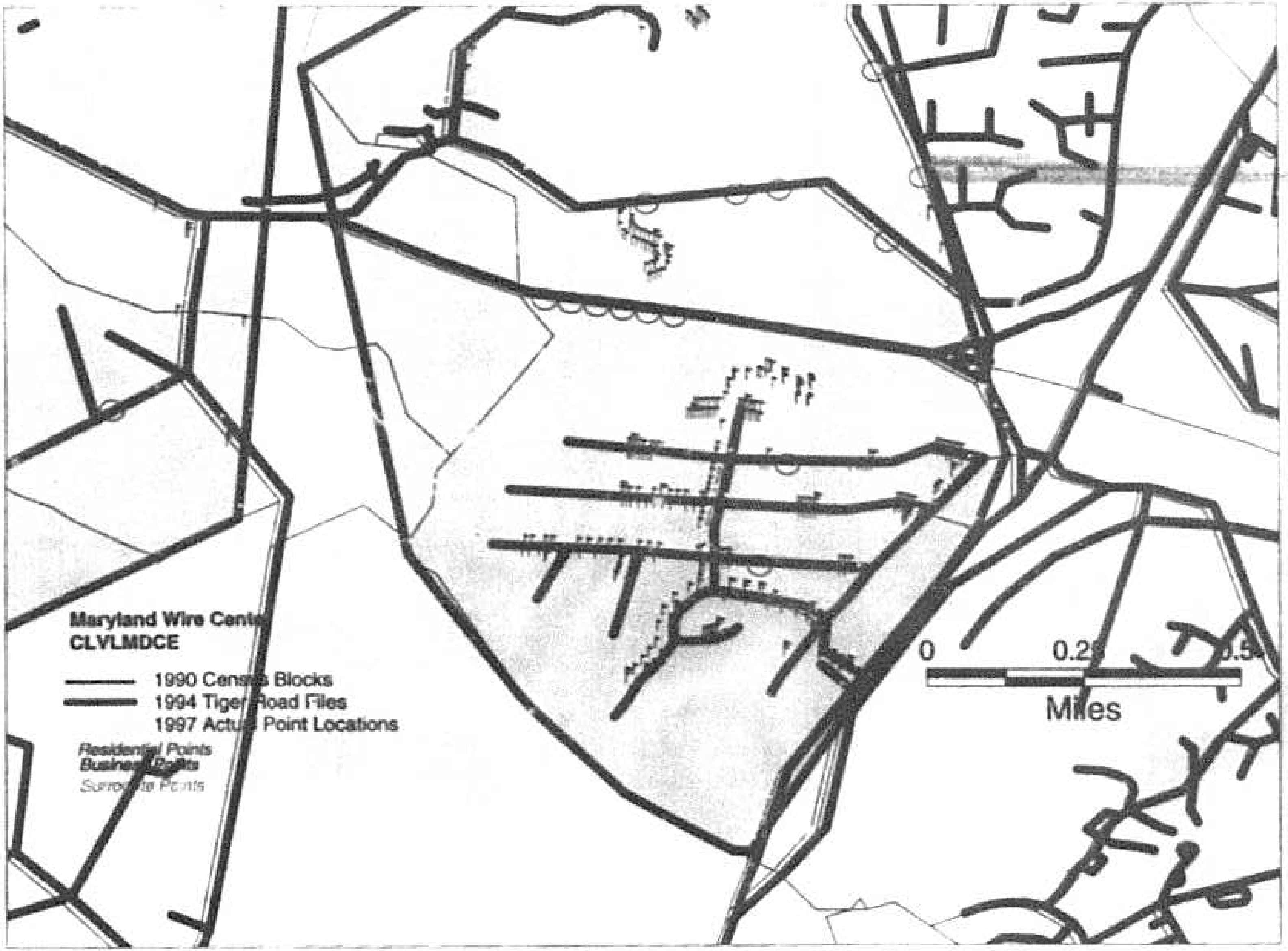
Effect of Empty Space in Clusters

Concept:

- Because even within clusters, there is further clustering (thus empty space), the HM DM practice of spreading BB&B cables uniformly throughout the engineered rectangle may place unneeded branch cables

Demonstration:

- (See following cluster map as an example)
- Thus, methodologies that assume quasi-uniform distributions of customers within cluster cannot be used as a standard for determining whether all customers are reached


Maryland Wire Cent
CLVLMDCE
1990 Cens Blocks
1994 Tiger Road Files
1997 Actu Point Locations
Residenti Points
Busine
Surro Points
0
0.2
Miles

Sprint's Analysis

- Investigations by Sprint have used a distance concept known as the "minimum spanning tree" (MST) between geocode points to as a distance standard to compare against HM distribution cable lengths
- Sprint claims to find that in many clusters (of its selection), the amount of HM-engineered BB&B cable falls short of the MST distance for that cluster, and concludes that the HM under-engineers distribution plant

Faults in Sprint's Analysis

- Sprint makes no correction for the excess area that exists within HM clusters because they are formed in part from CB-boundary surrogate points
- Sprint's failure to make such an adjustment is especially curious because the BCPM sponsors have:
  - argued in the past that HM clusters are too large and cover too much of the U.S. geography
  - advocated the use of a "Road" surrogate methodology for the assumed placement of customer locations
  - had PNR placed all surrogate points on roads rather than on CB boundaries, calculated MST distances would have dropped by about 2.6% (see Chart 4)

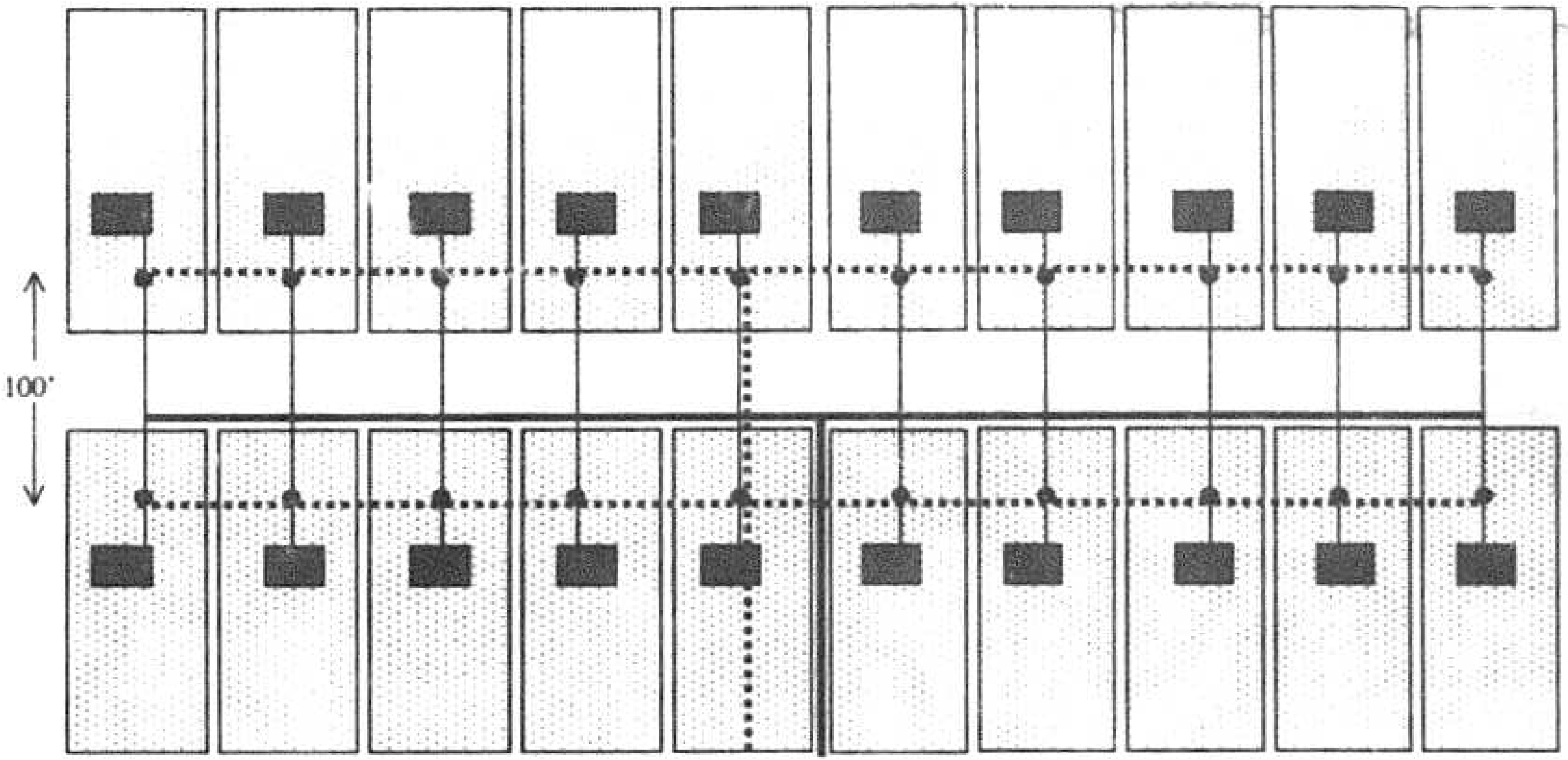
Faults in Sprint's Analysis

Sprint makes no upwards adjustment to HM DRD (or downwards adjustment to its MST lengths) to correct for the fact that the MST includes substantial portions of drop cable (engineered separately by the HM DM) before comparing this distance with the HM BB&B distance

See following viewgraphs and example numerical effects (Chart 5)

Distribution Cable Lengths vs. Strand Distances

Next-Door House Geocodes Closer than Across-Street House Geocodes



- House
- Geocode Point (offset 50' from street centerline)
- Rectangular Lots (w wide, 2w deep, w<100')
- Backbone or Branch Cable
- Drop Cable
- Strand Map

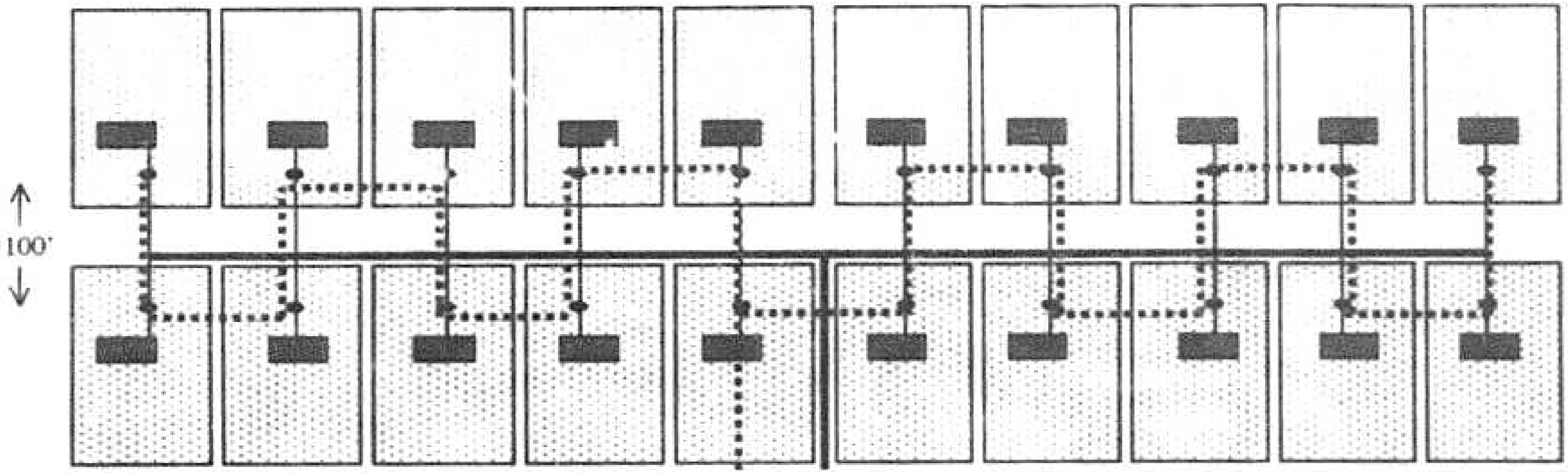
If w=75' (~¼ acre)

Mapped strand = 1550'
(but includes 1000' of drop)

Required Distribution Cable length = 825'

Distribution Cable Lengths vs. Strand Distances

Across-Street House Geocodes Closer than Next-Door House Geocodes



House

Geocode Point (offset 50' from street centerline)

Rectangular Lots (w wide, 2w deep, w>100')

Backbone or Branch Cable

Drop Cable

Strand Map

If w=150' (~1 acre)

Mapped strand = 2600'

(but includes 1000' of drop)

Required Distribution

Cable length = 1650'

Faults in Sprint's Analysis

It is especially curious that Sprint chooses to use a theoretical concept like MST as its standard for "correct" cable distances rather than statistically valid empirical data within its control (such as average loop lengths by wire center or plant records describing cable route distances) that could shed a clearer light on:

- whether on average the HM under- or over-engineers distribution cable lengths, or
- how frequently the MST is an accurate or useful distance concept, or what its biases might be

Faults in Sprint's Analysis

- In Nevada, the same state for which Sprint has proffered MST examples purporting to show that HM cable lengths are inadequate, Nevada Bell has reported that, on average
  - HM builds loops that exceed Nevada Bell's actual loop lengths, and
  - this over-building is greatest in rural areas
- In Texas, the PUC staff required SWBT to provide its average loop lengths for a specified collection of wire centers
  - HAI loop lengths exceeded SWBT lengths in 14 out of these 16 wire centers, and
  - in the other 2, HAI loop lengths were short by only 4.8%

Prisbrey's Analysis

- Prisbrey states that his analysis
  - "does not attempt to test the accuracy of the distribution or feeder algorithms used in the HAI model. Instead, it attempts to test the accuracy of the preprocessing algorithms used in converting geocoded and surrogate geocoded customer locations into rectangular serving areas"
- Its method of doing this is to use:
  - "a Monte Carlo simulation of a large number of randomly generated customer locations"
  - a particular assumption about how customer lots may be laid out in a uniform checkerboard fashion for distribution engineering by the HM
  - two distance/dispersion measures: the length of the MST and the length of a star network (SN)

Prisbrey's Analysis

- Although Prisbrey states that his methodology and assumptions do not provide "a test of the adequacy of the distribution plant ... built by the HAI Model," others have interpreted Prisbrey's analysis to suggest that the HM tends to under-build distribution plant everywhere, and that the shortfall is most severe in rural areas
- These parties focus on a statement by Prisbrey that the HM algorithms build:
  - a star network that is 15.4% less in length than exists within his randomly generated clusters of size 25
  - a MST that is 41.5% less in length than exists within his randomly generated clusters of size 25

Faults With These Conclusions

Prisbrey's analysis cannot be used to test the adequacy of HM distribution cable lengths because it:

- assumes a peculiar DA size and shape
- uses random customer locations rather than PNR actual and surrogate geocoded customer locations
- fails to recognize that multiple customers frequently have the same geocodes
- does not replicate the use of actual HAI engineering algorithms

Indeed, Prisbrey does not claim that his analysis demonstrates inadequate HM distribution cable lengths

In fact, if correctly executed, Prisbrey's analysis demonstrates that cable lengths engineered by the HM DM are adequate to reach its customers

Setting the Analytic Stage

Note that Prisbrey's analysis applies only to HM main clusters with 5 or more lines, and does not apply to the most rural clusters addressed by the HM, outlier clusters which have less than 5 lines

Note, too, that the average size of main clusters within the HM is:

- DZ1 (0-5 lines/sq mi): 34 locations/cluster
- DZ2 (5-100 lines/sq mi): 175 locations/cluster
- DZ3-DZ9 (100+ lines/sq mi): 560 to 791 locations/cluster

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Correcting for DA Size

A substantial skewing of Prisbrey's analysis arises because its algorithm's default setting places its randomly-generated customer locations within square areas that always approach 18 kft by 18 kft in size

- 18 kft x 18 kft (or 11.6 sq mi) is the absolute maximum size that the HM DM will engineer as a DA
- actual HM main clusters (<200 locations) average 6.3 sq mi in size, and its engineered DAs are even smaller
- by assuming a maximum size DA, customer lot size is biased upward -- and because the HAI DM places BB&B cables to within one lot depth and width of the the DA's boundaries, this excessive lot size will depress artificially the average DRD calculated by Prisbrey's algorithm

Correcting for DA Shape

- In addition to the skewing created by modeling only maximally-sized square DAs, a further bias results from modeling only square DAs
  - in a BB&B configuration, it will take slightly more cable to serve a square DA than a rectangular DA of equal size
  - actual HM clusters have an average aspect ratio of 1.8
- When Prisbrey's Monte Carlo algorithm is re-run to generate customer locations in non-square configurations that are smaller than 11.6 sq miles in size, a far closer match between SN/MST dispersion and HM dispersion is obtained

  (See Charts 7 and 8)

Correcting for Random Locations

- Another significant limitation of Prisbrey's analysis results from its use of randomly-generated (Monte Carlo) customer location points -- rather than actual customer geocode points
- By randomly locating its customers, Prisbrey's algorithm ignores the systematic clustering of customers that exists *within* PNR clusters. Such clustering within clusters:
  - tends to ensure that the actual SNs or MSTs associated with clusters will be significantly shorter than those calculated by Prisbrey's algorithms for random clusters (See Chart 2)
  - makes it likely that there is empty space within a cluster -- which may obviate the need for one or more branch cables

Correcting for Random Locations

- In fact, Prisbrey's Monte Carlo assumptions tend to create on average a uniform spread of customers across DAs -- an inaccurate modeling assumption that previously has been rejected by the Commission (see, 7/18/97 FNPRM at ¶44)
  - Thus, because cost models' use of uniform customer distributions has been rejected as inaccurate, a set of random points that tend to approximate a uniform distribution should not be used as a reference standard to evaluate the accuracy or "bias" of the HM
- When actual geocoded customer locations from the HM are inserted into Prisbrey's algorithms, even closer matches between SN/MST dispersion and HM dispersion are obtained (See Charts 9 and 10)

Correcting for Surrogate Locations

In addition, a further adjustment must be inserted to calculated HM distribution cable lengths to account for the fact that HM clusters are oversized due to their inclusion of surrogate geocode points

As shown earlier, this characteristic causes DZ1 HM DRDs to exceed by about 12% the amount that might be calculated if all customers' geocodes were known precisely

(See Charts 11 and 12)

Recognizing Subtending Outliers

Because analyses that consider only main clusters are partial, distribution cable distances associated with outlier clusters should be added to the cable lengths of their "home" main cluster

This further increases the amounts of cable associates with rural clusters and reduces and differences between HAI-modeled dispersion and SN/MST dispersion

(See Charts 13 and 14)

Evaluating the Results

- Finally, it is useful to evaluate these HAI vs. SN/MST dispersion ratios at the average number of locations per HM main cluster in DZ1 and DZ2
- This evaluation indicates that correctly developed dispersion ratios suggest that the HM engineers adequate (or more) cable lengths
- In particular, these dispersion ratios are:
  - very close to 1 for average size DZ1 main clusters, and
  - substantially above 1 for DZ2 and above main clusters

(See Charts 15 and 16)

Further Work

- If any adjustments to the HM are indicated by these analyses, they should have the effect of "twisting" the cable length comparison curves to:
  - ensure that even below-average size DZ1 clusters (<34 locations) have correct cable amounts, and
  - reduce the amounts of excess distribution cable engineered in clusters above an average size DZ1 cluster (>34 locations)
- ILECs should be required to provide statistically valid measures of actual plant lengths placed across all zones
  - average loop length by wire center
  - loop cable route distances

Further Work

- Based on the analyses performed here, HM processes will be adjusted as follows:
  - PNR will report the aspect ratio of minimum bounding rectangle to the HM DM
  - the HM DM will adjust downwards its count of drops to match more closely the number of separate customer locations
- Based on further data to be provided by the ILECs concerning proper targets for DRD, the HM DM also may be adjusted to provide for this "twisting"

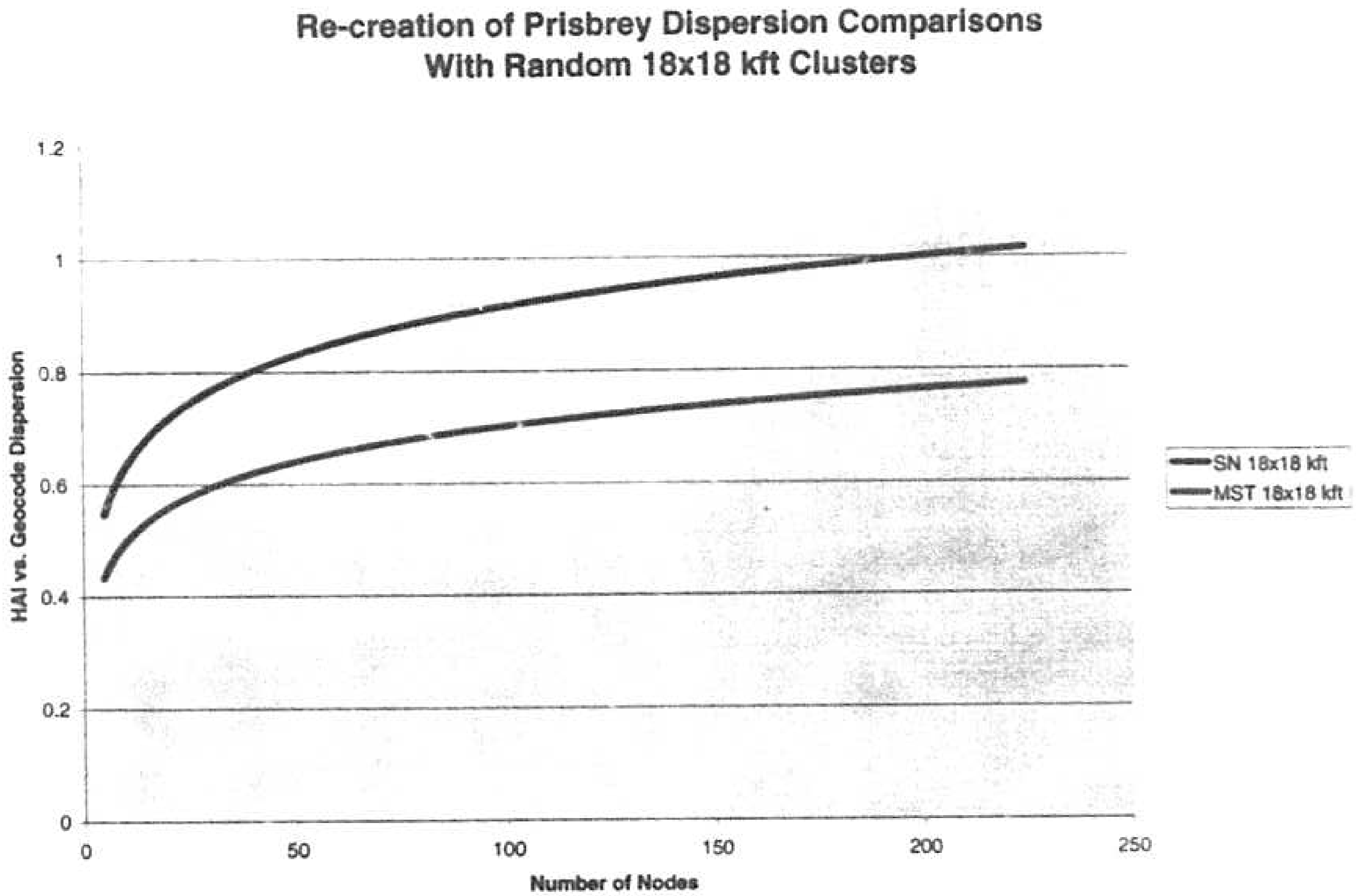
Further Work

These HM DM adjustments may, variously, include:

- BB&B cable length adjustments by DZ to:
  - orient BB cable always along the major axis of rectangle
  - push BB&B cable more toward the edges of the cluster
  - ensure a minimum BB cable length
- Normalize distribution cable lengths to an appropriate statistical measure of inter-customer distance

Overall evaluation of the accuracy of the model should be consistent with the granularity of the universal service support program

Chart 6



Re-creation of Prisbrey Dispersion Comparisons
With Random 18x18 kft Clusters
1.2
1
0.8
0.6
0.4
0.2
0
HAI vs. Geocode Dispersion
0
50
100
150
200
250
Number of Nodes
SN 18x18 kft
MST 18x18 kft

Chart 7

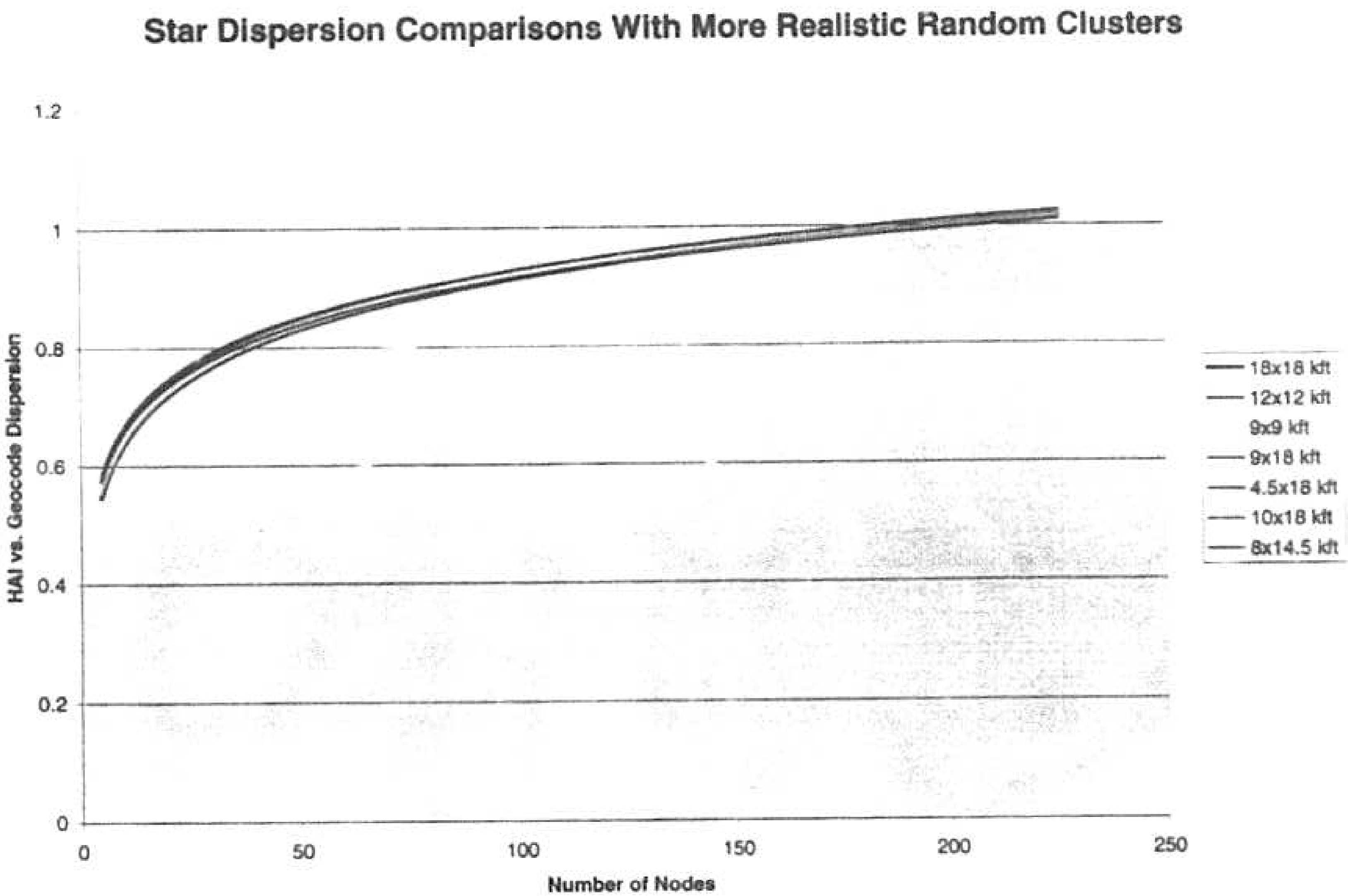

Star Dispersion Comparisons With More Realistic Random Clusters
HAI vs. Geocode Dispersion
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
Number of Nodes
18x18 kft
12x12 kft
9x9 kft
9x18 kft
4.5x18 kft
10x18 kft
8x14.5 kft

Chart 9

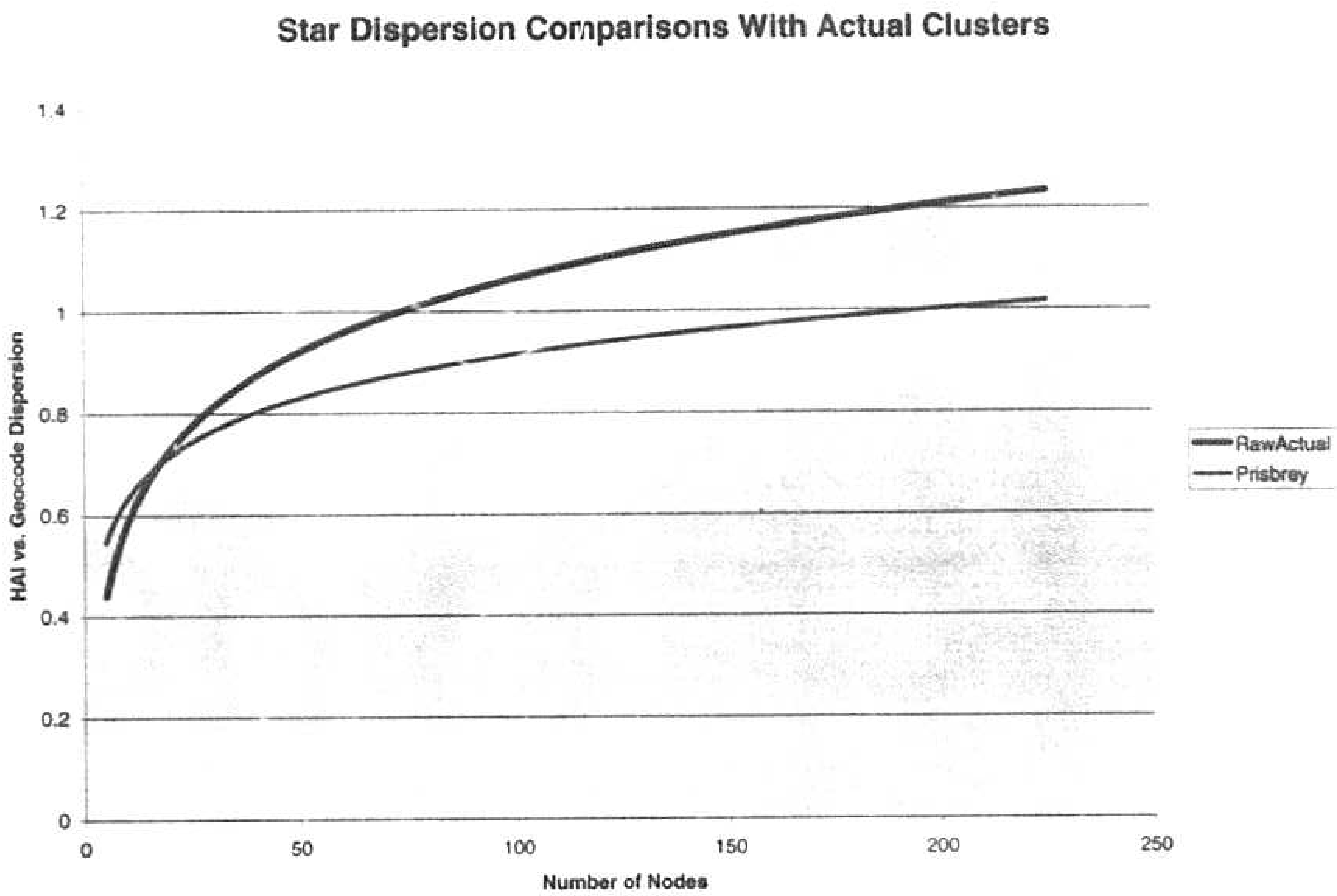

Star Dispersion Comparisons With Actual Clusters
1.4
1.2
1
0.8
0.6
0.4
0.2
0
HAI vs. Geocode Dispersion
0
50
100
150
200
250
Number of Nodes
RawActual
Prisbrey

Chart 10

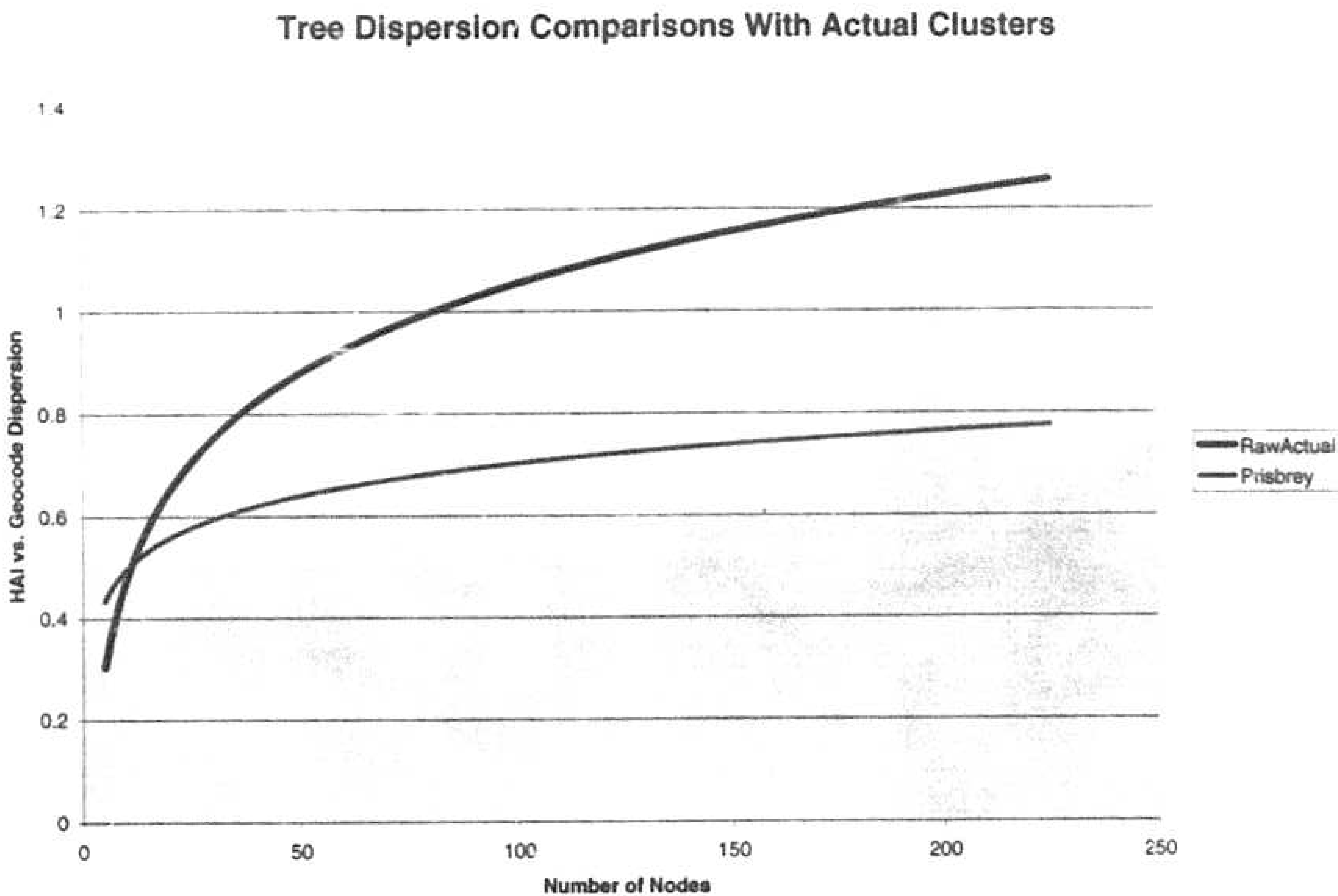

Tree Dispersion Comparisons With Actual Clusters
1.4
1.2
1
0.8
0.6
0.4
0.2
0
HAI vs. Geocode Dispersion
0
50
100
150
200
250
Number of Nodes
RawActual
Prisbrey

Chart 11

Star Dispersion Comparisons With Actual Clusters Including Surrogate Adjustment

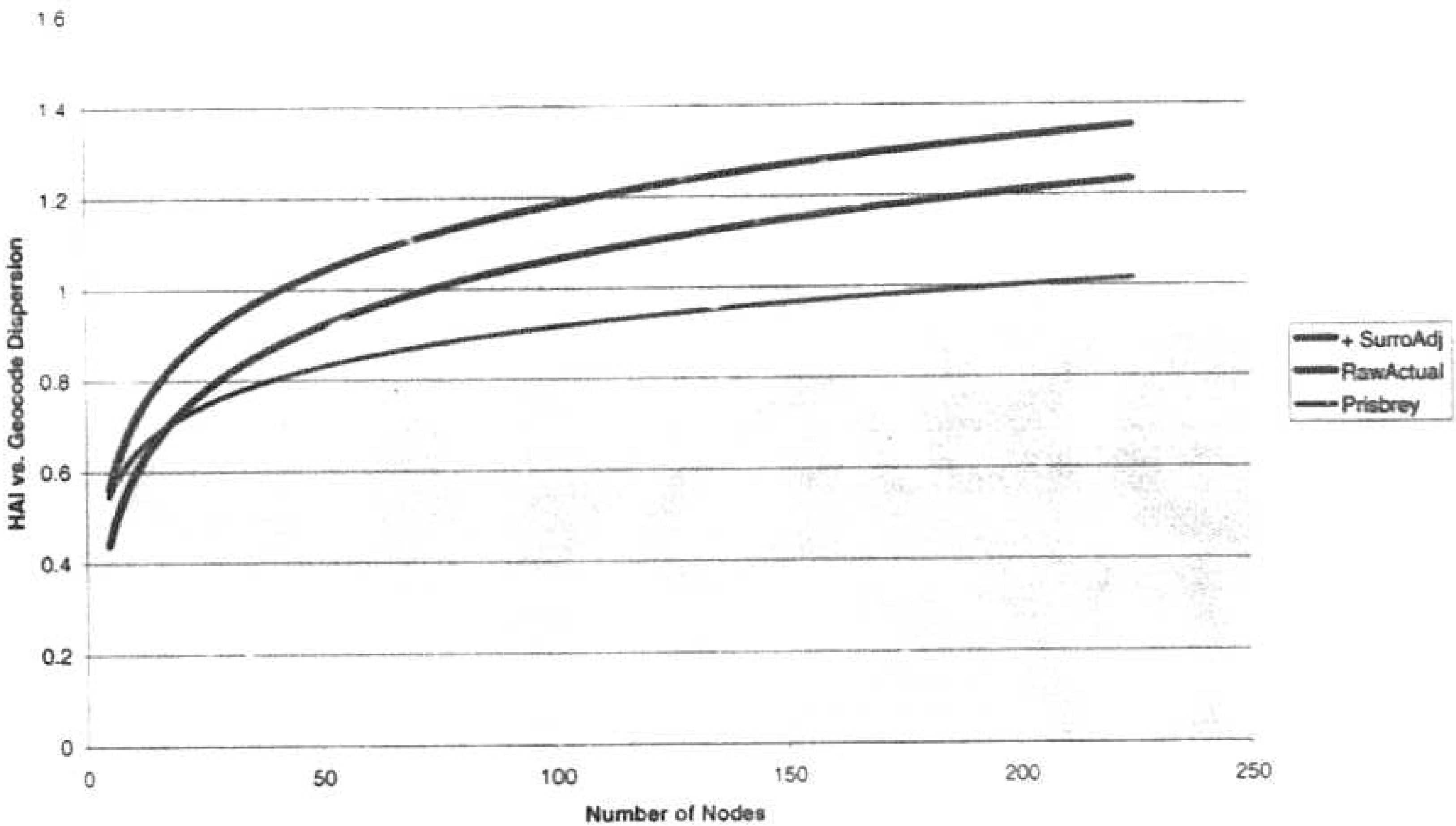
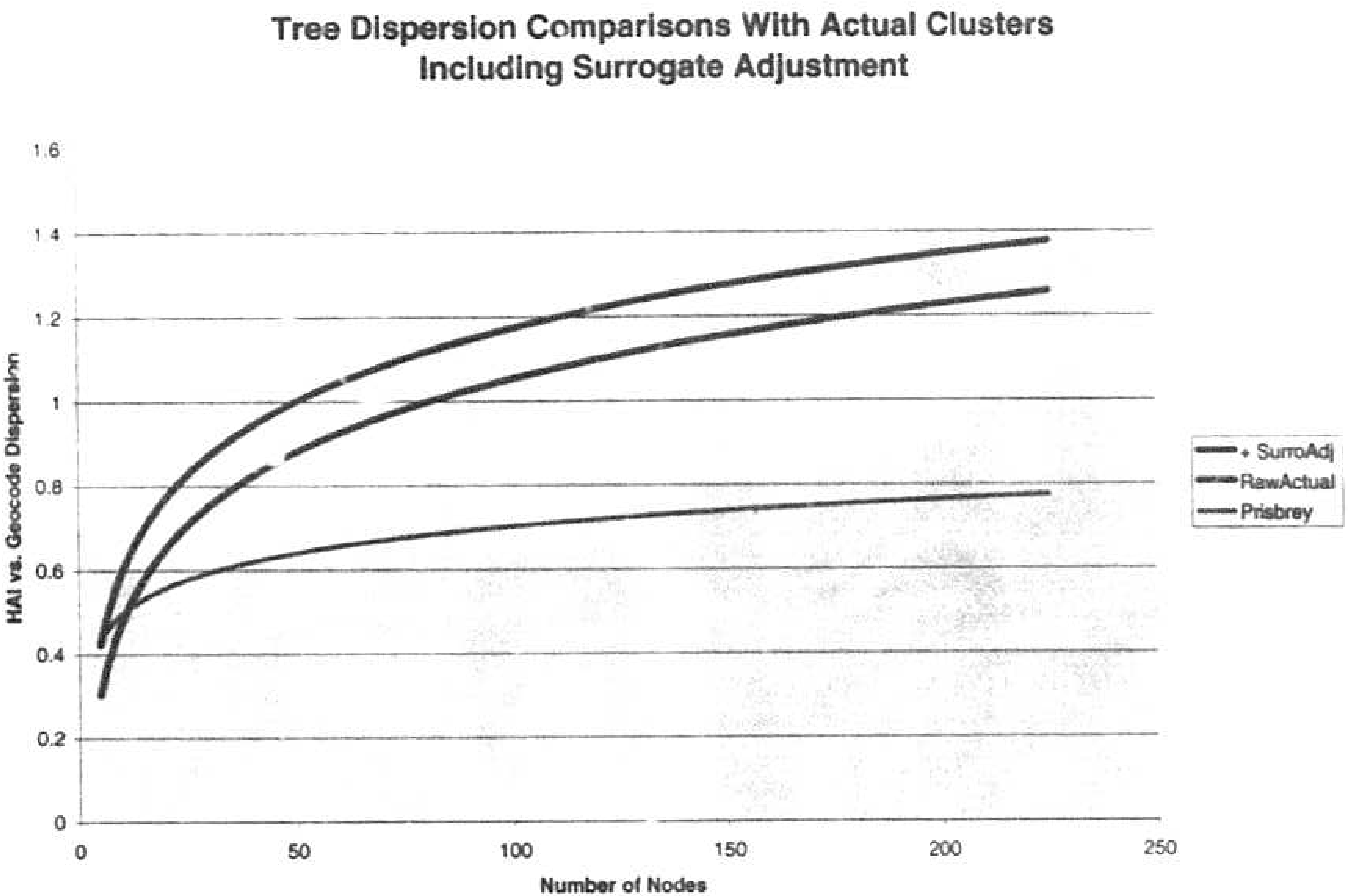
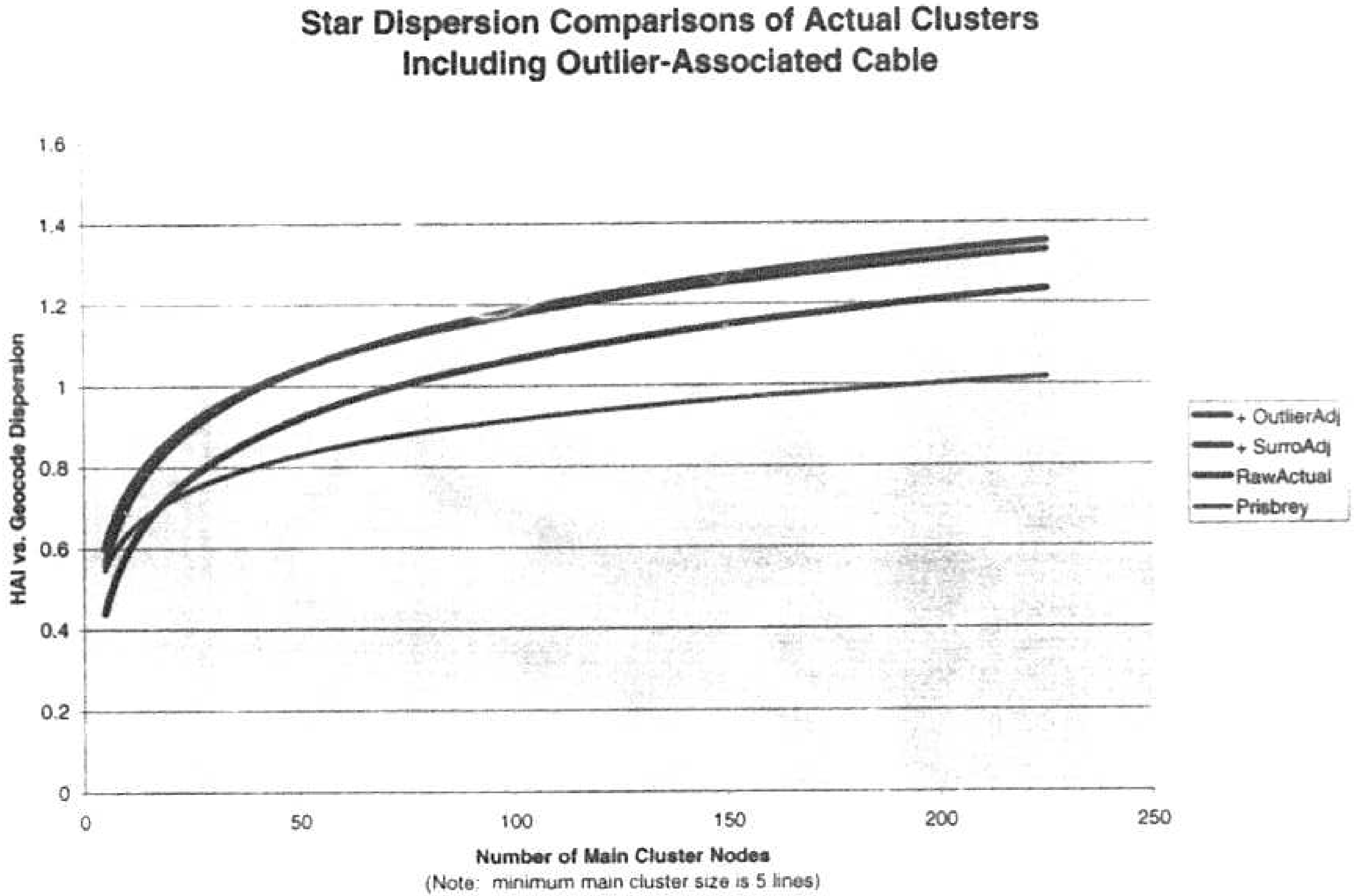


Chart 12



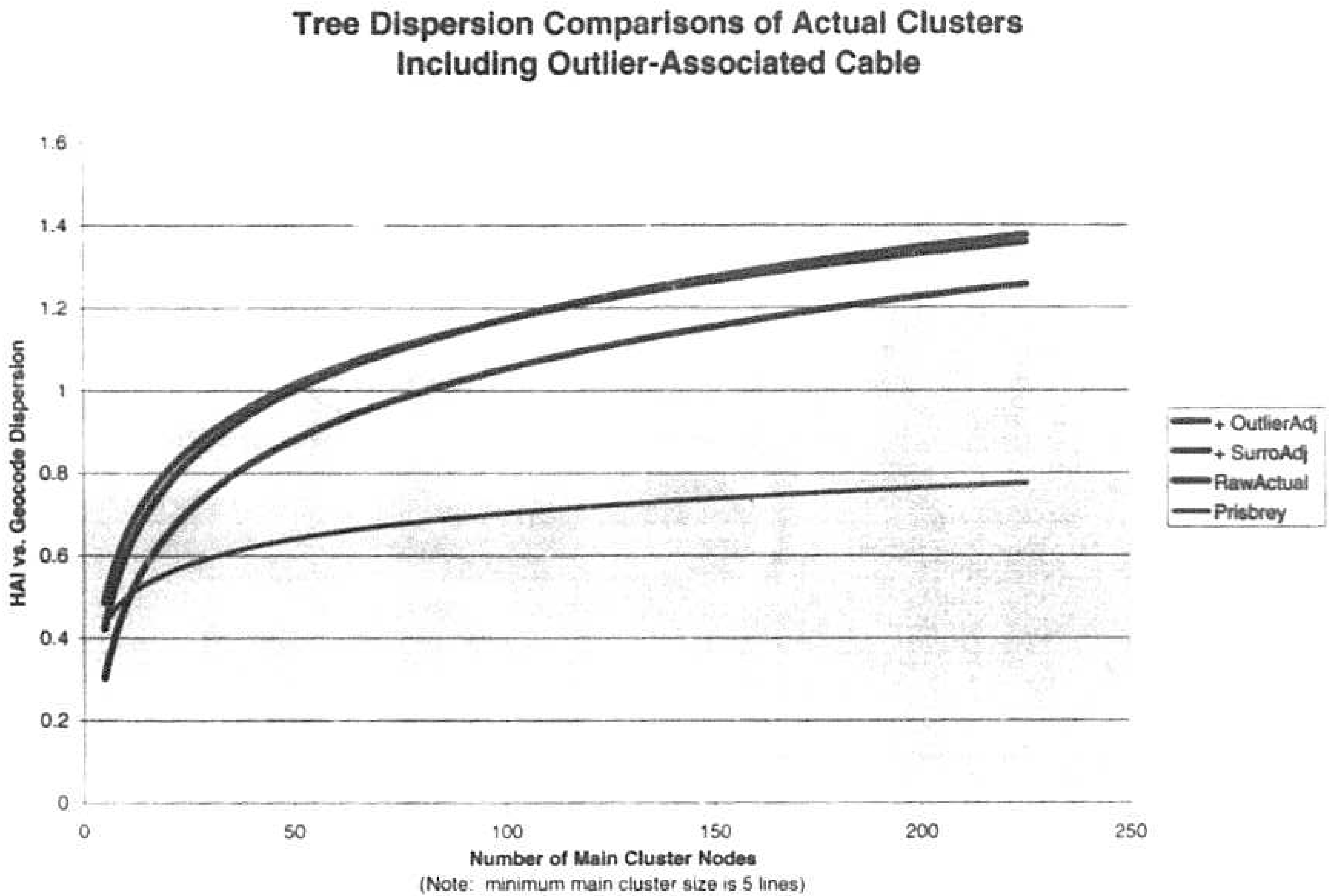
Tree Dispersion Comparisons With Actual Clusters
Including Surrogate Adjustment
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
HAI vs. Geocode Dispersion
0
50
100
150
200
250
Number of Nodes
+ SurroAdj
RawActual
Prisbrey

Chart 13



Star Dispersion Comparisons of Actual Clusters
Including Outlier-Associated Cable
HAI vs. Geocode Dispersion
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
+ OutlierAdj
+ SurroAdj
RawActual
Prisbrey
Number of Main Cluster Nodes
(Note: minimum main cluster size is 5 lines)

Chart 14



Tree Dispersion Comparisons of Actual Clusters
Including Outlier-Associated Cable
HAI vs. Geocode Dispersion
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
Number of Main Cluster Nodes
(Note: minimum main cluster size is 5 lines)
+ OutlierAdj
+ SurroAdj
RawActual
Prisbrey

Chart 15

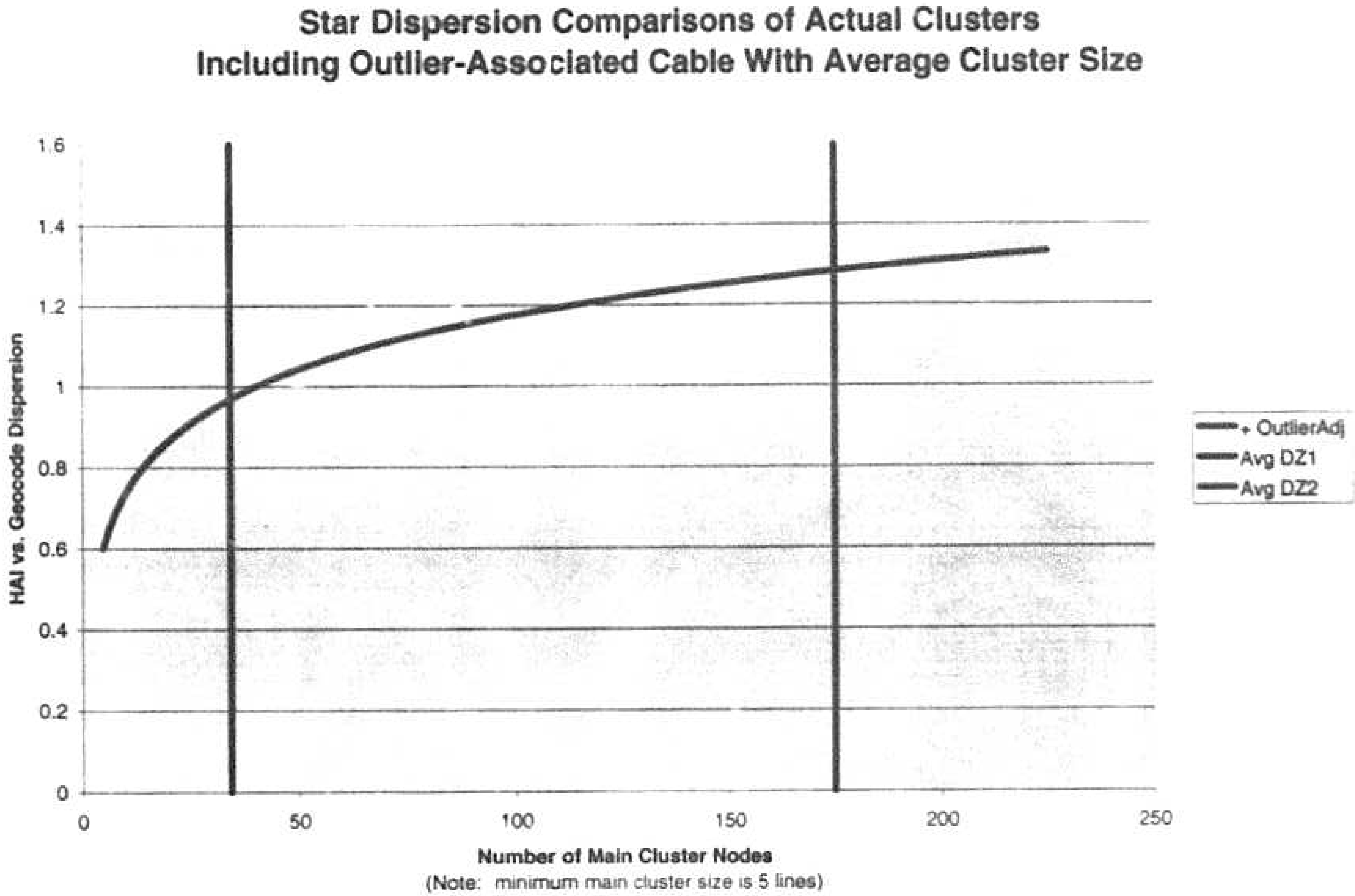
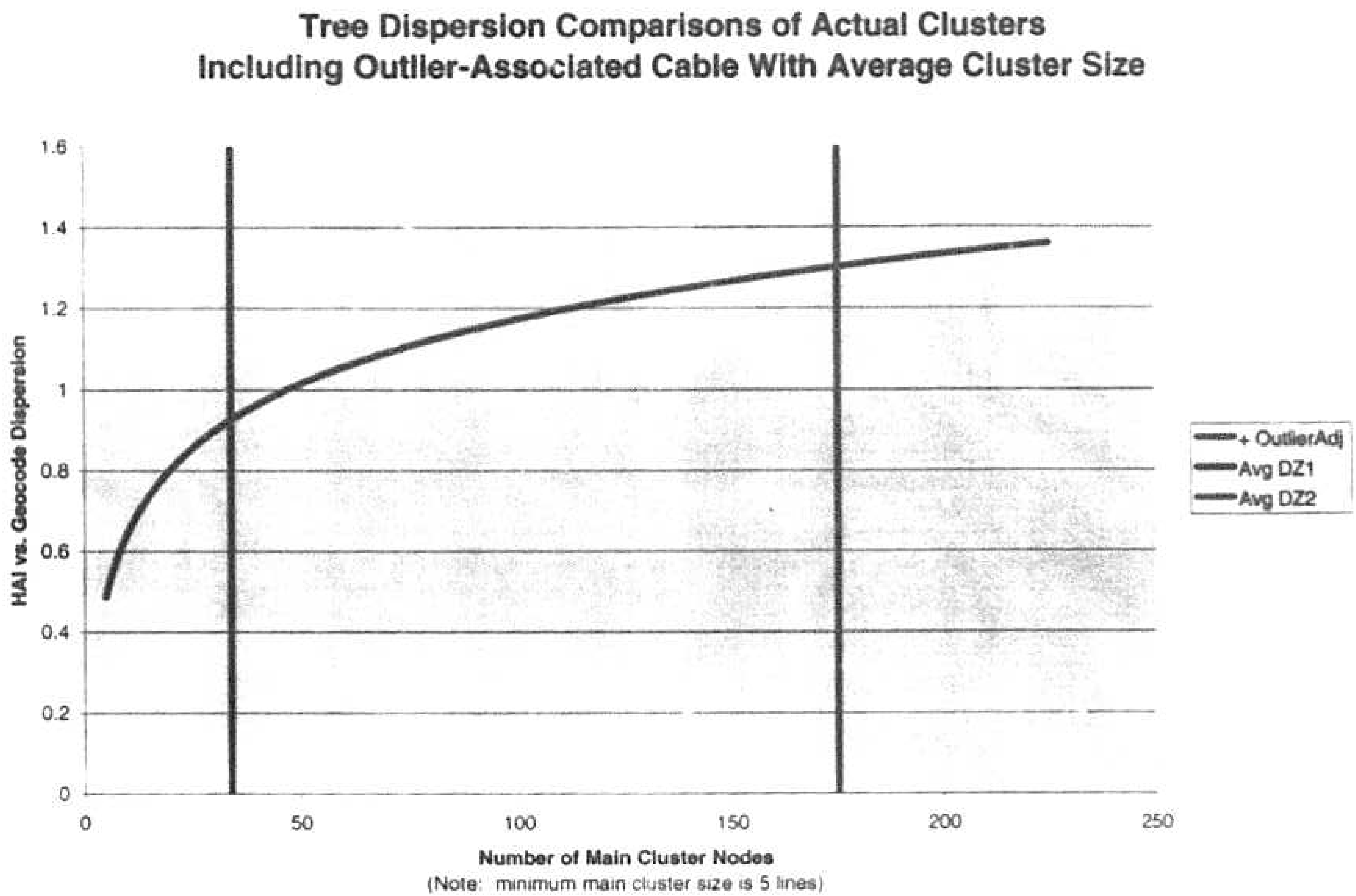

Star Dispersion Comparisons of Actual Clusters
Including Outlier-Associated Cable With Average Cluster Size
HAI vs. Geocode Dispersion
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
+ OutlierAdj
Avg DZ1
Avg DZ2
Number of Main Cluster Nodes
(Note: minimum main cluster size is 5 lines)

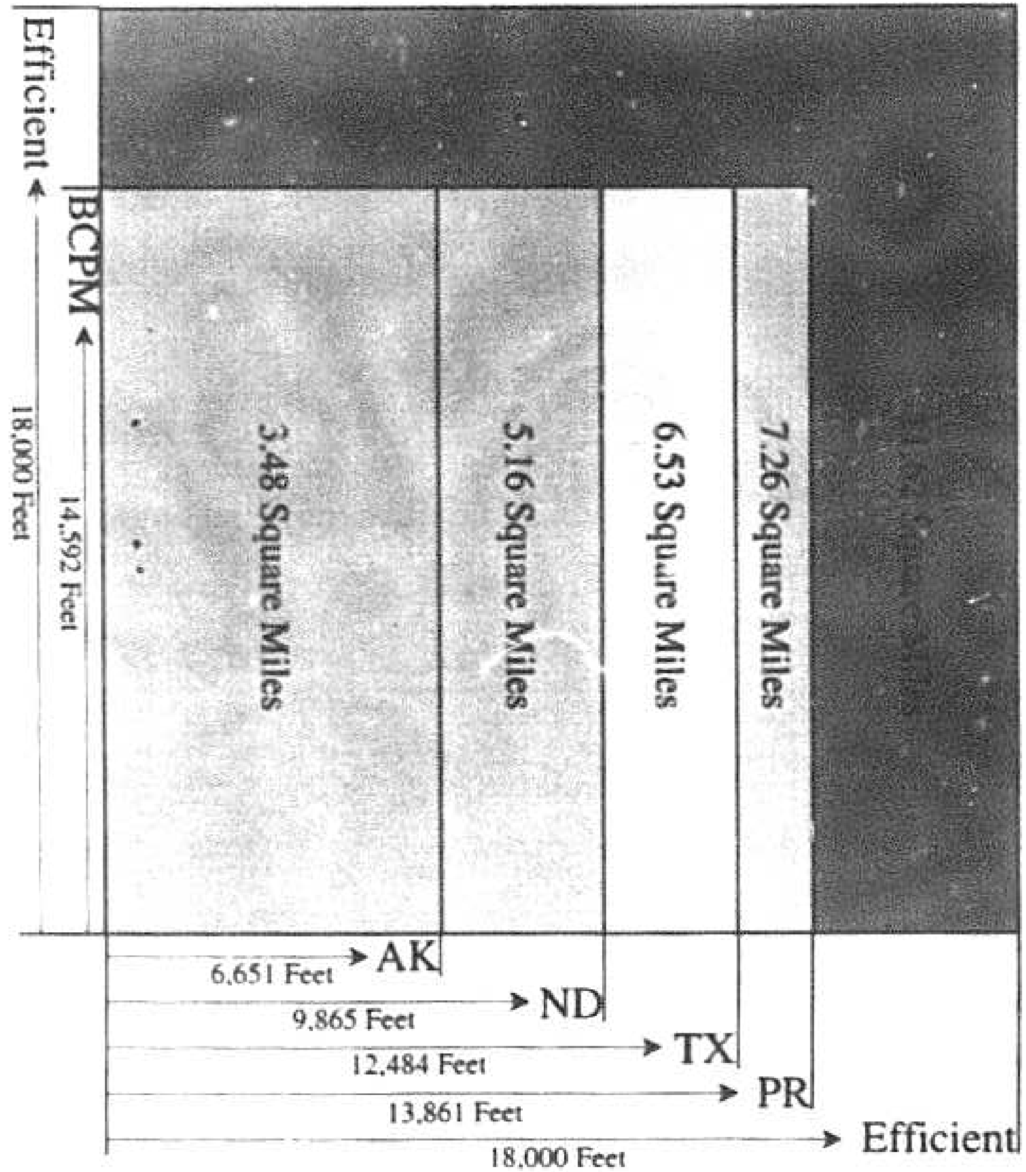
Chart 16



Tree Dispersion Comparisons of Actual Clusters
Including Outlier-Associated Cable With Average Cluster Size
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
HAI vs. Geocode Dispersion
0
50
100
150
200
250
Number of Main Cluster Nodes
(Note: minimum main cluster size is 5 lines)
+ OutlierAdj
Avg DZ1
Avg DZ2

Exhibit: _____ (DJW/BFP-8)

Illustration of Various BCPM Macrogrid Sizes Compared to an Efficient 18,000 Foot Design



COMPARISON OF BCPM'S VARIABLE SERVING AREA SIZE FOR VARIOUS STATES

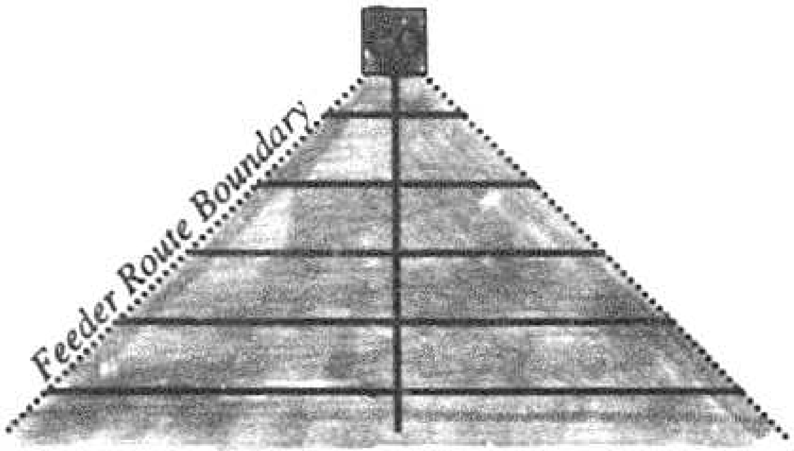
State Name	Latitude (Degree)	Average Miles per Degree		Macro-Grid			Efficient 18,000 Foot Area	
				Distance (In Feet)		Total Area	Total Area	% BCPM of Efficient Area
		Latitude	Longitude	Latitude	Longitude			
Alabama	32.6147	58.20	69.09	12,291	14,592	6.43	11.62	55.36%
Alaska	62.8855	31.49	69.09	6,651	14,592	3.48	11.62	29.95%
Arizona	34.5625	56.90	69.09	12,017	14,592	6.29	11.62	54.12%
Arkansas	34.7520	56.77	69.09	11,990	14,592	6.28	11.62	54.00%
California	36.8723	55.31	69.09	11,681	14,592	6.11	11.62	52.61%
Colorado	38.9983	53.70	69.09	11,341	14,592	5.94	11.62	51.07%
Connecticut	41.5164	51.73	69.09	10,926	14,592	5.72	11.62	49.21%
Delaware	38.8953	53.77	69.09	11,357	14,592	5.94	11.62	51.15%
District Of Columbia	38.8834	53.78	69.09	11,359	14,592	5.95	11.62	51.16%
Florida	27.9492	61.03	69.09	12,890	14,592	6.75	11.62	58.05%
Georgia	32.6814	58.15	69.09	12,282	14,592	6.43	11.62	55.32%
Hawaii	19.5957	65.09	69.09	13,747	14,592	7.20	11.62	61.91%
Idaho	44.6566	49.15	69.09	10,380	14,592	5.43	11.62	46.75%
Illinois	39.7542	53.12	69.09	11,219	14,592	5.87	11.62	50.52%
Indiana	39.7726	53.10	69.09	11,216	14,592	5.87	11.62	50.51%
Iowa	41.9397	51.39	69.09	10,855	14,592	5.68	11.62	48.89%
Kansas	38.4981	54.07	69.09	11,421	14,592	5.98	11.62	51.43%
Kentucky	37.5544	54.78	69.09	11,569	14,592	6.06	11.62	52.10%
Louisiana	30.9369	59.26	69.09	12,516	14,592	6.55	11.62	56.37%
Maine	45.2590	48.63	69.09	10,272	14,592	5.38	11.62	46.26%
Maryland	38.8165	53.83	69.09	11,370	14,592	5.95	11.62	51.21%
Massachusetts	42.3800	51.04	69.09	10,779	14,592	5.64	11.62	48.55%
Michigan	43.7422	49.92	69.09	10,542	14,592	5.52	11.62	47.48%
Minnesota	46.0686	47.92	69.09	10,121	14,592	5.30	11.62	45.58%
Mississippi	32.5880	58.22	69.09	12,296	14,592	6.44	11.62	55.37%
Missouri	38.3049	54.22	69.09	11,451	14,592	5.99	11.62	51.57%
Montana	46.6795	47.40	69.09	10,012	14,592	5.24	11.62	45.09%
Nebraska	41.5011	51.75	69.09	10,929	14,592	5.72	11.62	49.22%
Nevada	39.6551	53.19	69.09	11,235	14,592	5.88	11.62	50.60%
New Hampshire	43.5065	50.11	69.09	10,584	14,592	5.54	11.62	47.67%
New Jersey	40.0981	52.85	69.09	11,162	14,592	5.84	11.62	50.27%
New Mexico	33.9622	57.37	69.09	12,117	14,592	6.34	11.62	54.57%
New York	42.7542	50.73	69.09	10,715	14,592	5.61	11.62	48.26%
North Carolina	35.2206	56.44	69.09	11,921	14,592	6.24	11.62	53.69%
North Dakota	47.4679	46.71	69.09	9,865	14,592	5.16	11.62	44.43%
Ohio	40.1956	52.78	69.09	11,146	14,592	5.83	11.62	50.20%
Oklahoma	35.4855	56.26	69.09	11,882	14,592	6.22	11.62	53.51%
Oregon	44.1306	49.59	69.09	10,474	14,592	5.48	11.62	47.17%
Pennsylvania	40.9946	52.15	69.09	11,014	14,592	5.76	11.62	49.60%
Puerto Rico	18.2493	65.63	69.09	13,861	14,592	7.26	11.62	62.43%
Rhode Island	41.6623	51.62	69.09	10,902	14,592	5.71	11.62	49.10%
South Carolina	33.6231	57.53	69.09	12,151	14,592	6.36	11.62	54.72%
South Dakota	44.2176	49.52	69.09	10,458	14,592	5.47	11.62	47.10%
Tennessee	35.6306	56.02	69.09	11,831	14,592	6.19	11.62	53.28%
Texas	31.1869	59.11	69.09	12,484	14,592	6.53	11.62	56.22%
Utah	39.4999	53.31	69.09	11,260	14,592	5.89	11.62	50.71%
Vermont	44.2704	49.47	69.09	10,449	14,592	5.47	11.62	47.06%
Virginia	37.4656	54.84	69.09	11,582	14,592	6.06	11.62	52.16%
Washington	47.2747	46.88	69.09	9,901	14,592	5.18	11.62	44.59%
West Virginia	38.6684	53.95	69.09	11,393	14,592	5.96	11.62	51.31%
Wisconsin	44.7258	49.09	69.09	10,368	14,592	5.43	11.62	46.69%
Wyoming	43.0003	50.53	69.09	10,672	14,592	5.59	11.62	48.06%

Minimum	18.2493	31.49	69.09	6,651	14,592	3.48	11.62	29.95%
Maximum	62.8855	65.63	69.09	13,861	14,592	7.26	11.62	62.43%

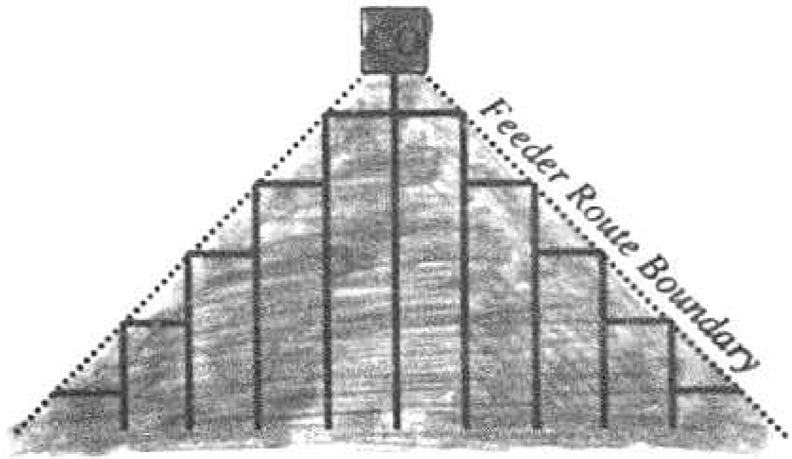
Exhibit: _____ (DJW/BFP-9)

BCPM "Bush" Feeder Design is Inefficient

"*Pine Tree*" Design



"*Bush*" Design



"Feeder and Branch Feeder Cable Locations. The economical layout of the local cable network is closely related to its physical arrangement. Branch feeder cables intersect the main feeder route and provide facilities to the feeder-route boundary. This configuration is commonly referred to as pine-tree geometry." [The figure above represents a similar figure shown in Bellcore documentation.] "Studies have indicated that the savings of the pine-tree over the bush geometry range from 5 to 30 percent of present worth of expenditures." (Bellcore, Telecommunications Transmission Engineering, 1990, p. 85 [Bellcore chart on p. 86].)

Step 1 : Geocode Actual Customer Locations

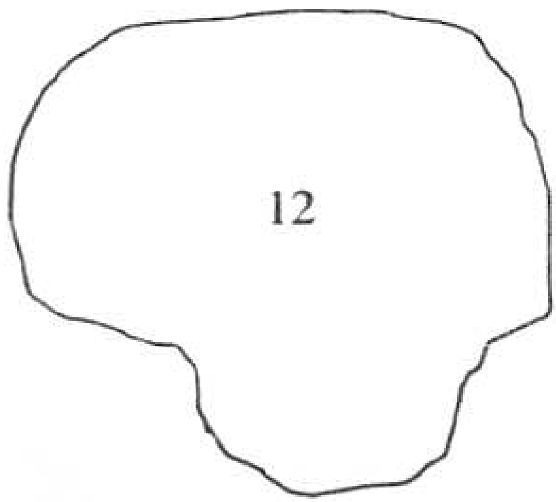
HAI Model	BCPM

N/A

BCPM DOES NOT GEOCODE ANY ACTUAL CUSTOMER LOCATIONS.

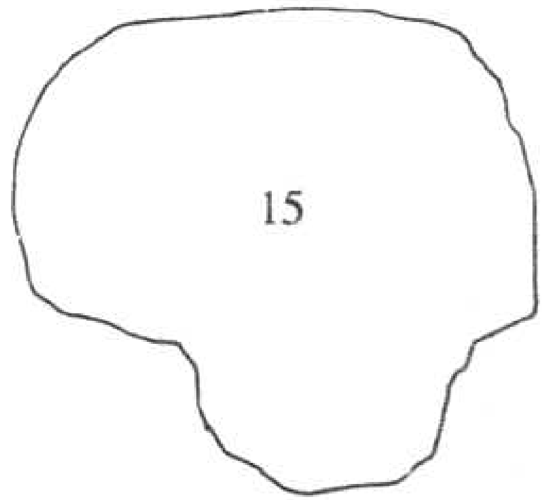
Step 2 : Get Number of Customer Locations at Census Block Level

HAI Model



12 Occupied Households and Businesses Idenitfied from Census Data

BCPM



15 Occupied Households, Businesses and Unoccupied Housing Units Identified from Census Data

Step 3 : Locate Surrogate Customers

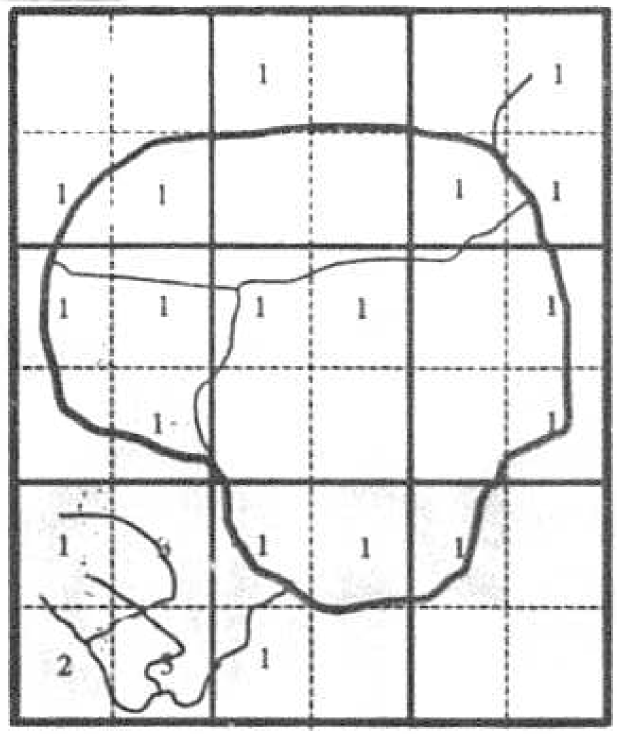
HAI Model

BCPM

Geocoded Customer Locations

Surrogate Occupied Households

Surrogates are Actually Placed Evenly Across Census Block Boundaries to Gross-Up Total Customers within each Census Block to the Census Reported Locations



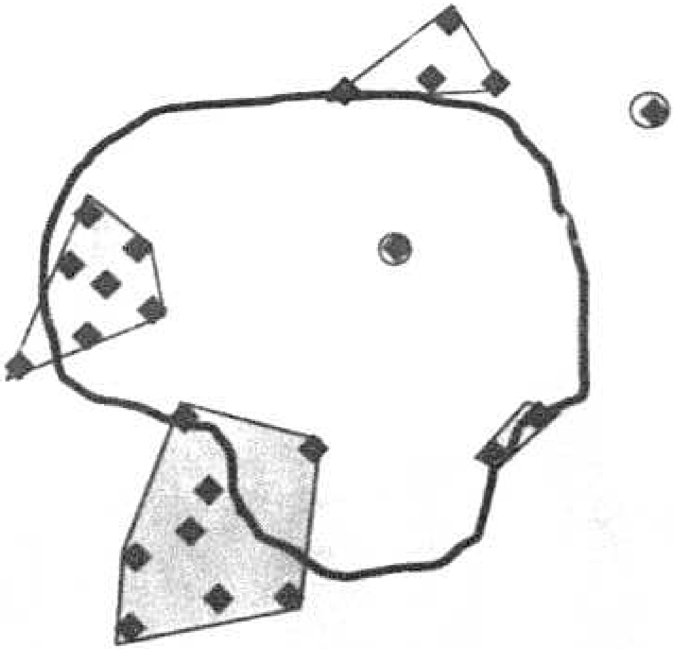
Allocates all Locations by Census Block to Grids Based on Relative Road Distance

Thick Lines Represent Ultimate Grids

Thin Dashed Lines Represent Grid Quadrants (Distribution Areas)

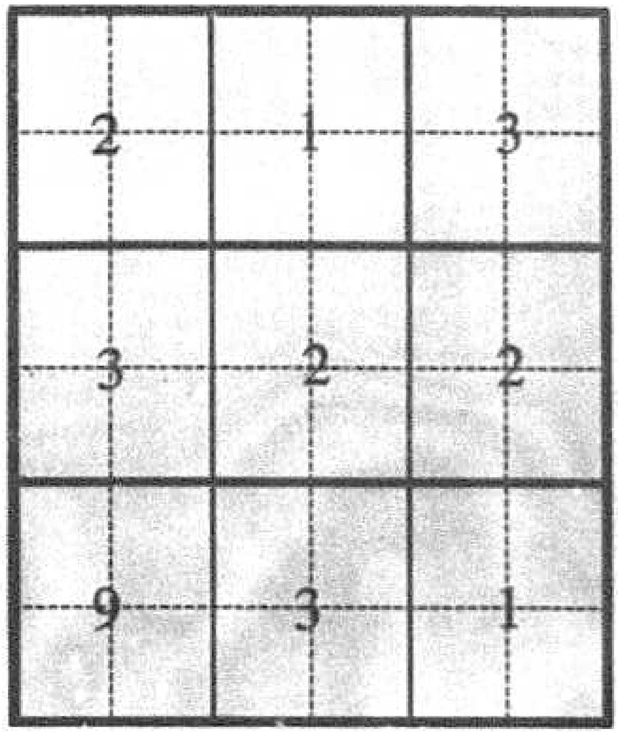
Step 4 : Identify Serving Areas

HAI Model



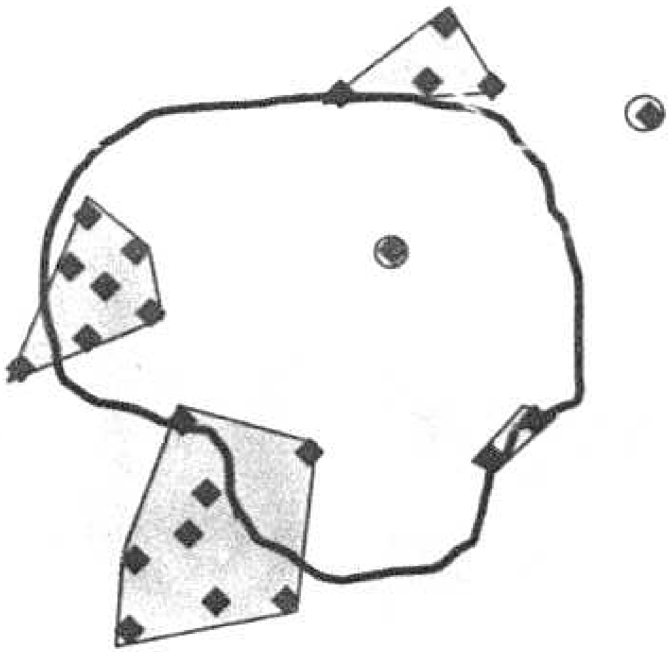
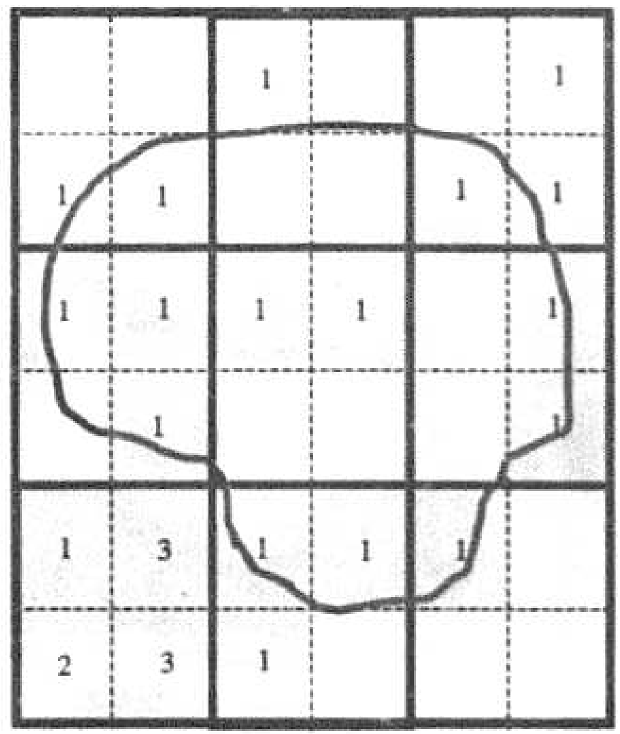
Establish Clusters as Serving Areas
Using Engineering Criteria

BCPM

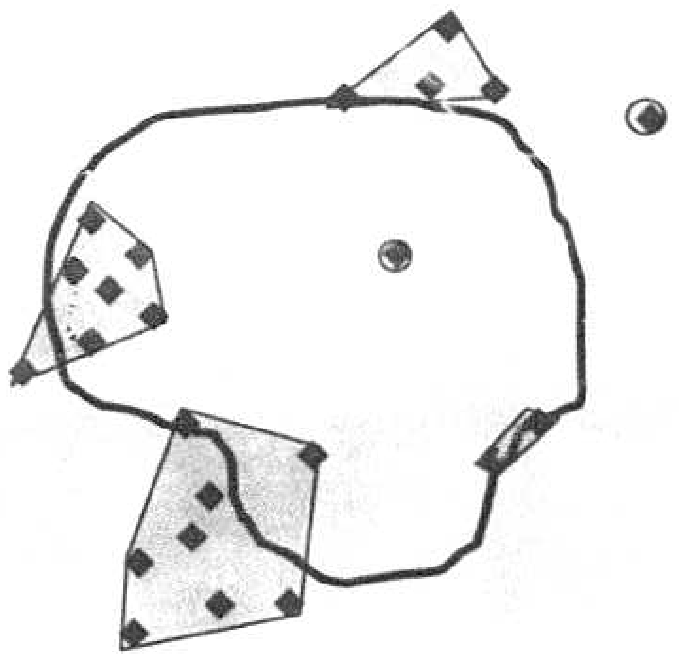
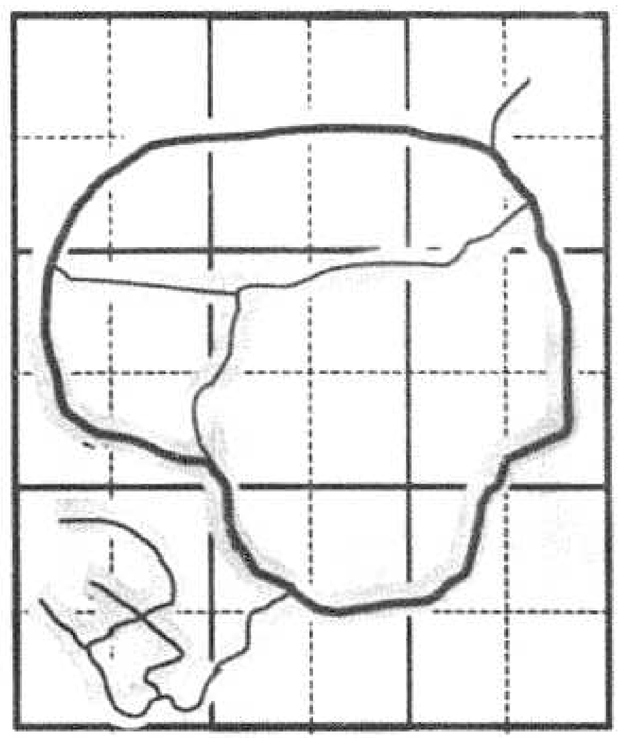


Serving Areas Consist of the Entire Ultimate Grid, which has been Arbitrarily Overlaid on the Wire Center

Step 5: Identify Distribution Areas

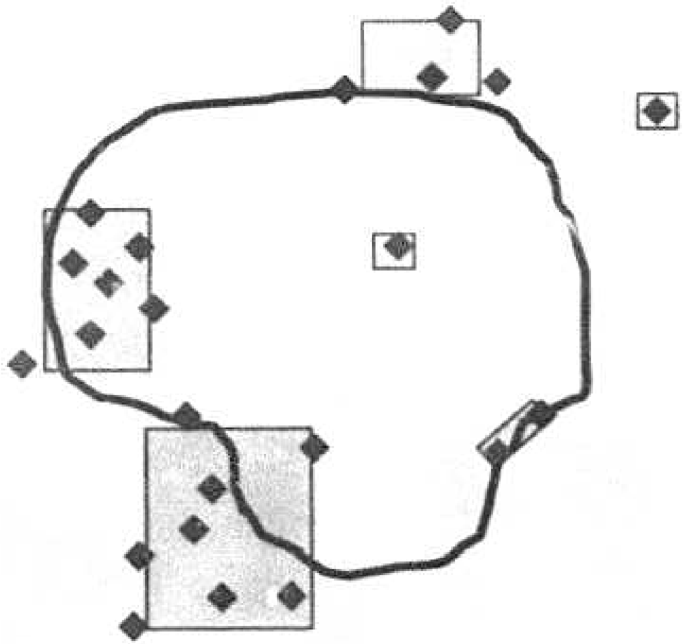
HAI Model	BCPM
	
Actual Cluster Area	Distribution Areas are the Grid Quadrants That Happen to Have Surrogates Located In Them

Step 6 : Calculate Distribution Area Sizes

HAI Model	BCPM
	
Actual Cluster Size	Distribution Area Size Equals 1,000 Feet Times the Included Road Lengths

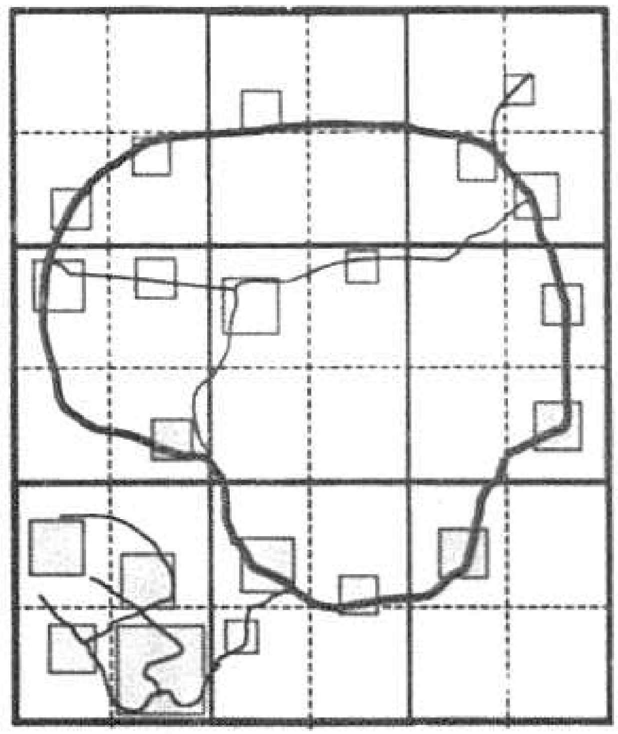
Step 7 : Create Distribution Areas

HAI Model



Distribution Areas Are Formed by the Clusters Relative Aspect Ratio, Area, and Location

BCPM

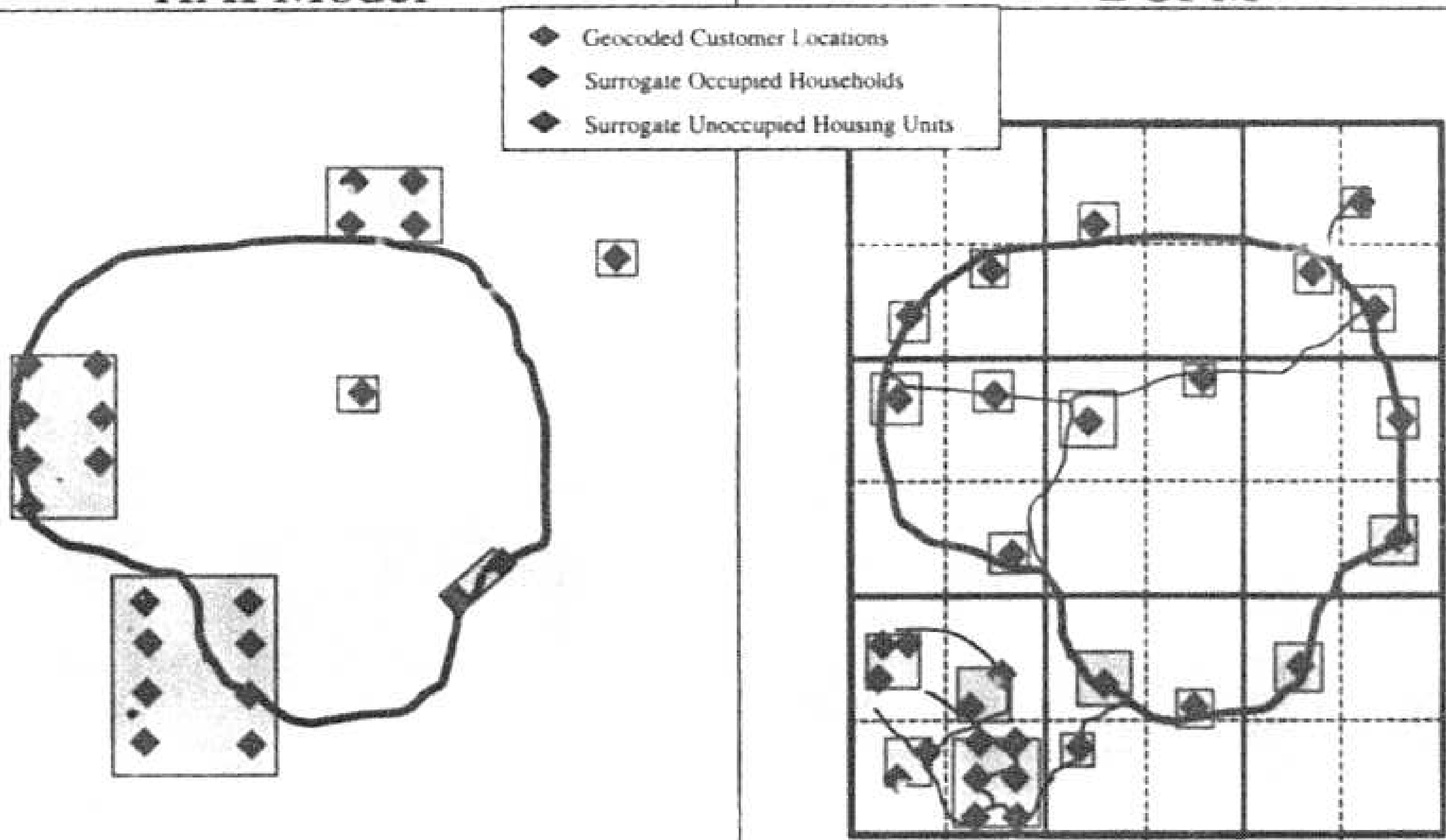


Distribution Areas are Formed Around the Road Centroid of the Quadrants Containing Surrogates, with an Area Equal to 1,000 Feet Times the Road Length

Step 8 : Evenly Distribute All Locations With Distribution Areas

HAI Model

BCPM

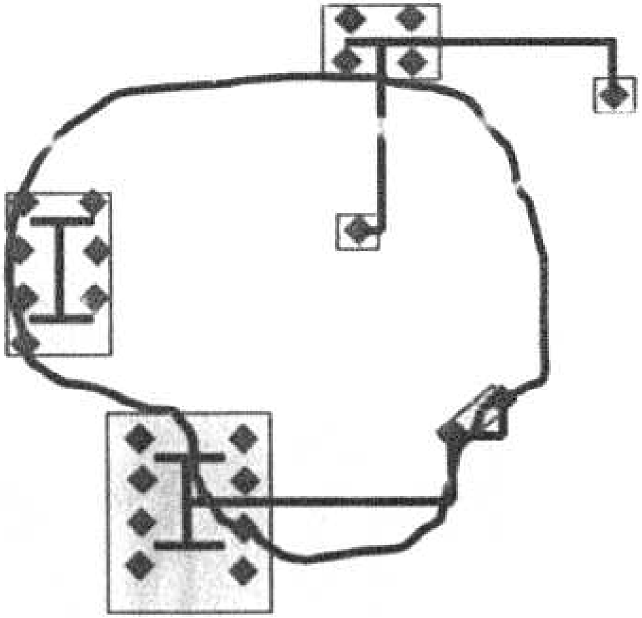


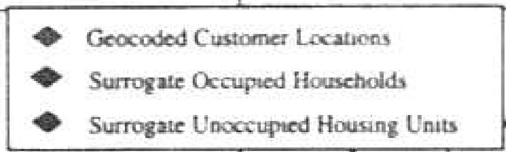
HAI Model: Assumes Customers are Evenly Spaced Throughout Distribution Area with Rectangular Lots

BCPM: Assumes Customers are Evenly Spaced Throughout Distribution Area, with Square Lots

Step 9: Build Distribution Plant

HAI Model

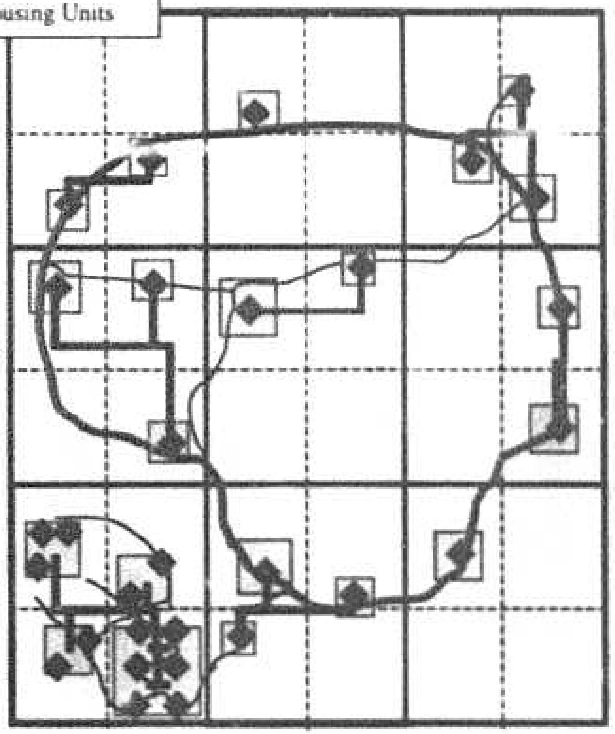




Distribution Plant is Built within each Main

Cluster with Road Cables Reaching Outlier Clusters

BCPM



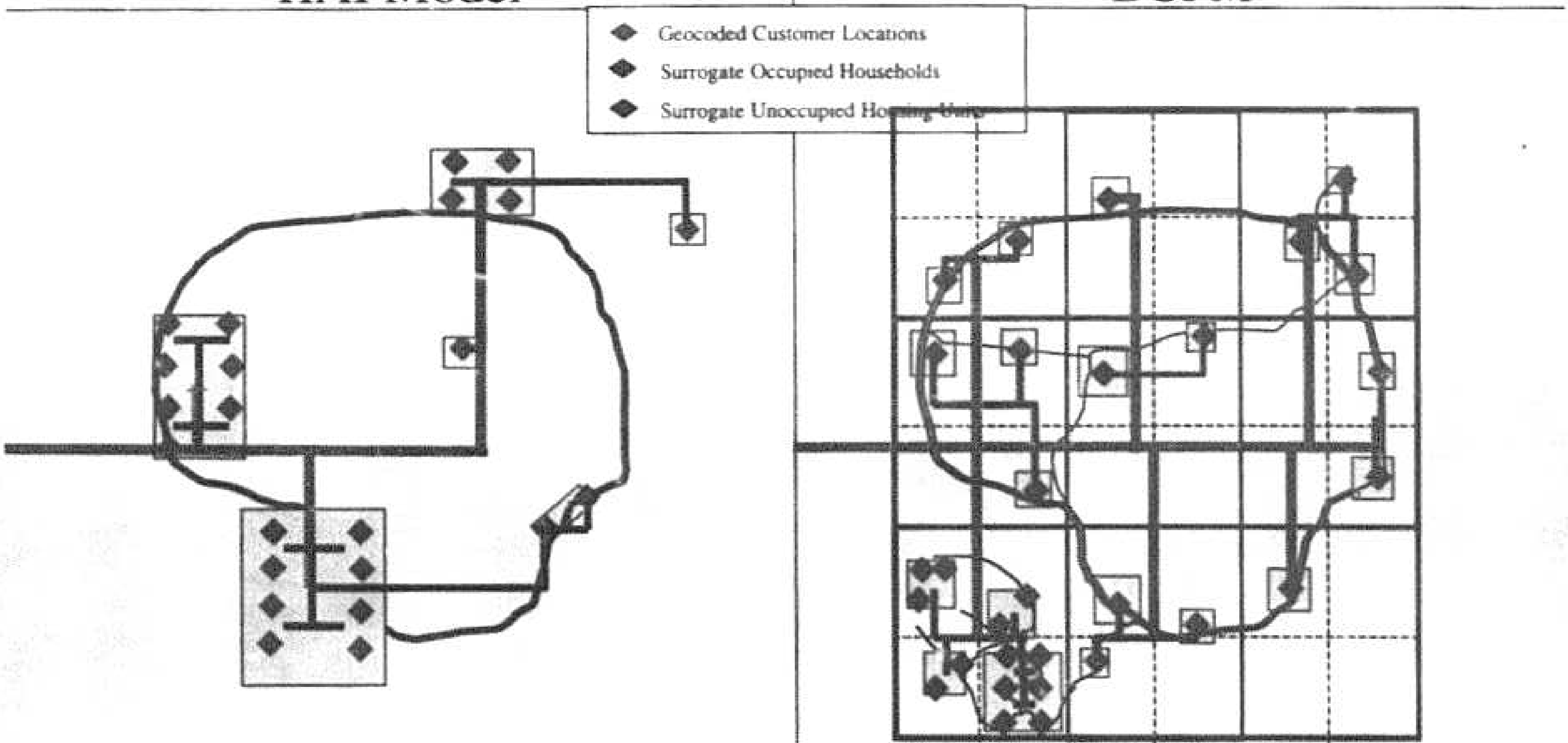
Distribution Plant is Built within

Road Reduced Quadrants and Connecting Cable is

Built to Distribution Areas

Step 10 : Build Feeder Plant

HAI Model | BCPM



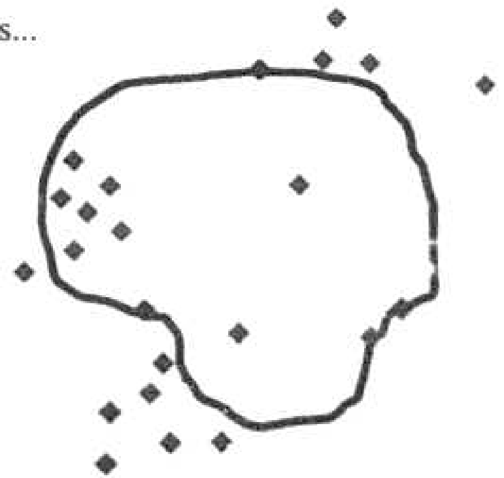
Feeder Plant is Built to Reach all Main Clusters

Feeder Plant is Built to Reach each Occupied Ultimate Grid

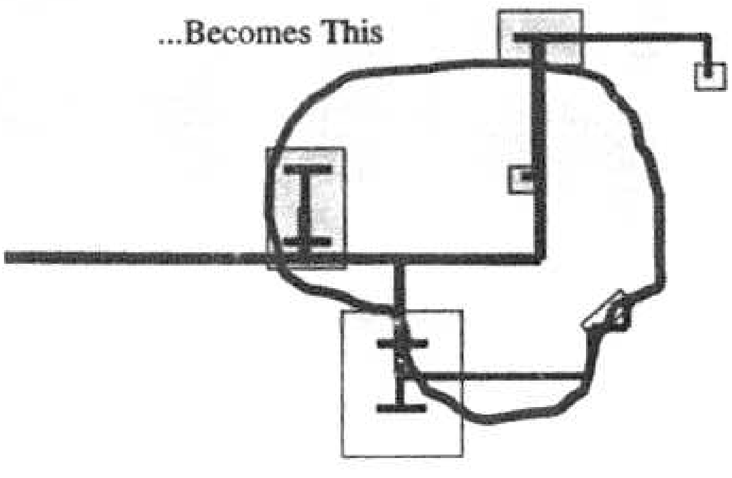
Step 11 : Summary

HAI Model

This...

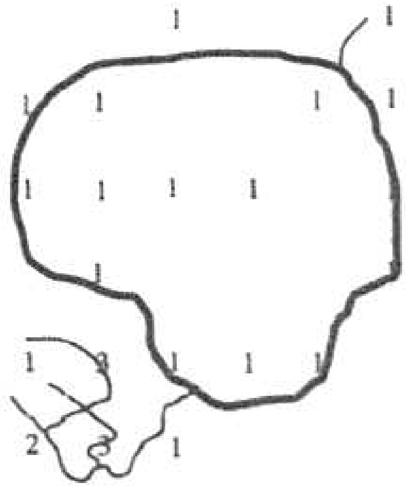


...Becomes This

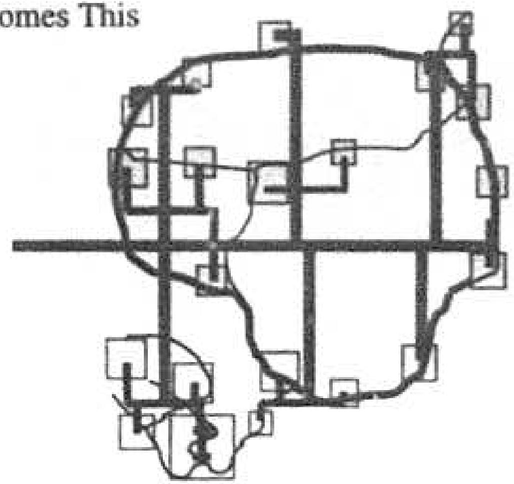


BCPM

This...

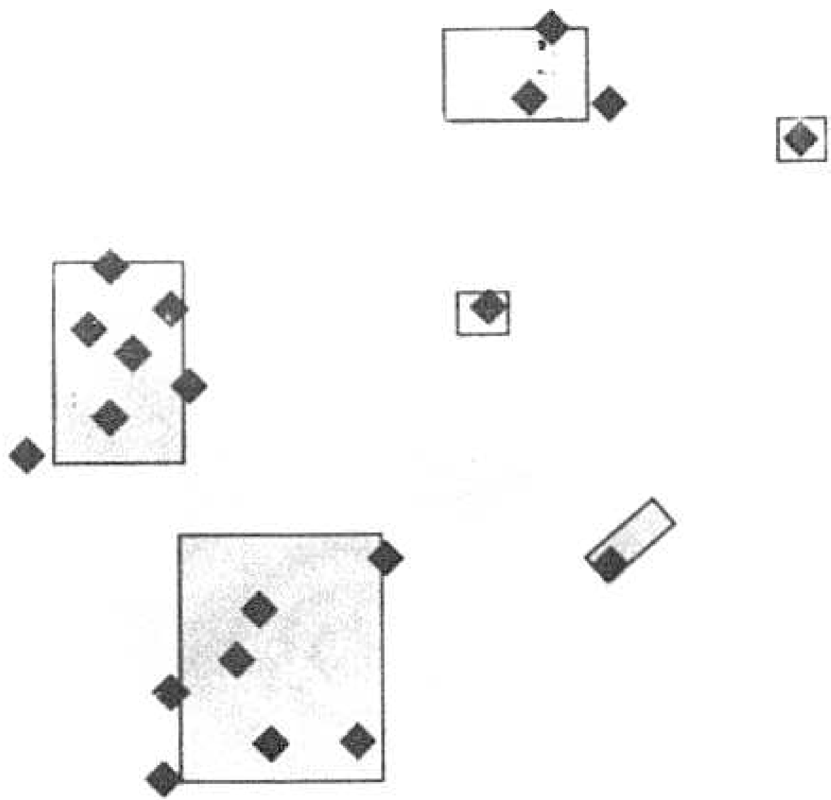


...Becomes This



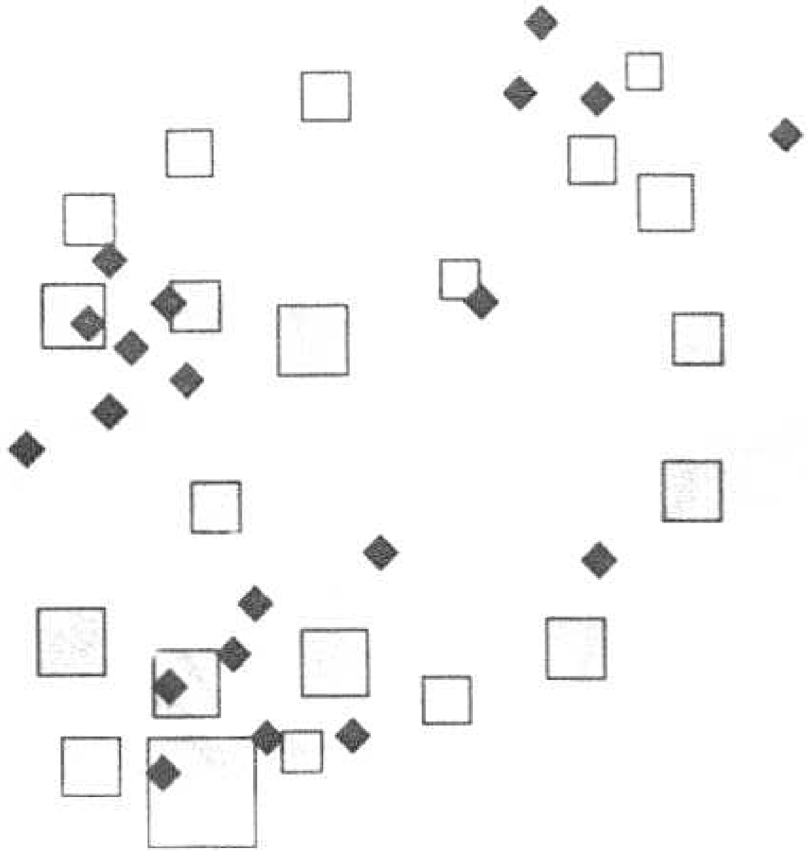
Step 12 : Coverage of Actual Geocoded Customer Locations

HAI Model



HM Clusters Cover Actual Locations

BCPM

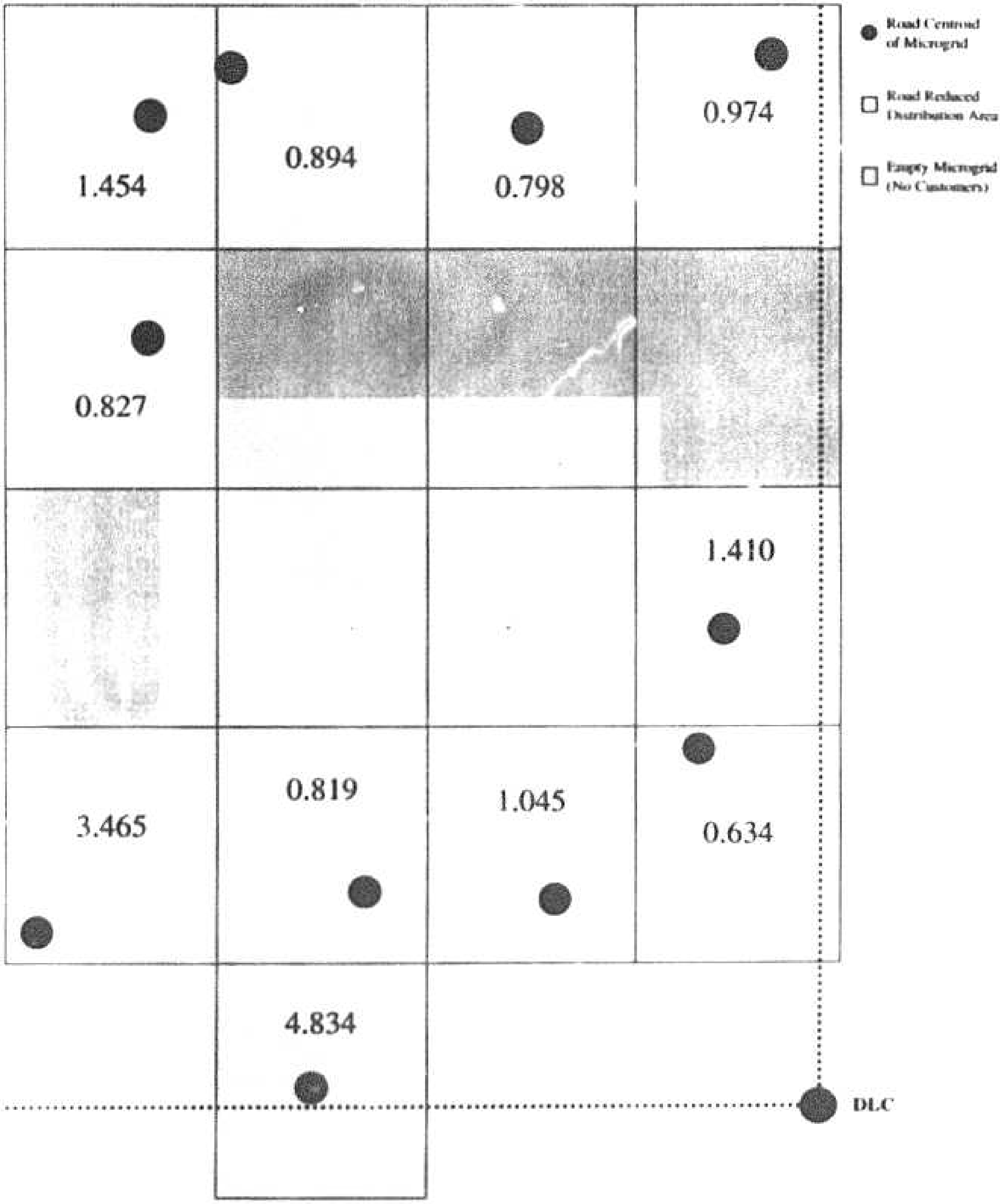


BCPM Distribution Areas Do Not Cover Actual Locations

Exhibit: _____ (DJW/BFP-11)

CLLI - CLEVTXCL, FDI Code - 1008431, Quad - ULQ

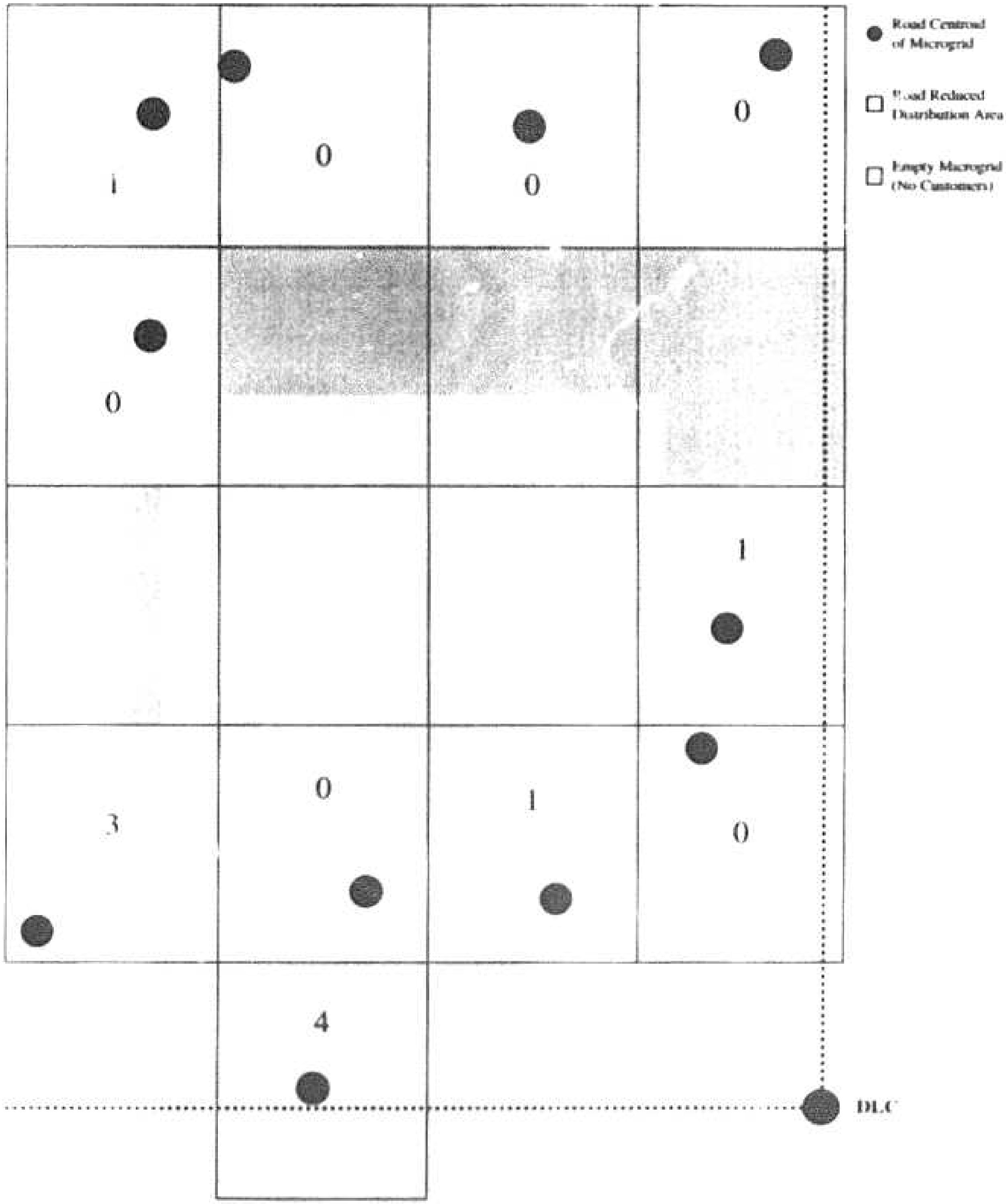
Step 1: Identify Microgrids of Quadrants and Number of Customers



17 Total Customers in Quadrant

CLLI - CLEVTXCL, FDI Code - 1008431, Quad - ULQ

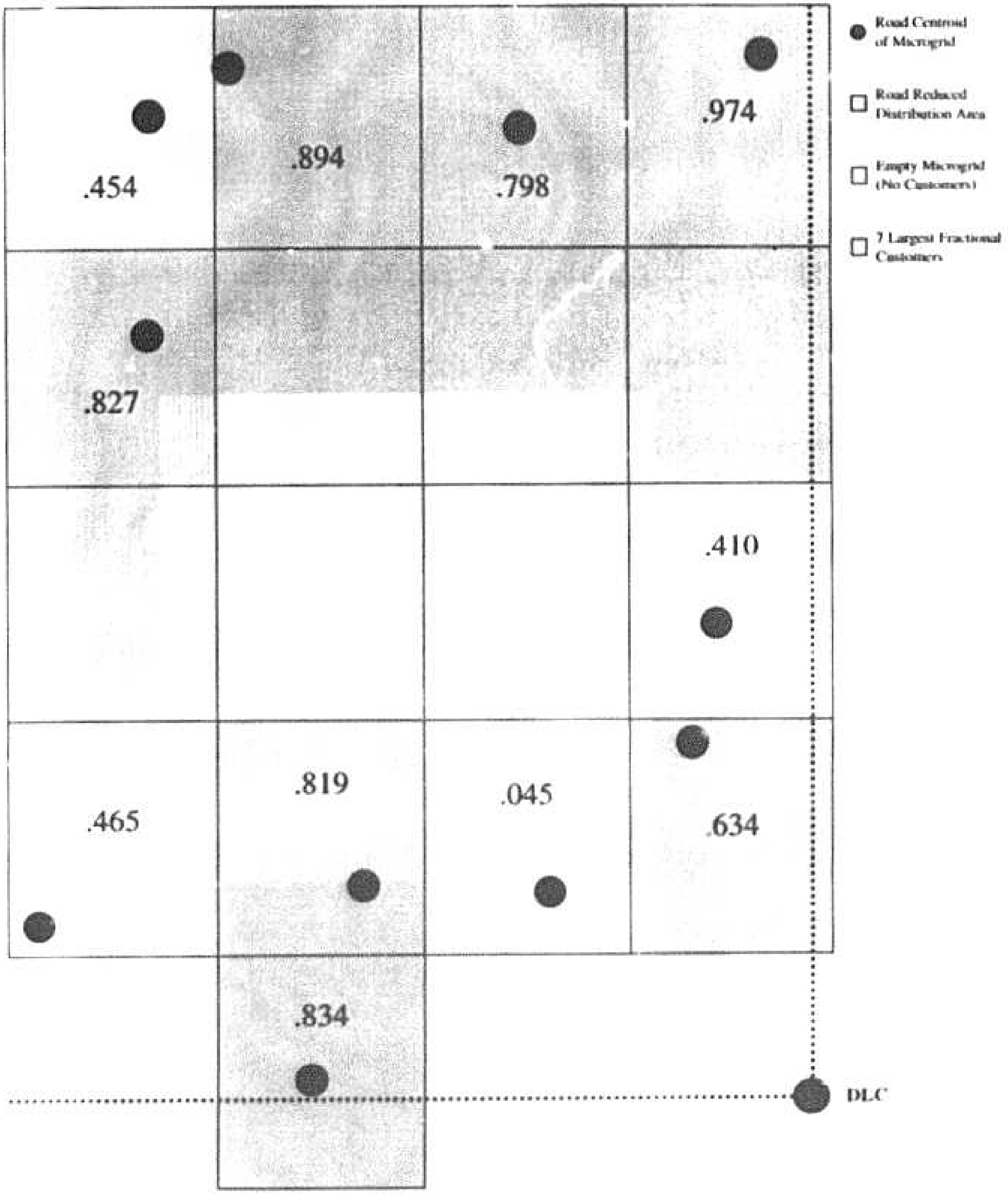
Step 2: Calculate Whole Customers in the Microgrids of the Quadrant



10 Whole Customers in Quadrant

CLLI - CLEVTXCL, FDI Code - 1008431, Quad - ULQ

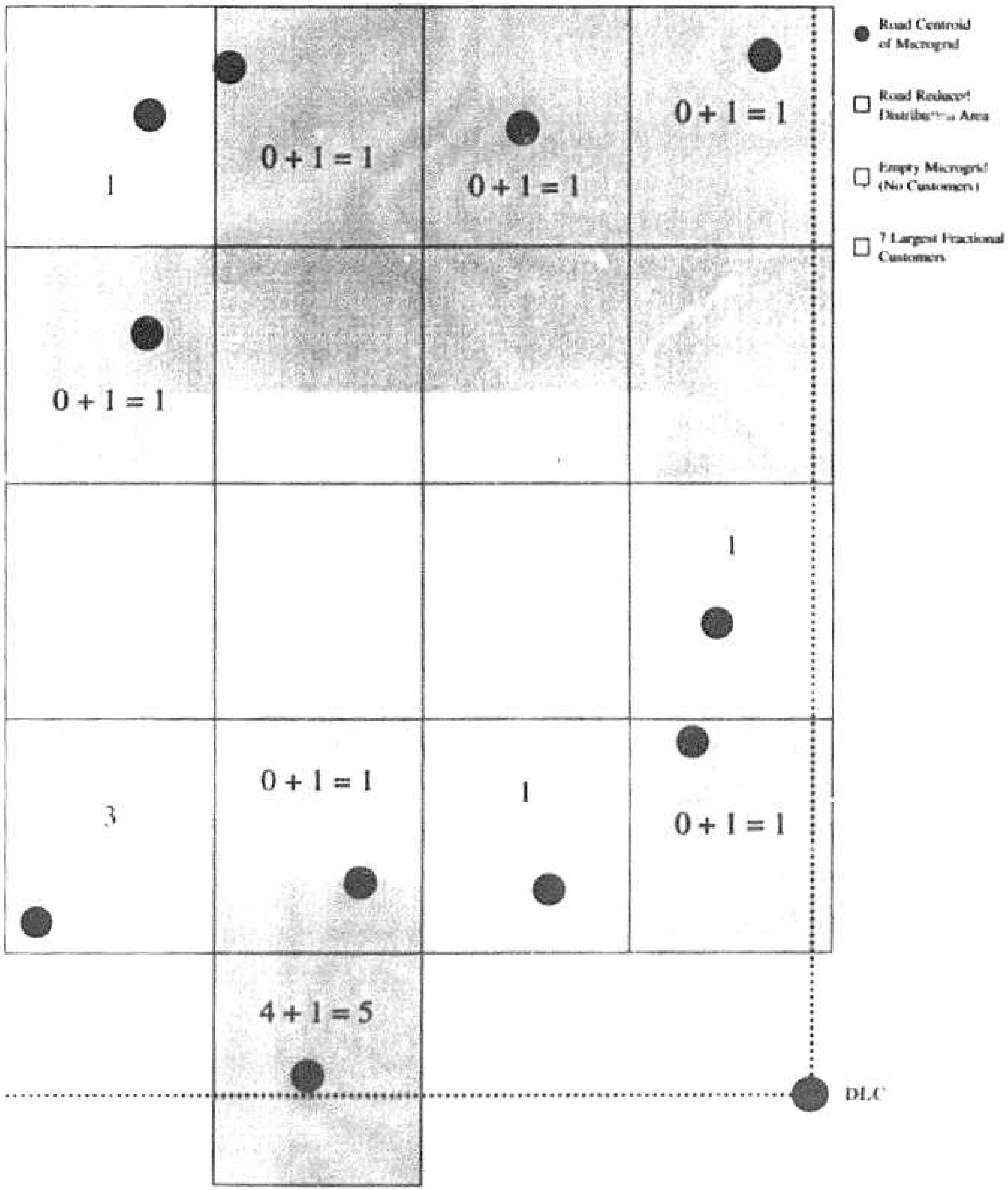
Step 3: **Identify Microgrids with Largest Fractional Customers**



17 Total Customers - **10 Whole Customers** = 7 Remaining Customers to Allocate

CLLI - CLEVTXCL, FDI Code - 1008431, Quad - ULQ

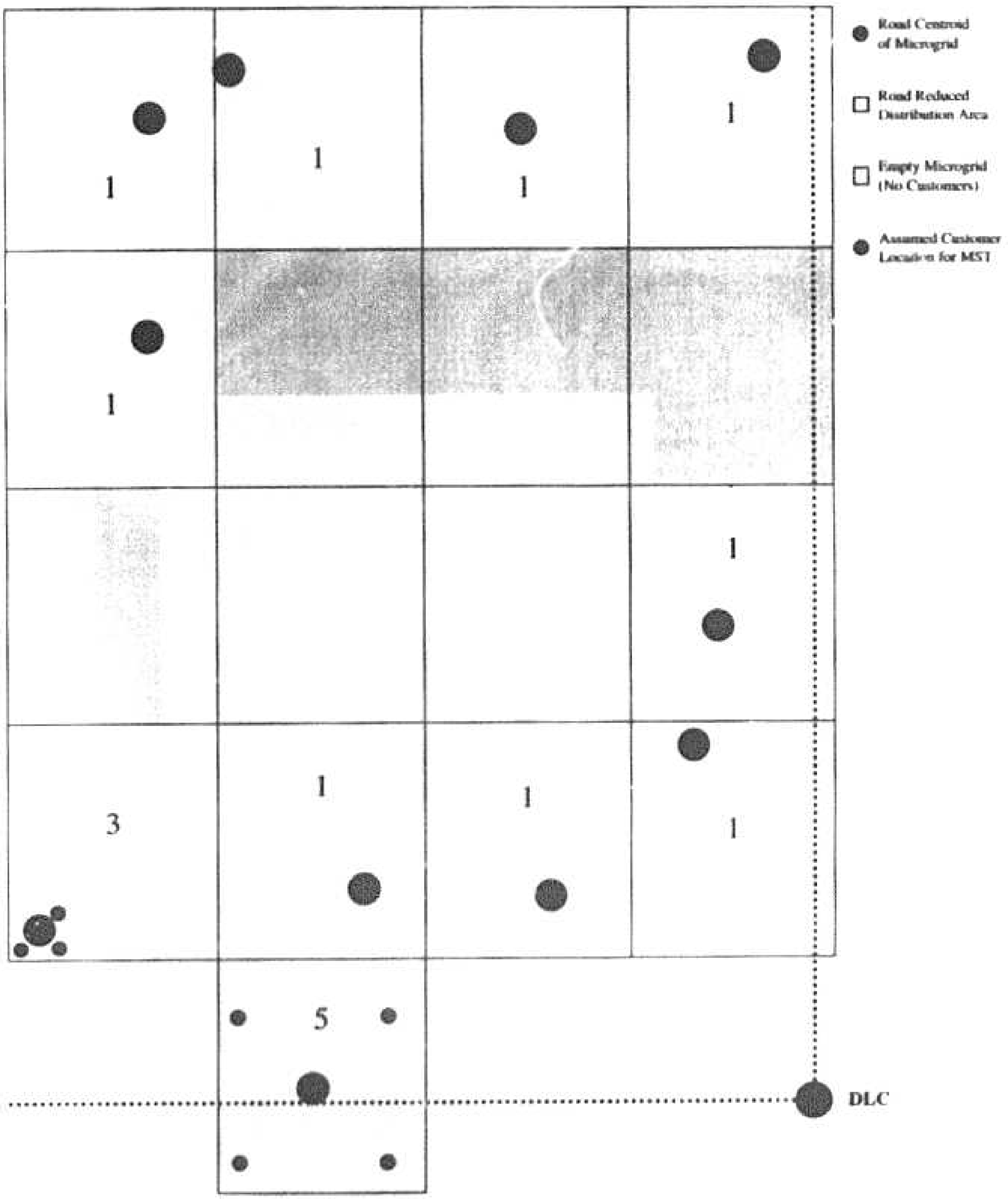
Step 4: Allocate Remaining **Customers to Microgrids** with Largest Fractional Customers



Add 1 Customer to **Microgrids with Largest Fractional** Customers to Get 17 Total Customers

CLLI - CLEVTXCL, FDI Code - 1008431, Quad - ULQ

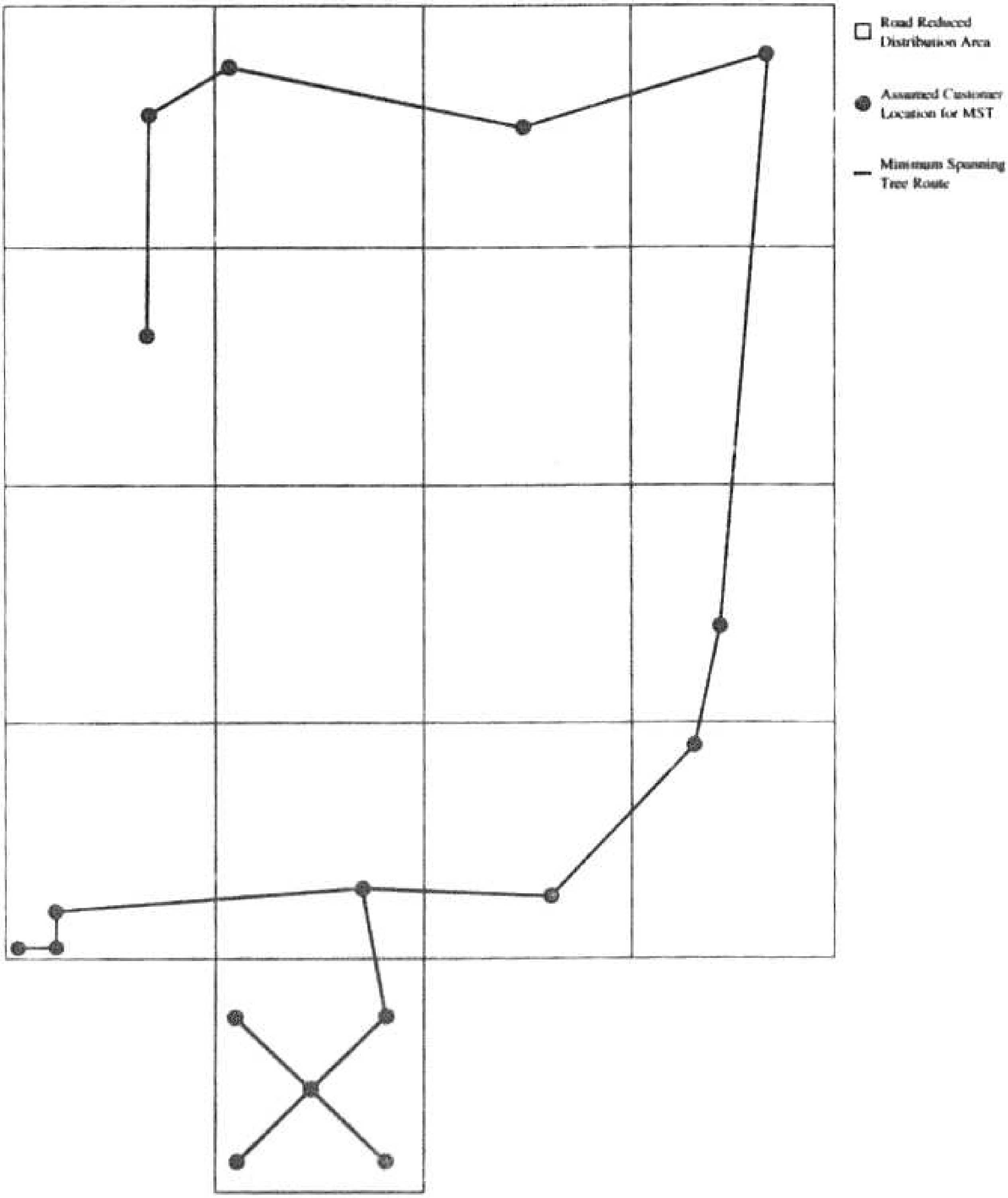
Step 5: **Distribute Customers around the** Road Centroid of the Microgrid



Customers are **Distributed using Assumptions** Consistent with the BCPM Methodology

CLLI - CLEVTXCL, FDI Code - 1008431, Quad - ULQ

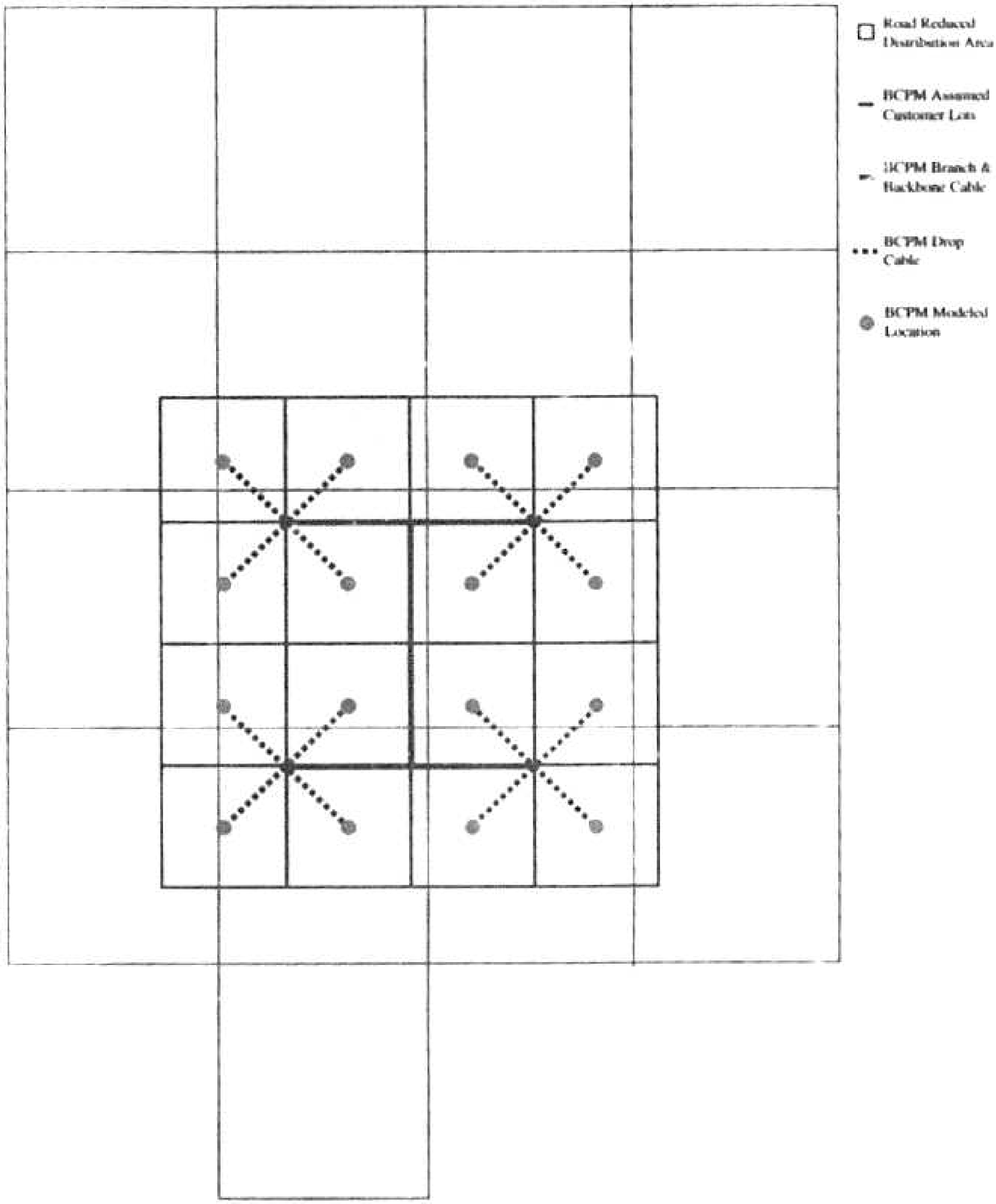
Step 6: Calculate the Minimum Spanning Tree Distance to Connect the Locations



Minimum Spanning Tree Feet = 17,022

CLLI - CLEVTXCL, FDI Code - 1008431, Quad - ULQ

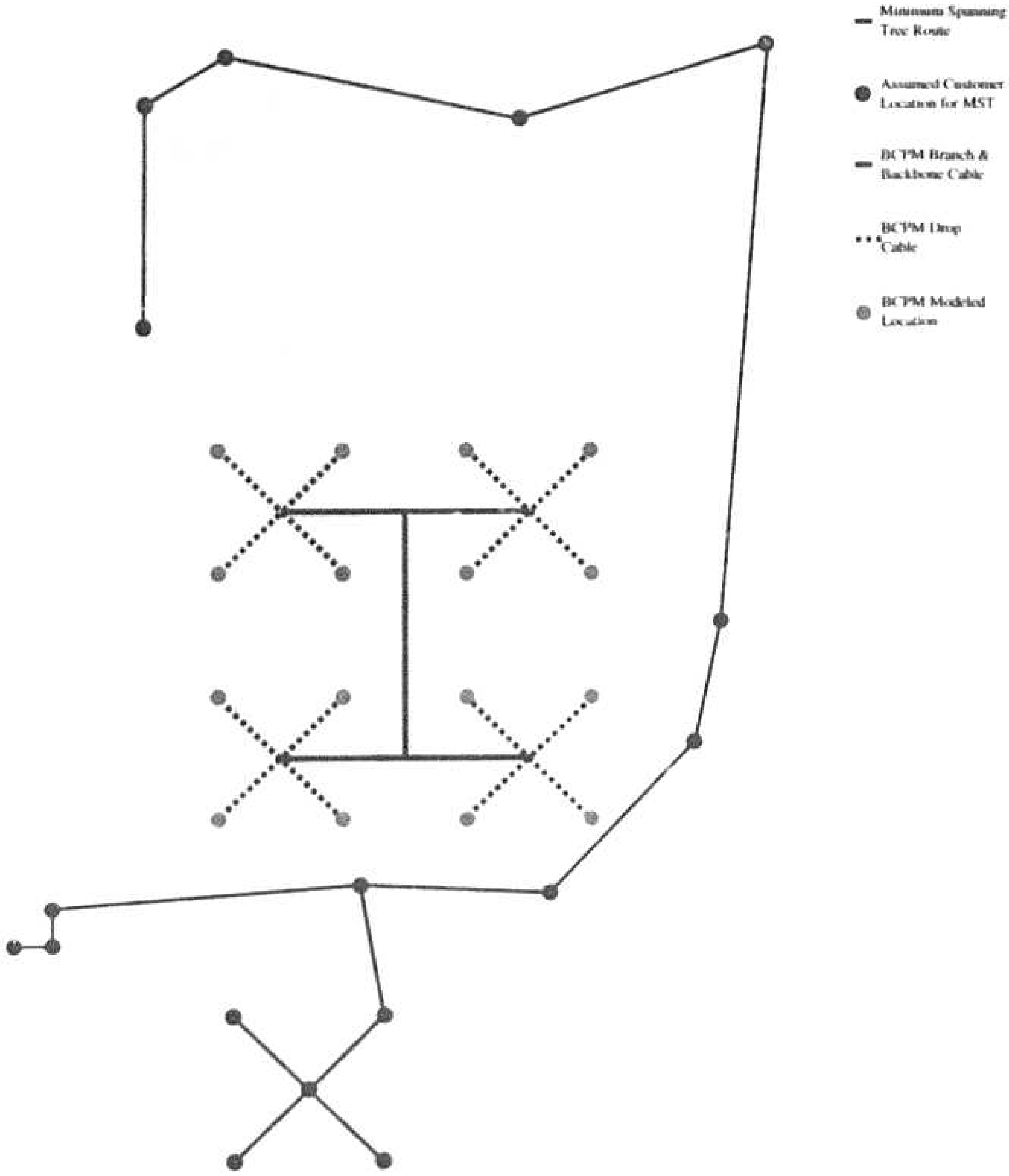
Step 7: Calculate Route Feet Produced by the BCPM



BCPM Route Feet = 13,372

CLLI - CLEVTXCL, FDI Code - 1008431, Quad - ULQ

Step 8: Comparison of Minimum Spanning Tree Feet to BCPM Modeled Route Feet



Minimum Spanning Tree Feet: 17,022 - BCPM Modeled Route Feet: 13,372 = Feet Shortfall: 3650

Exhibit: _____ (DJW/BFP-12)

HAI MODEL COPPER ANALOG DISTRIBUTION LOOP LENGTHS FOR THE STATE OF FLORIDA

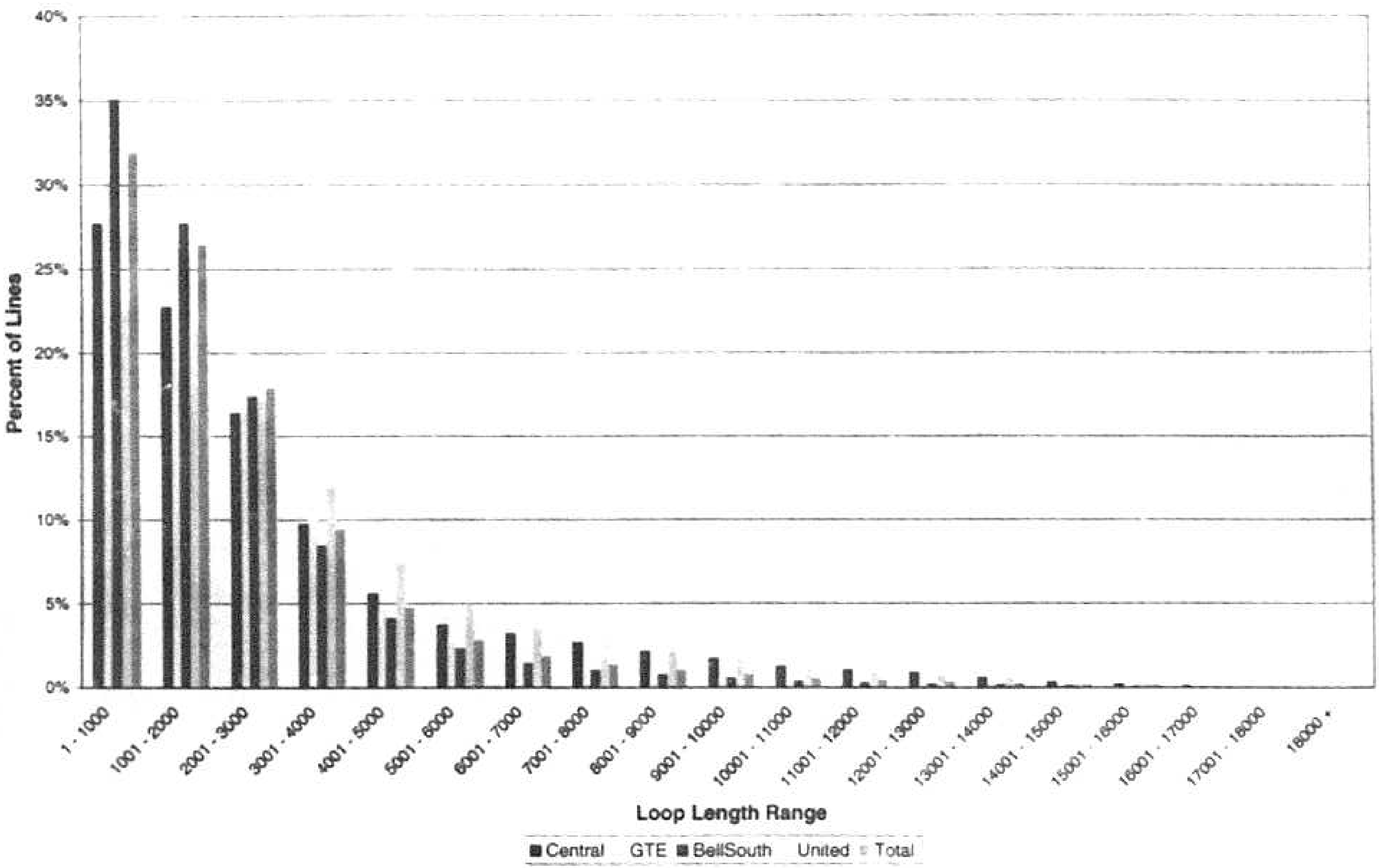


Exhibit: _____ (DJW/BFP-13)

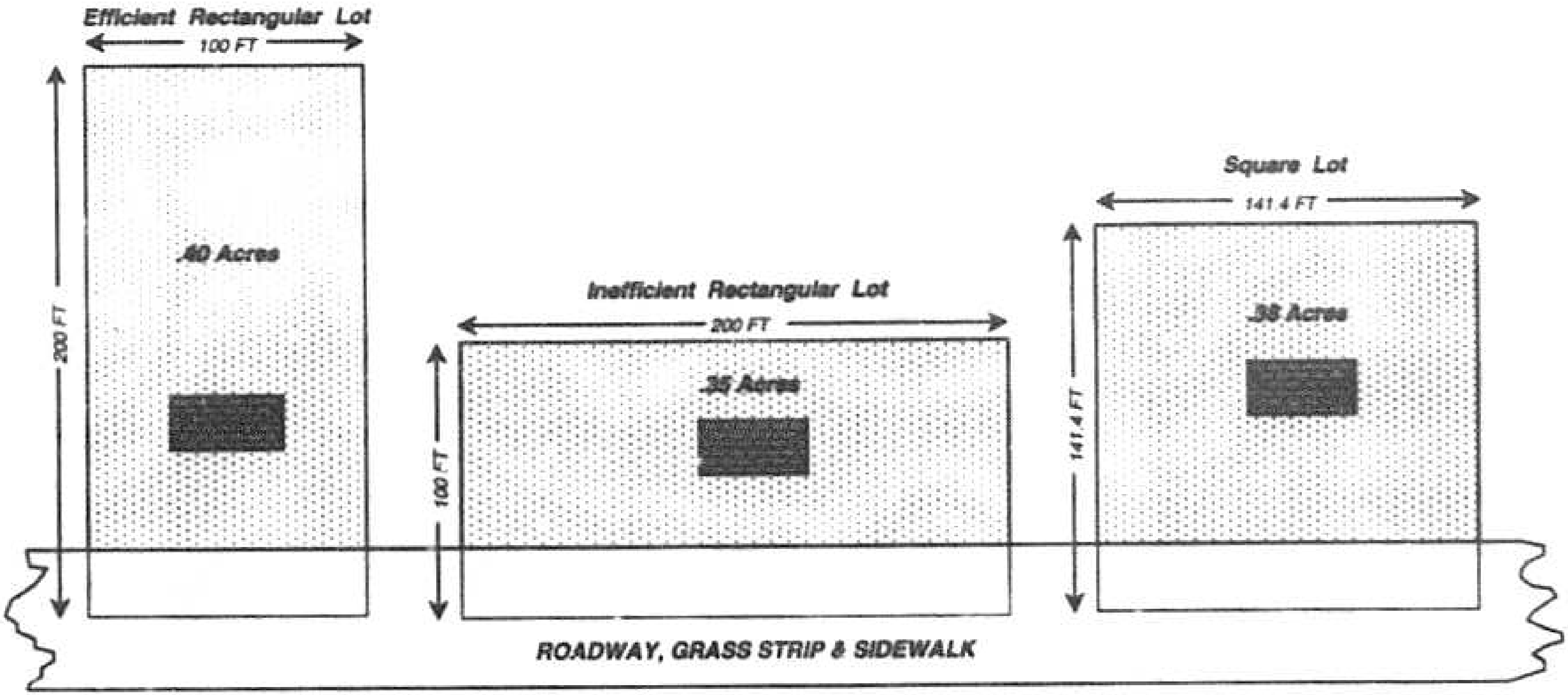
BCPM CABLE DOES NOT REACH MODELED CUSTOMER LOCATIONS IN FLORIDA

Percent Road Reduction	Number of Quadrants	Percent of Quadrants
0% - 10%	78	0.63%
10% - 20%	158	1.27%
20% - 30%	205	1.65%
30% - 40%	313	2.51%
40% - 50%	551	4.42%
50% - 60%	758	6.08%
60% - 70%	1,005	8.07%
70% - 80%	1,267	10.17%
80% - 90%	1,319	10.59%
90% - 100%	1,274	10.23%
No Adjustment	5,529	44.38%
Total	12,457	100.00%

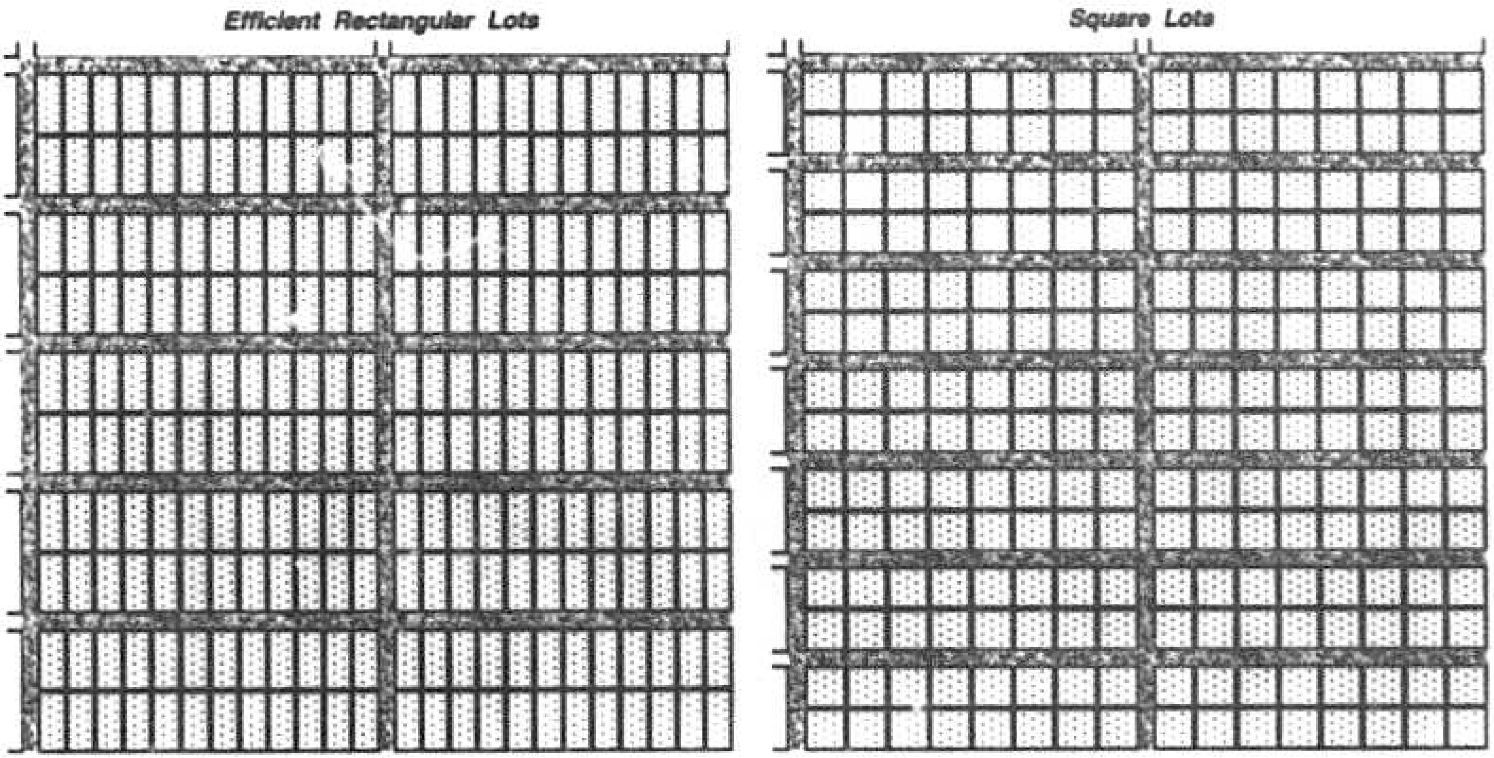
Exhibit: _____ (DJW/BFP-14)

Illustration of Various Lot Designs

20,000 Square Feet of Land



BCPM Square Lot Assumption is Inefficient



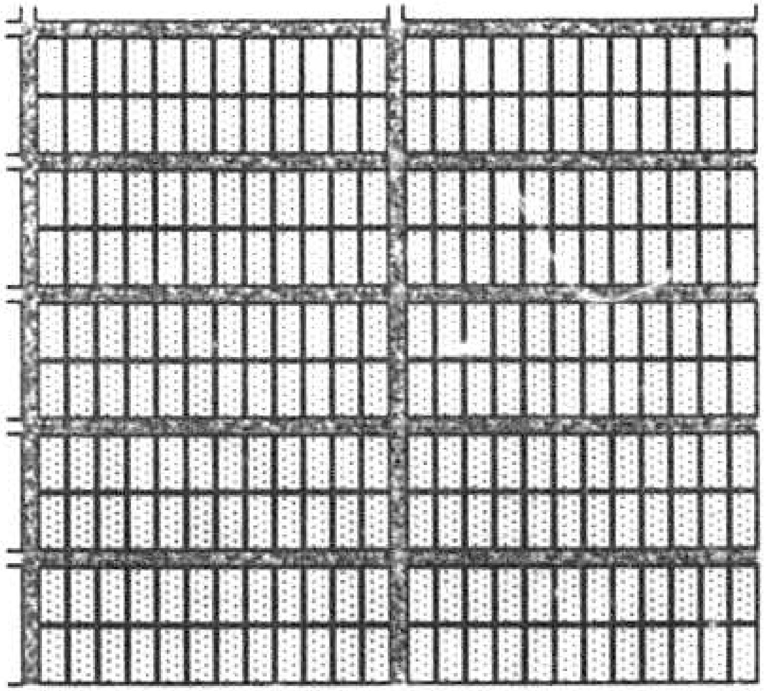
7 Roads
14 Lengths of Grass Strip
14 Lengths of Sidewalk

9 Roads
18 Lengths of Grass Strip
18 Lengths of Sidewalk

NOTE: ALL ROAD PAVING AT EXPENSE OF DEVELOPER
ALL GRASS STRIPS AT EXPENSE OF DEVELOPER
ALL SIDEWALKS AT EXPENSE OF DEVELOPER
USEABLE LOT SIZE IS REDUCED BY AMOUNT OF ROAD, GRASS STRIP & SIDEWALK AREA

Illustration of Inefficient Rectangular Lot Design

Efficient Rectangular Lots



7 Roads
14 Lengths of Grass Strip
14 Lengths of Sidewalk

Inefficient Rectangular Lots

11 Roads
22 Lengths of Grass Strip
22 Lengths of Sidewalk

NOTE: ALL ROAD PAVING AT EXPENSE OF DEVELOPER
ALL GRASS STRIPS AT EXPENSE OF DEVELOPER
ALL SIDEWALKS AT EXPENSE OF DEVELOPER
USEABLE LOT SIZE IS REDUCED BY AMOUNT OF ROAD, GRASS STRIP & SIDEWALK AREA

Exhibit: _____ (DJW/BFP-15)

COMPARISON OF HAI AND BCPM LINES PER SERVING AREA

For All Companies in Florida - Equivalent Wire Centers

Company	No. of WCs	Number of Lines				Number of Serving Areas				Average Lines per Serving Area			
		HAI	BCPM	No. Diff.	Percent Diff	HAI Main Cluster	BCPM Grid	No. Diff.	Percent Diff	HAI Main Cluster	BCPM Grid	No. Diff.	Percent Diff
ALLTEL	27	[illegible]	88,739	-12,025	-14%	331	702	-371	-53%	232	126	105	83%
BELLSOUTH	193	6,520,381	6,992,369	-471,988	-7%	5,948	11,633	[illegible]	[illegible]	1,096	591	505	86%
CENTRAL	45	384,802	375,979	8,823	2%	690	1,411	-721	-51%	558	266	291	109%
FLORALA	2	2,012	3,109	-1,097	-35%	24	54	-30	-56%	84	58	26	46%
FRONTIER	2	3,851	3,655	196	5%	21	46	-25	-54%	183	79	104	131%
GTE	89	2,339,416	2,351,843	-12,427	-1%	2,093	4,383	-2,290	-52%	1,118	537	581	108%
GULF	1	9,320	12,791	-3,471	-27%	40	112	-72	-64%	233	114	119	104%
INDIANTOWN	1	3,406	4,318	-911	-21%	15	34	-19	-56%	227	127	100	79%
NORTHEAST	2	7,767	9,607	-1,840	-19%	34	74	-40	-54%	228	130	99	76%
QUINCY	3	13,608	14,520	-912	-6%	38	87	-49	-56%	358	167	191	115%
ST. JOSEPH	13	30,115	36,782	-6,667	-18%	151	339	-188	-55%	199	109	91	84%
UNITED	91	1,460,289	1,511,811	-51,522	-3%	1,893	4,073	-2,180	-54%	771	371	400	108%
VISTA	1	16,265	3,400	12,865	378%	2	8	-6	-75%	8,132	425	7,707	1814%
TOTAL	470	10,867,976	11,408,954	-540,978	-5%	11,280	23,156	-11,876	-51%	963	493	471	96%

COMPARISON OF HAI AND BCPM LINES PER LARGE DLC

For All Companies in Florida - Equivalent Wire Centers

Company	No. of WCs	Lines Served by Large DLCs				Number of Large DLCs				Average Lines per Large DLC			
		HAI	BCPM	No. Diff.	Percent Diff	HAI	BCPM	No. Diff.	Percent Diff	HAI	BCPM	No. Diff.	Percent Diff
ALLTEL	27	22,873	48,020	-25,147	-52%	26	134	-108	-81%	880	358	521	145%
BELLSOUTH	193	4,139,966	4,332,121	-192,155	-4%	3,636	7,872	-4,236	-54%	1,139	550	588	107%
CENTRAL	45	184,088	209,880	-25,792	-12%	165	452	-287	-63%	1,116	464	651	140%
FLORALA	2	0	965	-965	-100%	0	3	-3	-100%	N/A	322	N/A	N/A
FRONTIER	2	0	1,384	-1,384	-100%	0	5	-5	-100%	N/A	277	N/A	N/A
GTE	89	1,455,148	1,436,723	18,425	1%	1,273	2,752	-1,479	-54%	1,143	522	621	119%
GULF	1	5,766	8,751	-2,985	-34%	5	19	-14	-74%	1,153	461	693	150%
INDIANTOWN	1	836	2,193	-1,357	-62%	1	4	-3	-75%	836	548	288	52%
NORTHEAST	2	1,268	6,160	-4,892	-79%	1	12	-11	-92%	1,268	513	754	147%
QUINCY	3	2,252	6,250	-3,998	-64%	3	19	-16	-84%	753	329	423	129%
ST. JOSEPH	13	6,162	17,862	-11,700	-66%	8	43	-35	-81%	770	415	356	85%
UNITED	91	908,354	1,009,862	-101,508	-10%	835	2,030	-1,195	-59%	1,088	497	590	119%
VISTA	1	16,265	3,366	12,898	383%	10	7	3	43%	1,626	481	1,146	238%
TOTAL	470	6,742,983	7,083,542	-340,559	-5%	5,963	13,352	-7,389	-55%	1,131	531	600	113%

COMPARISON OF HAI AND BCPM LINES PER SMALL DLC

For All Companies in Florida - Equivalent Wire Centers

Company	No. of WCs	Lines Served by Small DLCs				Number of Small DLCs				Average Lines per Small DLC			
		HAI	BCPM	No. Diff.	Percent Diff	HAI	BCPM	No. Diff.	Percent Diff	HAI	BCPM	No. Diff.	Percent Diff
ALLTEL	27	42,727	29,451	13,277	45%	411	555	-144	-26%	104	53	51	96%
BELLSOUTH	193	227,719	87,203	140,517	161%	1,839	1,682	157	9%	124	52	72	139%
CENTRAL	45	54,771	35,841	18,930	53%	542	777	-235	-30%	101	46	55	119%
FLORALA	2	2,002	2,144	-142	-7%	26	51	-25	-49%	77	42	35	83%
FRONTIER	2	3,839	2,163	1,675	77%	32	40	-8	-20%	120	54	66	122%
GTE	89	72,477	29,783	42,694	143%	590	504	86	17%	123	59	64	108%
GULF	1	2,212	2,354	-142	-6%	38	91	-53	-58%	58	26	32	125%
INDIANTOWN	1	1,152	1,054	98	9%	16	28	-12	-43%	72	38	34	91%
NORTHEAST	2	3,205	2,123	1,083	51%	37	60	-23	-38%	87	35	51	145%
QUINCY	3	5,328	3,168	2,160	68%	43	59	-16	-27%	124	54	70	131%
ST. JOSEPH	13	11,195	9,187	2,008	22%	160	278	-118	-42%	70	33	37	112%
UNITED	91	123,693	56,550	67,143	119%	1,088	1,419	-331	-23%	114	40	74	185%
VISTA	1	0	9	-9	-100%	0	1	-1	-100%	N/A	9	N/A	N/A
TOTAL	470	550,321	261,029	289,291	111%	4,822	5,545	-723	-13%	114	47	67	142%

COMPARISON OF HAI AND BCPM LINES PER DLC

For All Companies in Florida - Equivalent Wire Centers

Company	No. of WCs	Total Lines Served by DLCs				Total Number of DLCs				Average Lines per DLC			
		HAI	BCPM	No. Diff.	Percent Diff	HAI	BCPM	No. Diff.	Percent Diff	HAI	BCPM	No. Diff.	Percent Diff
ALLTEL	27	65,601	77,471	-11,870	-15%	437	689	-252	-37%	150	112	38	34%
BELLSOUTH	193	4,367,685	4,419,324	-51,639	-1%	5,475	9,554	-4,079	-43%	798	463	335	72%
CENTRAL	45	238,859	245,721	-6,862	-3%	707	1,229	-522	-42%	338	200	138	69%
FLORALA	2	2,002	3,109	-1,107	-36%	26	54	-28	-52%	77	58	19	34%
FRONTIER	2	3,839	3,547	292	8%	32	45	-13	-29%	120	79	41	52%
GTE	89	1,527,625	1,466,506	61,119	4%	1,863	3,256	-1,393	-43%	820	450	370	82%
GULF	1	7,979	11,106	-3,127	-28%	43	110	-67	-61%	186	101	85	84%
INDIANTOWN	1	1,988	3,247	-1,259	-39%	17	32	-15	-47%	117	101	16	15%
NORTHEAST	2	4,473	8,282	-3,809	-46%	38	72	-34	-47%	118	115	3	2%
QUINCY	3	7,586	9,424	-1,838	-20%	46	78	-32	-41%	165	121	44	36%
ST. JOSEPH	13	17,357	27,049	-9,692	-36%	168	321	-153	-48%	103	84	19	23%
UNITED	91	1,032,047	1,066,412	-34,365	-3%	1,923	3,449	-1,526	-44%	537	309	227	74%
VISTA	1	16,265	3,375	12,890	382%	10	8	2	25%	1,626	422	1,205	286%
TOTAL	470	7,293,304	7,344,571	-51,267	-1%	10,785	18,897	-8,112	-43%	676	389	288	74%

Exhibit: _____ (DJW/BFP-16)

COMPARISON OF HAI MODELED AND BCPM MODELED ROUTE MILES

For All Companies in Florida - Equivalent Wire Centers

Company	No. of WCs	HAI Model Route Miles							Benchmark Cost Proxy Model Route Miles						
		Outlier Road	Outlier Conn.	Branch	Back-bone	Conn. Cable	Sub-feeder	Main Feeder	Branch	Back-bone	Distrib Conn.	Feeder Conn.	Sub-feeder 2	Sub-feeder 1	Main Feeder
ALLTEL	27	9	122	3,249	666	135	718	617	2,348	654	1,707	354	54	922	764
BELLSOUTH	193	54	1,039	41,405	5,252	441	7,044	3,333	34,328	6,020	4,156	5,203	1,719	6,848	3,695
CENTRAL	45	13	324	5,857	1,033	143	1,201	901	4,254	1,041	2,358	749	134	1,544	1,044
FLORALA	2	1	16	186	42	2	56	44	101	37	154	9	6	80	47
FRONTIER	2	2	21	242	47	7	44	38	118	37	112	19	6	66	42
GTE	89	10	189	16,019	1,846	99	2,057	1,240	13,648	2,245	1,112	2,065	463	2,246	1,367
GULF	1	7	56	318	70	4	196	70	246	62	259	41	18	293	81
INDIANTOWN	1	0	30	91	19	3	38	31	44	10	76	11	8	58	25
NORTHEAST	2	0	0	277	55	9	99	70	194	48	140	35	6	91	77
QUINCY	3	2	7	442	92	22	65	65	292	77	173	46	9	113	70
ST. JOSEPH	13	6	142	1,042	208	25	421	310	714	185	680	103	40	508	392
UNITED	91	80	1,191	17,846	2,465	225	3,358	1,933	14,341	2,764	3,445	2,719	573	4,242	2,384
VISTA	1	0	0	7	1	0	2	3	5	1	1	2	0	5	4
TOTAL	470	183	3,138	86,981	11,794	1,116	15,295	8,655	70,636	13,182	14,374	11,346	3,036	17,016	9,992

COMPARISON OF HAI MODELED AND BCPM MODELED ROUTE MILES

For All Companies in Florida - Equivalent Wire Centers

Company	No. of WCs	Distribution Cable Route Miles				Feeder Cable Route Miles				Total Route Miles			
		HAI	BCPM	Diff. (Miles)	Percent Diff	HAI	BCPM	Diff. (Miles)	Percent Diff	HAI	BCPM	Diff. (Miles)	Percent Diff
ALLTEL	27	4,046	4,710	-664	-14.10%	1,470	2,094	-624	-29.80%	5,516	6,804	-1,288	-18.93%
BELLSOUTH	193	47,751	44,504	3,247	7.30%	10,819	17,466	-6,648	-38.06%	58,569	61,970	-3,401	-5.49%
CENTRAL	45	7,227	7,653	-426	-5.57%	2,245	3,471	-1,226	-35.32%	9,471	11,124	-1,652	-14.85%
FLORALA	2	245	292	-47	-16.05%	101	143	-42	-29.44%	346	434	-89	-20.44%
FRONTIER	2	312	267	46	17.12%	88	131	-43	-32.75%	400	398	3	0.68%
GTE	89	18,064	17,006	1,058	6.22%	3,396	6,131	-2,735	-44.61%	21,460	23,137	-1,677	-7.25%
GULF	1	450	566	-116	-20.51%	271	433	-162	-37.46%	721	999	-278	-27.85%
INDIANTOWN	1	140	130	9	7.26%	69	102	-32	-31.82%	209	232	-23	-9.87%
NORTHEAST	2	331	383	-51	-13.44%	178	208	-30	-14.60%	509	591	-82	-13.85%
QUINCY	3	544	542	2	0.39%	153	238	-86	-35.99%	696	780	-84	-10.74%
ST. JOSEPH	13	1,395	1,580	-184	-11.67%	757	1,042	-286	-27.41%	2,152	2,622	-470	-17.92%
UNITED	91	21,583	20,550	1,033	5.03%	5,516	9,918	-4,402	-44.38%	27,099	30,468	-3,369	-11.06%
VISTA	1	8	8	0	5.55%	4	12	-8	-64.09%	13	20	-8	-37.10%
TOTAL	470	102,096	98,190	3,907	3.98%	25,066	41,390	-16,324	-39.44%	127,162	139,580	-12,417	-8.90%

Exhibit: _____ (DJW/BFP-17)

Structure Costs - Distribution v Feeder
By Density Zone

Input Description	Density Zone 0 - 5			Density Zone 5 - 100			Density Zone 100 - 200		
	Distrib	Feeder	Diff. / Avg.	Distrib	Feeder	Diff. / Avg.	Distrib	Feeder	Diff. / Avg.
Distance (Feet)	1,000	1,000	0	1,000	1,000	0	1,000	1,000	0
Investment per Foot									
Aerial	$1.67	$1.67	$0.00	$1.67	$1.67	$0.00	$2.09	$2.09	$0.00
Buried	1.77	1.77	0.00	1.77	1.77	0.00	1.77	1.77	0.00
Underground	10.29	10.29	0.00	10.29	10.29	0.00	10.29	10.29	0.00
Plant Mix									
Aerial	25.00%	50.00%	25.00%	25.00%	50.00%	25.00%	25.00%	50.00%	25.00%
Buried	75.00%	45.00%	-30.00%	75.00%	45.00%	-30.00%	75.00%	45.00%	-30.00%
Underground	0.00%	5.00%	5.00%	0.00%	5.00%	5.00%	0.00%	5.00%	5.00%
Total Investment									
Aerial	$417.00	$834.00	$417.00	$417.00	$834.00	$417.00	$521.25	$1,042.50	$521.25
Buried	1,327.50	796.50	-531.00	1,327.50	796.50	-531.00	1,327.50	796.50	-531.00
Underground	0.00	514.50	514.50	0.00	514.50	514.50	0.00	514.50	514.50
TelCo Percent									
Aerial	50.00%	50.00%	0.00%	33.00%	33.00%	0.00%	25.00%	25.00%	0.00%
Buried	33.00%	40.00%	7.00%	33.00%	40.00%	7.00%	33.00%	40.00%	7.00%
Underground	100.00%	50.00%	-50.00%	50.00%	50.00%	0.00%	50.00%	40.00%	-10.00%
TelCo Investment									
Aerial	$208.50	$417.00	$208.50	$137.61	$275.22	$137.61	$130.31	$260.63	$130.31
Buried	438.08	318.60	-119.48	438.08	318.60	-119.48	438.08	318.60	-119.48
Underground	0.00	257.25	257.25	0.00	257.25	257.25	0.00	205.80	205.80
Total Telco Investment	$646.58	$992.85	$346.28	$575.69	$851.07	$275.39	$568.39	$785.03	$216.64
Percent BCPM Overstated by Using Feeder Cost			53.56%			47.84%			38.11%

Structure Costs - Distribution v Feeder
By Density Zone

Input Description	Density Zone 200 - 650			Density Zone 650 - 850			Density Zone 850 - 2,550		
	Distrib	Feeder	Diff. / Avg.	Distrib	Feeder	Diff. / Avg.	Distrib	Feeder	Diff. / Avg.
Distance (Feet)	1,000	1,000	0	1,000	1,000	0	1,000	1,000	0
Investment per Foot									
Aerial	$2.09	$2.09	$0.00	$2.38	$2.38	$0.00	$2.38	$2.38	$0.00
Buried	1.93	1.93	0.00	2.17	2.17	0.00	3.54	3.54	0.00
Underground	11.35	11.35	0.00	11.88	11.88	0.00	16.40	16.40	0.00
Plant Mix									
Aerial	30.00%	40.00%	10.00%	30.00%	30.00%	0.00%	30.00%	20.00%	-10.00%
Buried	70.00%	40.00%	-30.00%	70.00%	30.00%	-40.00%	70.00%	20.00%	-50.00%
Underground	0.00%	20.00%	20.00%	0.00%	40.00%	40.00%	0.00%	60.00%	60.00%
Total Investment									
Aerial	$625.50	$834.00	$208.50	$714.86	$714.86	$0.00	$714.86	$476.57	-$238.29
Buried	1,351.00	772.00	-579.00	1,519.00	651.00	-868.00	2,478.00	708.00	-1,770.00
Underground	0.00	2,270.00	2,270.00	0.00	4,752.00	4,752.00	0.00	9,840.00	9,840.00
TelCo Percent									
Aerial	25.00%	25.00%	0.00%	25.00%	25.00%	0.00%	25.00%	25.00%	0.00%
Buried	33.00%	40.00%	7.00%	33.00%	40.00%	7.00%	33.00%	40.00%	7.00%
Underground	50.00%	33.00%	-17.00%	40.00%	33.00%	-7.00%	33.00%	33.00%	0.00%
TelCo Investment									
Aerial	$156.38	$208.50	$52.13	$178.71	$178.71	$0.00	$178.71	$119.14	-$59.57
Buried	445.83	308.80	-137.03	501.27	260.40	-240.87	817.74	283.20	-534.54
Underground	0.00	749.10	749.10	0.00	1,568.16	1,568.16	0.00	3,247.20	3,247.20
Total Telco Investment	$602.21	$1,266.40	$664.20	$679.98	$2,007.27	$1,327.29	$996.45	$3,649.54	$2,653.09

Percent BCPM Overstated by Using Feeder Cost	Density Zone 200 - 650	Density Zone 650 - 850	Density Zone 850 - 2,550
	110.29%	195.19%	266.25%

Structure Costs - Distribution v Feeder
By Density Zone

Input Description	Density Zone 2,550 - 5,000			Density Zone 5,000 - 10,000			Density Zone 10,000 +		
	Distrib	Feeder	Diff. / Avg.	Distrib	Feeder	Diff. / Avg.	Distrib	Feeder	Diff. / Avg.
Distance (Feet)	1,000	1,000	0	1,000	1,000	0	1,000	1,000	0
Investment per Foot									
Aerial	$2.78	$2.78	$0.00	$0.00	$2.78	$2.78	$0.00	$2.78	$2.78
Buried	4.27	4.27	0.00	13.00	13.00	0.00	45.00	45.00	0.00
Underground	21.60	21.60	0.00	50.10	50.10	0.00	75.00	75.00	0.00
Plant Mix									
Aerial	30.00%	15.00%	-15.00%	60.00%	10.00%	-50.00%	85.00%	5.00%	-80.00%
Buried	65.00%	10.00%	-55.00%	35.00%	5.00%	-30.00%	5.00%	5.00%	0.00%
Underground	5.00%	75.00%	70.00%	5.00%	85.00%	80.00%	10.00%	90.00%	80.00%
Total Investment									
Aerial	$834.00	$417.00	-$417.00	$0.00	$278.00	$278.00	$0.00	$139.00	$139.00
Buried	2,775.50	427.00	-2,348.50	4,550.00	650.00	-3,900.00	2,250.00	2,250.00	0.00
Underground	1,080.00	16,200.00	15,120.00	2,505.00	42,585.00	40,080.00	7,500.00	67,500.00	60,000.00
TelCo Percent									
Aerial	25.00%	25.00%	0.00%	25.00%	25.00%	0.00%	25.00%	25.00%	0.00%
Buried	33.00%	40.00%	7.00%	33.00%	40.00%	7.00%	33.00%	40.00%	7.00%
Underground	33.00%	33.00%	0.00%	33.00%	33.00%	0.00%	33.00%	33.00%	0.00%
TelCo Investment									
Aerial	$208.50	$104.25	-$104.25	$0.00	$69.50	$69.50	$0.00	$34.75	$34.75
Buried	915.92	170.80	-745.12	1,501.50	260.00	-1,241.50	742.50	900.00	157.50
Underground	356.40	5,346.00	4,989.60	826.65	14,053.05	13,226.40	2,475.00	22,275.00	19,800.00
Total Telco Investment	$1,480.82	$5,621.05	$4,140.24	$2,328.15	$14,382.55	$12,054.40	$3,217.50	$23,209.75	$19,992.25
Percent BCPM Overstated by Using Feeder Cost			279.59%			517.77%			621.36%

Exhibit: _____ (DJW/BFP-18)

COMPARISON OF HAI MODEL AND BCPM MODELED DISTANCES

TO THE MINIMUM SPANNING TREE DISTANCE (by wire center)

For Distribution Areas with at least 2 Locations For BellSouth - Florida Included Wire Centers

Wire Center	HAI				BCPM			
	MST	Modeled	# Diff	% Diff	MST	Modeled	# Diff	% Diff
ARCHFLMA	172	235	62	36.18%	242	268	26	10.70%
BCRTFLBT	126	295	169	134.21%	290	285	-5	-1.74%
BGPIFLMA	104	177	73	70.41%	162	209	48	29.40%
BKVLFLJF	679	1195	515	75.85%	1351	1598	248	18.34%
BLDWFLMA	100	124	24	23.77%	112	106	-6	-5.33%
BLGLFLMA	144	247	103	71.97%	281	286	6	1.97%
BNNLFLMA	264	276	12	4.48%	373	411	38	10.21%
BRSNFLMA	216	194	-22	-10.25%	253	293	41	16.04%
CCBHFLAF	5	9	4	87.12%	7	10	3	33.69%
CDKYFLMA	63	62	-1	-1.34%	87	82	-5	-6.07%
CFLDFLMA	399	417	18	4.50%	511	587	76	14.84%
CHPLFLJA	380	379	0	-0.06%	489	522	33	6.68%
CSCYFLBA	206	183	-23	-11.02%	238	236	-3	-1.15%
DBRYFLDL	206	329	123	59.76%	378	449	71	18.91%
DBRYFLMA	108	214	106	98.06%	205	240	35	17.18%
DELDFLMA	411	761	350	85.10%	838	978	140	16.73%
DLBHFLKP	216	508	292	134.81%	579	435	-144	-24.88%
DLSPFLMA	82	131	49	59.22%	130	159	30	22.87%
DNLNFLWM	524	666	143	27.25%	784	1021	237	30.17%
DYBHFLFN	12	24	12	95.94%	25	13	-12	-47.00%
DYBHFLMA	370	690	320	86.29%	809	785	-24	-2.96%
DYBHFLOB	434	822	388	89.57%	831	847	16	1.89%
DYBHFLOS	66	123	56	84.60%	143	146	3	2.07%
EGLLFLIH	189	408	219	115.74%	403	400	-2	-0.60%
EORNFLMA	210	338	128	60.91%	304	364	61	19.97%
FLBHFLMA	72	120	48	67.28%	144	152	9	6.04%
FRBHFLFP	279	477	197	70.67%	477	529	52	10.94%
FTGRFLMA	28	36	7	25.95%	25	26	1	5.26%
FTLDFLCY	172	444	272	158.59%	402	389	-13	-3.35%
FTLDFLSG	21	54	32	150.89%	40	41	1	3.15%
FTLDFLSU	188	528	340	181.09%	640	546	-94	-14.76%
FTLDFLWN	102	306	204	200.56%	192	138	-54	-28.05%

COMPARISON OF HAI MODEL AND BCPM MODELED DISTANCES
TO THE MINIMUM SPANNING TREE DISTANCE (by wire center)
For Distribution Areas with at least 2 Locations For BellSouth - Florida Included Wire Centers

Wire Center	HAI				BCPM			
	MST	Modeled	# Diff	% Diff	MST	Modeled	# Diff	% Diff
GCSPFLCN	299	412	113	37.84%	472	520	48	10.13%
GCVLFLMA	306	300	-7	-2.24%	376	396	20	5.20%
GENVFLMA	128	174	46	35.69%	173	213	40	23.29%
GLBRFLMC	202	408	206	102.03%	439	453	14	3.08%
GSVLFLNW	99	282	183	184.24%	268	264	-3	-1.22%
HAVNFLMA	244	346	102	41.64%	337	394	57	16.86%
HBSDFLMA	115	211	96	83.80%	227	263	36	15.62%
HLNVFLMA	275	441	166	60.40%	423	544	121	28.67%
HLWDFLHA	84	205	121	144.69%	274	176	-98	-35.91%
HMSTFLHM	596	751	155	25.93%	412	434	22	5.25%
HMSTFLNA	124	245	120	96.92%	257	306	49	19.09%
HTISFLMA	119	220	100	84.23%	276	251	-25	-9.12%
HWTHFLMA	346	351	5	1.49%	445	533	88	19.76%
ISLMFLMA	46	93	47	102.02%	86	97	10	12.08%
JAY FLMA	346	342	-4	-1.29%	449	448	-1	-0.22%
JCBHFLAB	113	247	134	119.05%	203	215	12	5.76%
JCBHFLMA	239	563	324	135.29%	522	522	0	-0.05%
JCBHFLSP	56	121	65	116.43%	94	92	-2	-1.73%
JCVLFLCL	277	556	280	101.20%	611	663	51	8.39%
JCVLFLFC	176	280	104	58.73%	347	346	0	-0.08%
JCVLFLIA	11	22	11	107.63%	17	18	1	5.83%
JCVLFLJT	7	27	20	267.99%	15	15	0	-3.28%
KYHGFLMA	243	300	57	23.32%	406	527	121	29.77%
KYLRFLLS	77	166	89	116.41%	170	202	31	18.36%
KYLRFLMA	85	219	134	158.15%	179	194	15	8.18%
KYWSFLMA	141	428	287	204.07%	352	347	-6	-1.59%
LKCYFLMA	982	1181	200	20.32%	1401	1624	223	15.92%
LKMRFLMA	85	187	102	119.34%	98	105	7	7.10%
LYHNFLOH	223	372	149	66.94%	414	485	71	17.23%
MCNPFLMA	185	183	-2	-1.24%	180	201	22	12.04%
MDBGFLPM	362	616	254	70.02%	612	784	172	28.19%
MIAMFLAE	240	674	434	181.31%	565	565	0	0.02%

COMPARISON OF HAI MODEL AND BCPM MODELED DISTANCES

TO THE MINIMUM SPANNING TREE DISTANCE (by wire center)

For Distribution Areas with at least 2 Locations For BellSouth - Florida Included Wire Centers

Wire Center	HAI				BCPM			
	MST	Modeled	# Diff	% Diff	MST	Modeled	# Diff	% Diff
MIAMFLAL	172	379	207	120.70%	411	434	23	5.68%
MIAMFLAP	25	63	38	155.59%	52	52	-1	-1.53%
MIAMFLBA	115	319	204	176.97%	314	279	-34	-10.96%
MIAMFLBC	65	151	86	133.66%	132	120	-12	-8.87%
MIAMFLBR	114	348	234	204.86%	376	204	-173	-45.89%
MIAMFLFL	105	322	217	205.64%	279	262	-17	-6.24%
MIAMFLGR	53	315	262	490.97%	170	115	-55	-32.26%
MIAMFLKE	28	66	38	134.08%	81	57	-24	-29.30%
MIAMFLME	54	184	130	242.28%	144	105	-38	-26.62%
MIAMFLNM	127	299	172	135.54%	309	275	-34	-11.14%
MIAMFLNS	227	415	188	82.43%	503	548	45	8.92%
MIAMFLPB	220	444	224	101.62%	482	477	-5	-1.11%
MIAMFLPL	153	448	294	191.77%	369	395	26	7.07%
MIAMFLSH	249	515	266	106.73%	544	578	34	6.28%
MIAMFLWD	207	581	374	180.50%	630	561	-69	-10.94%
MIAMFLWM	182	445	263	144.96%	429	438	9	2.13%
MICCFLBB	39	87	48	124.44%	54	58	4	7.72%
MLTNFLRA	498	797	299	60.13%	850	979	129	15.17%
MNDRFLAV	17	67	50	304.62%	61	25	-37	-59.71%
MNDRFLLO	337	695	358	106.05%	683	681	-1	-0.20%
MNDRFLLW	110	182	72	65.64%	161	184	23	14.47%
MNSNFLMA	129	82	-47	-36.38%	127	95	-32	-25.14%
MRTHFLVE	124	276	152	123.39%	260	270	10	3.89%
MXVLFLMA	124	157	32	26.08%	151	169	18	11.91%
NDADFLAC	186	448	263	141.35%	510	373	-137	-26.81%
NDADFLGG	160	381	221	137.53%	427	392	-36	-8.33%
NDADFLOL	97	290	193	199.34%	337	217	-120	-35.55%
NKLRFLMA	15	48	33	217.01%	58	55	-3	-5.10%
NWBYFLMA	187	255	69	36.73%	257	288	31	12.27%
OKHLFLMA	91	134	43	47.01%	117	132	15	12.91%
OLTWFLLN	267	289	22	8.23%	425	529	104	24.59%
ORPKFLMA	247	473	226	91.67%	487	493	6	1.17%

COMPARISON OF HAI MODEL AND BCPM MODELED DISTANCES

TO THE MINIMUM SPANNING TREE DISTANCE (by wire center)

For Distribution Areas with at least 2 Locations For BellSouth - Florida Included Wire Centers

Wire Center	HAI				BCPM			
	MST	Modeled	# Diff	% Diff	MST	Modeled	# Diff	% Diff
ORPKFLRW	151	285	134	88.84%	319	312	-7	-2.24%
PACEFLPV	300	507	207	69.15%	487	570	83	17.12%
PAHKFLMA	71	111	39	55.34%	142	149	7	4.77%
PLCSFLMA	261	462	200	76.60%	490	578	87	17.84%
PLTKFLMA	598	754	156	26.06%	889	1027	139	15.64%
PMBHFLCS	339	788	449	132.46%	874	748	-126	-14.45%
PMBHFLTA	172	434	262	152.06%	532	444	-87	-16.44%
PMPKFLMA	153	193	40	26.05%	204	264	60	29.47%
PNCYFLCA	156	285	130	83.37%	263	282	20	7.47%
PNSCFLHC	164	300	136	82.62%	295	339	45	15.13%
PNSCFLPB	92	198	106	114.84%	183	177	-6	-3.50%
PNVDFLMA	180	338	158	87.86%	348	332	-16	-4.53%
PRSNFLFD	209	228	19	9.19%	238	262	24	10.07%
PTSLFLSO	153	313	160	104.58%	338	367	29	8.70%
SBSTFLFE	98	88	-10	-10.57%	96	112	16	16.78%
SBSTFLMA	233	429	196	84.26%	398	503	105	26.34%
SGKYFLMA	89	159	69	77.36%	117	147	29	25.20%
STAGFLBS	93	191	99	106.33%	202	180	-22	-10.81%
STAGFLMA	482	791	309	63.98%	535	630	95	17.70%
SYHSFLCC	177	157	-20	-11.40%	248	227	-21	-8.57%
TRENFLMA	388	405	17	4.35%	462	490	28	6.02%
TTVLFLMA	507	882	375	73.94%	975	1024	49	5.07%
VERNFLMA	288	243	-44	-15.43%	291	293	2	0.69%
VRBHFLBE	110	242	132	119.51%	233	221	-12	-5.20%
WELKFLMA	154	183	29	18.85%	202	256	55	27.05%
YNFNFLMA	212	231	19	8.99%	315	337	21	6.82%
YNTWFLMA	190	173	-17	-9.02%	224	232	9	3.89%
YULEFLMA	134	160	26	19.53%	165	201	35	21.36%
TOTAL	24,259	41,179	16,920	69.74%	43,103	45,298	2,195	5.09%

Exhibit: _____ (DJW/BFP-19)

COMPARISON OF HAI MODEL AND BCPM MODELED DISTANCES

TO THE MINIMUM SPANNING TREE DISTANCE (by density zone)

For Distribution Areas with at least 2 Locations For BellSouth - Florida Included Wire Centers

Density Zone	HAI				BCPM			
	MST	Modeled	# Diff	% Diff	MST	Modeled	# Diff	% Diff
00000 - 00005	1,120	852	-268	-23.94%	1,036	640	-396	-38.23%
00005 - 00100	9,616	12,662	3,046	31.67%	10,776	12,173	1,397	12.96%
00100 - 00200	2,310	3,880	1,570	68.00%	4,192	5,371	1,180	28.15%
00200 - 00650	3,215	6,577	3,362	104.56%	5,406	6,413	1,007	18.63%
00650 - 00850	775	1,327	553	71.34%	1,270	1,359	90	7.06%
00850 - 02550	3,179	5,973	2,794	87.91%	7,413	7,662	249	3.35%
02550 - 05000	2,366	5,063	2,697	114.00%	6,593	6,682	90	1.36%
05000 - 10000	1,386	3,679	2,293	165.38%	4,133	3,615	-518	-12.53%
10000 +	293	1,166	873	298.37%	2,285	1,382	-903	-39.52%
TOTAL	24,259	41,179	16,920	69.74%	43,103	45,298	2,195	5.09%

Exhibit: _____ (DJW/BFP-20)

METROMAIL

Date: December 19, 1997

To: Ron Lindsay cc: Glenn Hudock

From: Kevin Wieser

Subject: Emerson and Associates' Metromail findings.

After reviewing the document prepared by Emerson and Associates to compare data sources utilized for their Benchmark Cost Planning Model(BCPM) and Hatfield Cost Planning Model (Hatfield 5.0); it is apparent that some inaccurate statements have been made concerning Metromail's National Consumer Database (NCDB). I would like to clarify some of the following statements: *(Please note, further investigation is being pursued in relation to other statements made about the NCDB.)*

Statement: *As of December 5, 1997, the Metromail database contained 74.4 million named and unnamed address record's for the 50 states.*

Fact: As of December 19, 1997, the Metromail database contains 98.2 million named and unnamed households.

Statement: Hence, the Metromail database contains only 69% of the potential addresses.....The Hatfield documentation for Preliminary Release 5.0 claims that the Metromail database includes 90% of the 1995 Census count.

Fact: The Metromail database does have over 90% (approximately 91.5%) of the residential addresses in the U.S.

Further, address counts listed within the document are under represented at the state and county level (see attachments). Investigation is being made into other geo coverage statements and will be forthcoming.

If you need any other clarifications, please feel free to call me at 402-473-4866. Thanks. Have a happy holiday.

Exhibit: _____ (DJW/BFP-21)

COMPARISON OF ANNUAL CHARGE FACTORS AND CAPITAL COSTS BETWEEN THE BCPM AND THE HAI MODEL METHODOLOGY

ARMIS Account Name	HAI Model Investment		Annual Cost Factor		Monthly Capital Cost		Capital Cost Difference
	Total	Per Month per Line	BCPM	HAI Model	BCPM	HAI Model	
Motor Vehicle	$16,723,128	$0.21	14.57%	20.29%	$0.03	$0.04	$0.01
Garage Work	402,354	0.01	14.53%	18.43%	0.00	0.00	0.00
Other Work	23,339,264	0.30	14.02%	17.17%	0.04	0.05	0.01
Building	235,581,238	3.01	15.84%	15.59%	0.48	0.47	-0.01
Furniture	1,747,367	0.02	13.81%	16.72%	0.00	0.00	0.00
Office Support	5,888,215	0.08	14.51%	18.38%	0.01	0.01	0.00
Computers	79,990,762	1.02	17.74%	29.12%	0.18	0.30	0.12
Switching	580,000,30[illegible]	7.41	15.02%	19.83%	1.11	1.47	0.36
Circuit/DLC	864,307,481	11.05	15.34%	20.80%	1.69	2.30	0.60
Pole	49,662,720	0.63	15.69%	15.98%	0.10	0.10	0.00
Aerial Copper	416,902,016	5.33	16.67%	18.29%	0.89	0.97	0.09
Aerial Fiber	64,762,670	0.83	15.71%	16.53%	0.13	0.14	0.01
UG Copper	134,052,068	1.71	17.02%	18.99%	0.29	0.33	0.03
UG Fiber	192,447,167	2.46	15.59%	16.35%	0.38	0.40	0.02
Buried Copper	1,142,515,789	14.60	16.52%	17.89%	2.41	2.61	0.20
Buried Fiber	155,719,440	1.99	15.57%	16.32%	0.31	0.32	0.01
Conduit	87,518,098	1.12	14.56%	15.66%	0.16	0.18	0.01
TOTAL	$4,051,560,079	$51.78			$8.23	$9.70	$1.47

PERCENT HAI MODEL CAPITAL COST PER MONTH PER LINE IS GREATER THAN BCPM	17.85%

Notes:
- Investment is based on HAI Model run for BellSouth in Florida
- Investment per month per line is estimated on 6,520,381 BellSouth lines in Florida
- BCPM annual cost factors are from BellSouth's FLEcon2 run submitted in this proceeding, modified for square life curves
- HAI Model annual cost factors are based on the BCPM inputs used in BellSouth's FLEcon2 run submitted in this proceeding