ORIGINAL

DIRECT TESTIMONY OF MR. JAMES W. STEGEMAN

ON BEHALF OF BELLSOUTH TELECOMMUNICATIONS, INC.

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

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INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS AFFILIATION.

A. My name is James W. Stegeman. I am the President of CostQuest Associates, Inc. I am testifying on behalf of BellSouth Telecommunications ("BellSouth", "BST" or the "Company").

Q. WHAT EXPERIENCE AND QUALIFICATIONS DO YOU HAVE PERTAINING TO YOUR TESTIMONY?

A. I have a Bachelors degree in Mathematics and Statistics and a Masters degree in Statistics from Miami University, Oxford, Ohio. Previously I was employed with Merrell Dow Research Institute, Cincinnati Bell Telephone, and INDETEC International. My work has included statistical evaluation of data, training, cost estimation, and financial analysis. I have developed systems and models to perform a variety of functions including the following: cost estimation; competitive assessment; product profitability; and budgeting.

Q. DO YOU HAVE EXPERIENCE WITH MODELS DESIGNED TO ESTIMATE THE COSTS OF BASIC LOCAL EXCHANGE SERVICE AND ITS COMPONENTS?

A. Yes. I designed, coded and implemented the Cost Proxy Model (CPM) currently in use in California. I assisted in the design, coding and implementation of the Benchmark Cost Proxy Model (BCPM). I designed the Universal Service Cost model adopted for use in Hong Kong. I led the development of the Australian Universal Service Cost model, and consulted on the development of similar costing models in Japan. I have also reviewed the HAI and HCPM models during their development.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. I describe the BellSouth Telecommunication Loop Model (BSTLM©). This includes an overview of the model development, the process by which customer locations are determined and located, the preprocessing steps, the architecture, logic, and processing of the model, and the models reporting capability. Daonne Caldwell will discuss the inputs into the model and results of the model. Keith Milner will cover some of the engineering aspects of the model.

Also, for the readers' convenience, I have provided a list of acronyms used as an attachment to my testimony as exhibit JWS-1.

Q. BRIEFLY OUTLINE YOUR TESTIMONY?

A. The major sections of my testimony discuss the following topics:

1. BSTLM© background, including a discussion of why the model was built and the nature of its development.
2. An overview of the model architecture, various processing steps, and a description of some of the advantages of the BSTLM©.
3. A discussion of customer data, plant data, geocoding results, and the geocoding process.
4. Geographic Information Systems (GIS) preprocessing of the geographic data used in the model.
5. The GIS Process that determines clusters and the network layout.
6. Configuration component of the model.
7. Investment component of the model.
8. Summary component of the model.
9. Reports generated by the model.
10. The major design points of the BSTLM© compared to other models.

SECTION 1

BACKGROUND

Q. WHY WAS THE BSTLM© BUILT?

A. As BellSouth began planning for the next round of UNE hearings over one and one-half years ago, it was recognized that new loop costs would be needed. Three basic options existed for BellSouth: 1) use the same sampling process used in prior proceedings; 2) expand or enhance existing proxy models in the public arena; or 3) develop a new model that incorporated the best techniques from all models. The third approach was selected. The reasons for this decision will be covered in detail in this testimony.

Q. WHY WAS THE SAMPLING APPROACH NOT USED?

A. While cost studies based upon sampling have been accepted in Florida before, BellSouth recognized that this approach had certain limitations:

- Sampling is very time-consuming and expensive;
- Sampled data becomes dated rapidly;
- Sample data does not provide data for the latest technologies and services;
- Samples typically were only provided at a statewide level -geographic de-averaging is not possible without a significant increase in the sample size;
- Due to the sample, some network elements may not be represented;
- Selection of sample can be contested;

Due to these limitations, BellSouth elected not to pursue sampling in developing its cost studies

Q. DID BELLSOUTH CONSIDER THE USE OR MODIFICATION OF EXISTING LOOP MODELS?

A. Yes. BellSouth was well aware of the models that were available at the time. I also provided assistance in the review of the features of the HAI, BCPM, and the HCPM portion of the Synthesis model. Please note that at the time BSTLM© development began, the HCPM was still under construction.

Q. IS THE USE OR MODIFICATION OF ONE OF THE EXISTING PROXY MODELS A VIABLE ALTERNATIVE?

A. No. The HAI, BCPM and HCPM have been accepted as models for estimating the cost of the efficient carrier providing universal service. In fact, BellSouth was one of the sponsors of the BCPM. However, the existing models have limitations and major modifications would be needed to make the models both applicable for UNEs and to meet the internal demands of BellSouth. The following highlights some of the limitations and required modifications:

- The Proxy models provide results only for basic residential and basic business services.

- The Proxy models would require revisions to provide investments for all services and unbundled network elements (UNEs).
- The Proxy models do not reflect the engineering practices of any specific provider, most importantly BellSouth's engineering practices.
- Model changes may be so significant that the resulting model would bear little resemblance to the original model, thereby, eliminating any benefit of using the platform as a starting point.
- The current platforms of these models do not have the flexibility to meet BellSouth's requirements:
  - Include as much actual data as possible;
  - Account for various network architectures;
  - Model loops associated with all services and UNEs;
  - Provide dynamic reporting;
  - Provide accurate costs at a low geographic level;
- The accuracy of the resulting model may be endangered by the constraints of the selected base platform.
- The cost and time to modify the existing models may be higher and longer than starting from scratch.

Q. WERE THE EXISTING PROXY MODELS IGNORED DURING THE DEVELOPMENT OF BSTLM©?

A. No. To the contrary, the BSTLM© development team was well versed in the methodologies used by the existing proxy models. In fact, members of the development team were instrumental in the development of the BCPM and HCPM and in the review of the HAI. Given this in-depth knowledge, the team was also aware of the design shortcomings of the proxy models.

In building the BSTLM©, the development team incorporated the best methods and techniques of the existing models while incorporating next-generation modeling techniques. The resulting model is truly the "next generation" loop model. The team worked to ensure the BSTLM© would have the following characteristics.

- The results accurately reflect BellSouth's engineering practices;
- It incorporates all of BellSouth's geocoded customer and network data;
- It provides results for most required services and UNEs;
- It does not rely on sampling techniques;
- The results can support geographic de-averaging of costs;
- Would provide an easy-to-use interface.

Q. YOU MENTIONED EARLIER THAT THE PROXY MODELS COULD NOT MEET THE DEMANDS OF THE DEVELOPMENT TEAM. WHAT WERE SOME OF THOSE MODELING DEMANDS?

A. The key design characteristics required in the model were as follows:

- The model must improve upon the routing techniques used in the current models. Use road data to provide a more accurate portrayal of cable routing.
- All loop services and UNEs must be incorporated into the model. In so doing, the model must account for the specific engineering constraints of these services and the dispersion of these services.
- It must incorporate BellSouth's geocoded data, including:
  - All customer points
  - Wire center locations
  - Wire center boundaries
- It must correctly model the provisioning of Special Services. This would include 2-wire, 4-wire and, DS1 loops and subloops.
- The user must be able to control and evaluate all inputs.
- The model must be easy to run, have basic window features, built using common programming tools, open to review, and flexible to meet the demanding and diverse needs.
- The model must reflect the diversity of services and UNEs offered by BST. It must not assume "a loop is a loop."
- It must incorporate BellSouth's engineering approaches.
- The model should perform most processing in the platform to avoid the "Data Black boxes" found in other models. This means that clustering should be a basic part of the model.
- It should use the best modeling approaches to all parts of the network.

- The model should build the network to customers, rather than moving customers to the network that is built.

Q. WHAT IS THE HISTORY OF THE BSTLM© DEVELOPMENT?

A. Preliminary work on the model started in the last quarter of 1998. Formal development began in the 1st quarter of 1999. The initial version of the BSTLM© was completed in the last quarter of 1999. The current version used in this filing was completed early this year.

The development team consisted of INDETEC International and BellSouth. CostQuest Associates and Stopwatch Maps worked as sub-contractors to INTEDEC international.

Q. EARLIER YOU MENTIONED KEY DESIGN FEATURES, WERE THERE OTHER OBJECTIVES USED BY THE DEVELOPMENT TEAM IN BUILDING THE MODEL?

A. Yes, there were several, including:

- Run on a PC platform
- Distributable in a standard Windows setup package
- Open Platform
    - Use Excel as much as possible to allow easier review by outside parties
    - Auditable

- Support Total Element and Total Service Long-Run Incremental costing principles.

SECTION 2

OVERVIEW

Q. HOW DOES THE BSTLM© DEVELOP REQUIRED LOOP DISTANCE.

A. First, note that a detailed overview of the model methodology was filed with the Commission on April 17, 2000. Obviously, my testimony cannot serve to replace the BSTLM© Model methodology, and those interested in the details of the model should refer to that document.

The BSTLM© is the next-generation approach to understanding the loop costs of an efficient telecom provider. As such, it reflects the forward-looking engineering practices of BellSouth. While it is a new platform, it has its basis in the BCPM, HAI and HCPM models that preceded it.

At its most basic level, the model is simply the development of the best "connects the dots" approach that is available.

In past proceedings in Florida and at the national level, many of the existing models were reviewed and gauged using a Minimum Spanning Tree ("MST"). The MST represents a theoretical minimum amount of plant distance required to serve a set of customers. Using this tool, reviewers could determine that a model built sufficient plant to meet this MST minimum. A model failing this test clearly built too little plant to connect customers. However, the test could never determine if the model built the right amount of plant.

In continuing the evolution of the loop models, the FCC incorporated the use of the MST in the HCPM. In so doing, the FCC recognized the strength of the MST in determining airline routing from point to point. However, the FCC also recognized that the MST was not a true measure of the required routing but rather a test for the minimum plant distance needed. In order to develop a more accurate routing test, the FCC chose a modified MST. That is, the FCC uses rectilinear routing of the MST to estimate the actual routing that may take place between points.[1] However, rectilinear routing will still lead to overstatements of actual plant distance in some instances and understatements in other instances.

The BCPM sponsors recognized that roads provided the best approximation of telecom routing. However, the BCPM approach did not implement a true road routing of points in the model.

The BSTLM© development team recognized that a major deficiency in the existing proxy models exists in that they unsuccessfully capture the realistic routing that occurs between points in actual telecommunications networks. The BSTLM© represents the implementation of the next generation of model routing. It combines the aspects of the MST with the knowledge of roads and the rights-of-way that the telecom network will

[1] Rectilinear routing assumes that routing occurs at right angle paths to points, rather than along a straight line.

typically route over. This approach is referred to in the documentation (and in the rest of my testimony) as the Minimum Spanning Road Tree ("MSRT"). This a breakthrough approach in that it builds the minimum amount of plant that connects points following the road network.

It is worth noting that the MSRT most likely results in less plant than is actually in place in BellSouth's network. The MSRT represents the minimum road distance with complete knowledge of all current roads and customers. BellSouth's actual cable routes were developed over time in recognition of customer growth patterns and in part during time periods before all current roads were in existence. BellSouth also faces constraints on the use of rights-of-way.

Q. PLEASE PROVIDE A BRIEF OVERVIEW OF THE MODEL'S DESIGN.

A. The BSTLM© can be thought of as two modules. The first, or pre-processing module, refines data into a format useful for investment determination. The second module is the BSTLM© application. The BSTLM© clusters customers, constructs a wire line network adhering to user inputs and generally accepted engineering algorithms, develops investment and ultimately produces investment data specific to a service or UNE.

Q. WHY WAS THE BSTLM© CONSTRUCTED IN TWO MODULES?

A. The architecture of the BSTLM© is not unlike other proxy models. The functions of customer clustering, network construction and investment determination are open and available to users. The pre-processing module, which is essentially a data preparation process, is computationally intensive and time consuming. Further, the output of pre-processing changes infrequently. To increase the processing speed and turn-around time for most analyses, the data preparation steps are separated from the other modeling components of the BSTLM©.

Q. PLEASE REVIEW THE STRUCTURE AND ARCHITECTURE OF THE BSTLM© APPLICATION.

A. The BSTLM© application is made up of the GIS Process, Edit Inputs area, the Network process (Configuration, Investment, and Summary) and the Reporting process (as depicted in the main screen of the model).

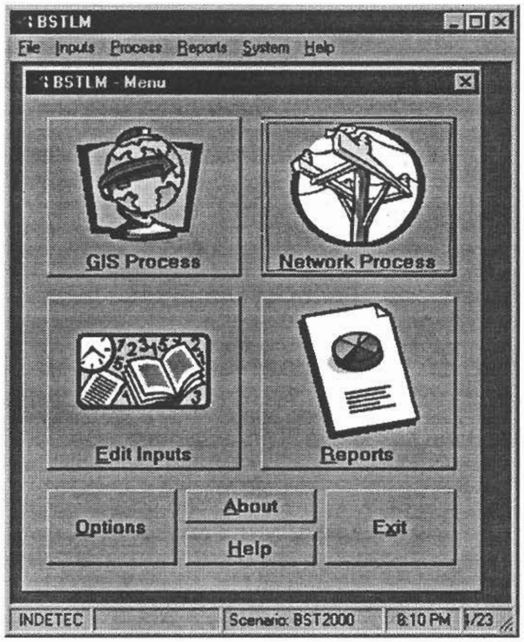

FIGURE 1: BSTLM© MAIN MENU

The GIS process creates the engineering areas, routing, and plant locations. The network process determines the engineering of the network, including the size and type of plant and the necessary investment, and the association of the investment with the services provided. The Reporting process is a dynamic tool allowing the user to obtain a wide variety of information from the model.

The following chart depicts the basic architecture of the model.

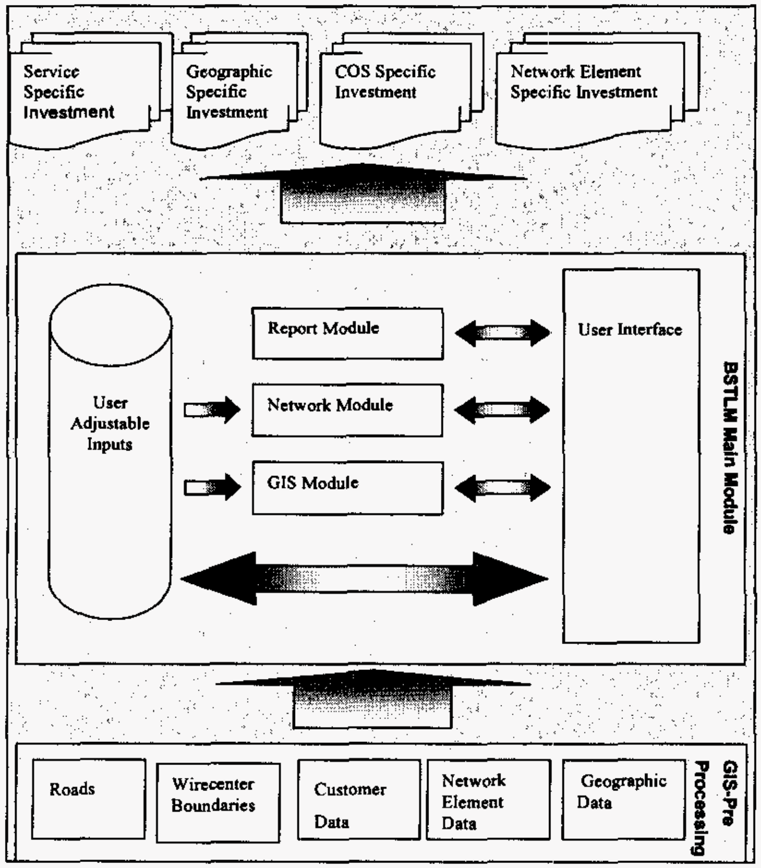

FIGURE 2: BSTLM© ARCHITECTURE

Q. PLEASE PROVIDE A PARTIAL LIST OF THE KEY DESIGN FEATURES.

A. The following are the key design features:

- Based upon BellSouth Engineering practices
- Utilizes BellSouth's customer database
- Includes loops associated with all services and UNEs
- Uses MSRT for creation of the clusters and the routing of both the distribution and feeder network.
- Designs a Scorched Node model using BellSouth's wire center locations

- o Builds the network to the customer
  - ▪ The model develops each and every segment of the network. The model starts at the customer location, locates its specific distribution terminal (DT), then runs the specific routing from that DT all the way back to the central office (CO).
- o The model utilizes an improved customer location approach.
  - ▪ At its worse, the model is no worse than the HCPM and HAI in determining where customers are located. At its best, the customer location achieves unsurpassed accuracy. When customers are not geocoded, Stopwatch Maps has developed techniques to determine the best estimated placement. This can come from their Zip+4 enhancement and the road surrogation procedure employed. In addition, even with good geocoded customer points, Stopwatch Maps has developed routines that work around recognized deficiencies in typical geocoding output.
- o Complies with all applicable FCC criteria
- o Uses more actual data than any other model
  - ▪ Customer and Service points
  - ▪ Wire center location and boundary
  - ▪ Road Data
- o Includes all processing in the model (including clustering)
- o Can build to working lines, households or housing units.
- o Variable copper distribution design point
- o Ability to provide Total Element Long-Run Incremental costing

- o Recognition of Multi-dwelling units and office buildings and the vertical cabling that may be required in these buildings.

Q. WHAT ADVANTAGES DOES THE BSTLM© HAVE OVER OTHER MODELS?

A. The following highlights the major advantages of the model.

- o Uses more actual data than any other model
  - ▪ Actual BellSouth customer Records
    - • With most advanced surrogation technique
  - ▪ Actual BellSouth wire center locations and boundaries
  - ▪ Road database allows use of MSRT
- o MSRT used to cluster and to lay out both feeder and distribution Network
- o Incorporates impact of all services
  - ▪ Specific engineering
  - ▪ Counts and Dispersion
- o Determines best estimated placement of all plant items
- o Allows modeling of Working Lines, Households and/or Housing Units
- o Model Flexibility
  - ▪ User has control over all inputs
- o Model Accuracy at all levels of geography – Even at the customer level.
- o Audit tools of model to allow understanding of processing.
- o Model Reporting is the most dynamic Loop reporting engine available.
- o Model correctly builds to Multi-Dwelling units and Office buildings

- Model recognizes and places appropriate vertical building cable.

Q. IN PAST PROCEEDINGS IN FLORIDA AND ACROSS THE U.S., THE ISSUE OF A VALID MAXIMUM COPPER LOOP LENGTH HAS BEEN A MAJOR ISSUE. HOW DOES THE BSTLM© DEAL WITH THIS ISSUE?

A. The development team was well aware of the arguments surrounding the appropriate copper loop length to use in a model. In past proceedings, recommended maximum loop lengths generally ranged from 12 to 18 kilofeet. Some parties contended that 18 kilofeet was feasible, while others stated that 12 kilofeet should represent the maximum copper distance due to the additional costs that were caused by attempting to extend copper plant beyond 12 kilofeet and the fact that the ability to provision a variety of wire line services could be impeded.

In creating the BSTLM© model, the development team gave the user control of the cost, efficiency, and physical limitations. The user has the control over two key physical design variables: the soft copper design limit; and the hard copper design limit. The Hard limit provides the maximum distance which copper cannot exceed to provision quality service. The soft limit provides the limit at which most of the network should be built to meet the engineering of all services.

The user also has control over distance related cost variables. BSTLM© provides an input to control the installation of thicker gauge cable. Thicker gauge cable allows for longer runs of copper cable without hindering the ability to provide the required service level. The model also has inputs that let the user control the installation of extended range line cards. Like the thicker gauge cable, these cards allow the extension of services to greater distances without hindering service levels. The user can control the number of extenders allowed in a single Carrier Serving Area ("CSA") beyond the soft limit. If enough extender customers exist, the economics may indicate that sufficient demand exists for another DLC site. In concert with these smaller line CSAs, the model allows the input of small optical remote. Finally, the model allows the user to determine the extended range break point of each service. In total, the model is the most complete approach to this complex subject and should provide a common solution that is agreeable to all.

SECTION 3

<u>GIS DATA INPUTS</u>

Q. DOES THE BSTLM© USE BELLSOUTH SPATIAL INFORMATION, SUCH AS CUSTOMER SERVICE ADDRESSES?

A. BellSouth made use of customer specific data such as service addresses (already contained within billing systems) by geocoding each customer address.

Geocoding allows a simple address to be converted into spatial coordinates, i.e., to be located on a map. Each geocoded customer location is associated with the services actually provided to that customer.

Q. PLEASE DESCRIBE WHAT GEOCODING IS AND HOW IT WORKS.

A. In basic terms, geocoding allows an address to be identified on a map. The process begins with two pieces of data: the customer address; and the road segment corresponding to that address. The segment of road containing an address, generally one block in length, is a part of a large group of road segments. This large group of roads segments known as a *road network* includes most, if not all, of the roads within a certain area. In the case of geocoding BST's Florida customers, the road network for the entire state of Florida was used.

Each road segment is associated with a street name and address range. A geocoder takes an input address, a BST customer address for example, and matches it to the road segment sharing the same name and address range as the input address.

The table below displays some of the information that may be associated with a road segment. Each side of a street has associated data such as Census codes, Federal Information Processing Standards (FIPS) codes, and Feature Class Codes, which are used to identify the classification of a road (for example A41is a Local Road, undivided). Street segments have street name information, address ranges, and ZIP codes.

Street Name	FromLeft	ToLeft	FromRight	ToRight	RecordID	FeatClass	FeatClSF	ZipLeft	ZipRight
10TH AVE E	101	109	102	110	301833271	A	41	32648	32648
10TH AVE E	0	0	0	0	301833275	A	41	32648	32648
10TH AVE E	0	0	0	0	301833276	A	41	32648	32648
10TH AVE W	0	0	0	0	301833249	A	41	32648	32648
10TH AVE W	0	0	0	0	301833250	A	41	32648	32648
11TH AVE W	0	0	0	0	301833245	A	41	32648	32648
1ST AVE	0	0	0	0	27347923	A	40	32680	32680
1ST AVE	0	0	0	0	27347924	A	40	32680	32680

FIGURE 3: ROAD SEGMENT DATA

For example, the first street segment entry in the table might be pictured as shown below.

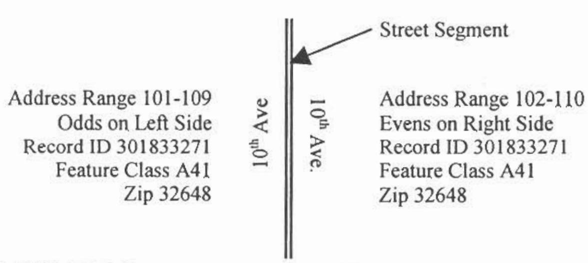

FIGURE 4: SAMPLE ROAD SEGMENT

Notice that the address range associated with the left side of the street segment is different than the address range associated with the right side.

If attempting to geocode the address 103 10th Avenue, the geocoder would first identify the left side of the street segment shown above. It would then measure 25%[2] from the top of that left segment to identify the location of house number 103. The number of addresses covered by a road segment address range determines the percentage of a road segment occupied by each house number. In the case the range 101 – 109, indicates five separate house numbers as shown below.

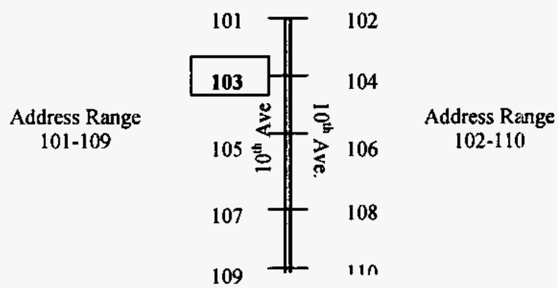

FIGURE 5: GEOCODING EXAMPLE

For more detail on the geocoding process, see the BSTLM© Model Methodology, pages 17-19, Section B.

Q. PLEASE EXPLAIN HOW BELLSOUTH SERVICE ADDRESSES WERE GEOCODED.

[2] The 25% is the result of the fact that there are 4 segments between the five addresses. Therefore, assuming that the addresses start at the beginning and end of the segment, the distance between each of the points represent 25% of the road segment length.

A. All addresses were geocoded using Centrus™ GeoStan™ software in conjunction with GDT Dynamap/2000® Street Network. GeoStan is specifically designed to geocode large batches of addresses minimizing required user interaction. This allows BellSouth to geocode all customer service addresses efficiently and frequently.

NAD 83 datum was employed as a GeoStan geocoding parameter. All geographic data including geocoded addresses, wire center boundaries, and roads share the same NAD 83 datum.[3]

Q. WHY WERE GDT ROADS SELECTED?

A. Qualitative Marketing Software has specifically designed GeoStan to work in conjunction with GDT Dynamap/2000 Roads. The Dynamap/2000 product primarily contains publicly available road information developed by the US Census Bureau. However, GDT continuously improves this data with as many as one million changes each quarter, including new streets, changes to road names, and ZIP code revisions. The Dynamap/2000 product now contains more than 14 million addressed street segments nation wide.

[3] See BSTLM Model Methodology, page 19, Section 1.1.

The accuracy of the roads used in the geocoding process will directly affect the validity of the geocoding outputs. To maintain validity, BST updates the road network used in the geocoding process every two months.[4]

Q. CAN ALL ADDRESSES BE ACCURATELY GEOCODED?

A. No. Unfortunately, not every address can be properly matched with a road segment resulting in an accurate geocode. However, many levels of geocoding accuracy can be produced, and GeoStan produces a location code that can be used to identify the level of accuracy achieved for each input address.

For the purposes of this model, BST chose to only accept addresses that had been geocoded to the address level, resulting in an AS0 location code[5], or a ZIP+4 centroid identified by a Z*9a, Z*9A, Z*9b, or Z*9B location code[6]. All customer locations that were not geocoded with one of these (very high level of accuracy)location codes, were set aside to be surrogated by the GIS Preprocessing module, which is described later in my testimony.[7]

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[4] See BSTLM Model Methodology, pages 18-19, Section 1.1 and Appendix B, page 2. The Dynamap release 3/1/1999 was utilized.

[5] An AS0 location code identifies addresses that have been matched to the proper position and side of the correct street block. This level of geocode success is frequently described as "to the door step." The ASO code represents this level of success only when using Centrus Geostan geocoding software.

[6] Centrus GeoStan software generates Z*9a, Z*9A, Z*9b, or Z*9B location codes when an address can be matched to the correct ZIP+4 centroid. This type of location typically locates an address to the middle of the correct street block.

[7] See BSTLM Model Methodology, page 17, Section B; page 19, Section 1.1; and page 21, Section 2.

Q. WHEN A CUSTOMER RECORD DOES NOT GEOCODE WITH AN ACCEPTABLE LEVEL OF ACCURACY, WHAT HAPPENS TO IT?

A. When a customer address is not geocoded to the address level (AS0) or ZIP+4 centroid (Z*9a/b) level of accuracy, the latitude and longitude (the geocoded location) is discarded. This does not mean the entire record is eliminated. Rather, the existence of the customer and the service types associated with known BST customer are retained, and the location of the customer is surrogated.

Q. HOW IS A BELLSOUTH CUSTOMER LOCATION SURROGATED?

A. Customer locations are surrogated, that is placed randomly along roadsides within Census Blocks containing a deficient number of households or firms. A deficiency in the number of households is determined by comparing the number of households reported by the Census to be within a Census Block, to the number of BellSouth customers successfully geocoded (as described above) to road segments within that Census Block. This same approach is used to identify business location deficiencies using PNR[8] firm counts.

Q. HOW DOES THE BSTLM© SURROGATION APPROACH COMPARE TO THAT USED BY THE HCPM?

[8] Obtained from PNR and Associates. This dataset is based on their Access Line Model that estimates access lines and locations throughout the U.S. This data has been used by the BCPM, HCPM, and HAI models.

A. Both BSTLM© and HCPM surrogation methodologies rely upon a comparison of geocoded locations to household (Census) and firm (PNR) counts to determine the number of locations that must be surrogated. These methodologies also generate surrogate locations along roads within deficient Census Blocks.

However, the BSTLM© and HCPM generate surrogate locations differently. The HCPM elects to space surrogate locations evenly along the road network within deficient Census Blocks. The BSTLM© surrogation process randomly places surrogate locations along roadsides. Furthermore, because the BSTLM© surrogates actual BellSouth customers, unlike other models, the exact services associated with a customer are retained no matter where the location is surrogated.

Q. PLEASE CHARACTERIZE BSTLM©'S USE OF CUSTOMER & SERVICE DATA.

A. BST customer data (including telephone number, service address and service types associated with that line) was extracted from the Customer Records Information System (CRIS) and Carrier Access Billing System (CABS) databases. The resulting customer addresses were then geocoded using Centrus™ Geostan™ geocoding software produced by Qualitative Marketing Software, as described above. Once geocoded, the customer data is entered into the GIS Preprocessing module of the model.

Customer Records Information System customer data was extracted from a December of 1998 file. Carrier Access Billing System data was pulled in June of 1999.

Q. PLEASE DESCRIBE THE USE OF BST'S PLANT DATA.

A. Wire Center boundary maps were digitized by a BellSouth organization known as the Regional Landbase Administration Center (RLAC). These digitized boundary maps were updated during the second half of 1999.

The locations of all BST switches were generated and geocoded by BellSouth and updated by the BellSouth Regional Landbase Administration Center during the second half of 1999.

SECTION 4

GIS PREPROCESSING

Q. PLEASE DESCRIBE THE GIS PREPROCESSING MODULE.

A. The GIS Preprocessing module is a series of programmed procedures whose purpose is to prepare the data required by the GIS processes of the main module. The preprocessing procedures take, as input, data provided by BellSouth (customer locations and services, switch locations, wire center boundaries) and available reference data (roads, Census Block boundaries, demographics, and ZIP+4 centroids). This data is modified for use in the BSTLM©.

Q. WHY IS PREPROCESSING USED?

A. The preprocessing is a voluminous task, requiring a great deal of computing resource. For example, the entire road network of a state must be split up by wire center. For each wire center the relationship of all road segments, one to another, and the relationship of every customer location to the road segments, must be established. Furthermore, the amount of reference data that is required during the preprocessing consumes a number of gigabytes of disk space. It would be an inefficient use of disk space and processing time to include the preprocessing steps in the main module of the BSTLM©. In addition, there are no user controlled inputs or algorithms that need be maintained. The preprocessing steps simply provide an association of massive amounts of data. Therefore, the preprocessing procedures have been designed to be performed by BellSouth before distribution of the BSTLM©. These procedures have been designed such that BellSouth can re-run the preprocessing procedures in the future with updated data.

Q. WHAT DATA DOES BELLSOUTH PROVIDE TO PREPROCESSING?

A. BellSouth provides an already-geocoded set of customer locations, one record for each BST customer in the state (business, residential, or special access line) including the customer's telephone number, serving wire center, service address, and ZIP code. BST also provides a file of the set of services delivered to each customer.[9]

BellSouth also provides the latitude and longitude of each its switches. Finally, the actual boundary of each BST wire center is provided by BellSouth, from its own map files; this is not an "estimation" of the boundary as might be obtained from some independent sources.

Q. WHAT ADDITIONAL REFERENCE DATA IS USED IN PREPROCESSING AND WHAT ARE THE SOURCES OF THIS DATA?

A. The largest set of external data is the set of roads for the state, provided by GDT's Dynamap/2000 Street Network. This data matches the street data used for geocoding. The road segments represent the possible cable routing paths to be used by the GIS module.

[9] This file is related to the first through the telephone number in the record.

Census Block Boundaries, and county boundaries, are obtained from Stopwatch Maps, Inc. of St. Louis (derived from US Census Bureau's TIGER 97). Stopwatch generated the estimated household and housing unit counts for 1997 from other Census Bureau sources. The estimated business firms and business lines per Census Block are obtained from PNR's Access Line Model, of 1997 vintage. This demographic information allows for the surrogation of customer locations to be concentrated in areas deficient of properly geocoded customers as described previously in my testimony.

Stopwatch also provided an enhanced set of ZIP+4 centroid points, derived from United States Postal Service (USPS) sources with additional analysis performed. ZIP+4 centroid points are used in the location of some customers not successfully geocoded.

Q. BRIEFLY DESCRIBE THE STEPS USED IN THE GIS PREPROCESSING PROCEDURE.

A. The procedure includes the following steps:

- Roads Preparation: This step takes road data that is provided in Dynamap/2000 by county, and joins and cuts that data to generate the necessary road information specific for each wire center. Duplicate GDT segments are eliminated, partial segments are concatenated, and each segment's length (along its possibly curved route) is calculated. The resulting segments for the wire center are tested for continuity and, if necessary, minimal additional segments are generated to form a complete graph. The adjacencies of all segments and intersections are determined. For each wire center, this very long step produces the road segments and the adjacency list which (after they have been assigned to a specific switch in the next step) become inputs to GIS processing.

- Switches Preparation: This step collects and records all switches in a wire center, then determines the main switch in each central office which will serve as the point from which all cable paths emanate in that wire center. The nearest road point for the switch is determined, and the shortest road path distance of every intersection from the switch is calculated. The roads tables produced in the previous step are assigned, in each wire center, to the main switch of that wire center.
- Census Blocks Preparation: This step associates the boundaries and the residential and business demographics of each Census Block with the wire center in which it falls. If a Census Block spans wire center areas, the Census Block is cut at the boundary and the demographics are assigned to the part in each wire center proportionally to the area of the Census Block that falls in each wire center. This Census Block information is used in the surrogation process in Customer Preparation.
- Services Preparation: This step validates and associates service records, by matching telephone number, with the customer being served. The business/residential nature of the each customer is determined from the service

records. Each customer record is pointed to the set of service records that apply to that customer.

- Customer Preparation: This step relates customer records to all the other information that has been prepared. First, the wire center into which each successfully geocoded customer actually falls is determined.[10] Next, for each location not successfully geocoded but with a ZIP+4 in its address, if that ZIP+4 has a known valid centroid (in the supplementary ZIP+4 table cited earlier), that customer is assigned to that ZIP+4 centroid.[11] This determines the wire center in which it falls.

Then, for each wire center:

- Locations of customers geocoded to an exact address are examined and, if appropriate, those locations are "rectified" (spread along the block) to overcome the "bunching" phenomenon that may have resulted from geocoding with very general address ranges for each street block.[12]
- Locations of customers geocoded (or later assigned) to a ZIP+4 centroid are spread along the block where the range of that ZIP+4 is one side of a street block.
- For each customer not successfully geocoded, a location along a road segment in the wire center must be assigned by surrogation. After it has been determined which geocoded customers fall in which Census Blocks, Census Block business

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[10] Here, "successfully geocoded"means geocoded to the exact address or to the ZIP+4 centroid.

[11] A "centroid" is the geographic center of geometric shape. Usually it is the gravity center (where each point's distance from the centroid is given a squared weight) of a two-dimensional plane polygon.

[12] For example, the street address range may be from 6801 to 6899, but actual addresses may only range from 6801 to 6837.

and residential demographics are used to determine the Census Blocks which lack the expected number of customers of each type. Unlocated customers are then assigned to Census Blocks proportional to the "shortage" in each Census Block, then assigned to a random location within that Census Block.[13]

- Because the BSTLM© can build telecommunications plant not only to existing customers, but also to the total set of households and to the total set of housing units within a wire center, surrogation of additional households and additional housing units is also performed, on a proportional basis. These additional locations do not correspond to existing customers; they are assigned only the simplest POTS service, and they are used only by specific request by the model user. BellSouth chose, for this filing, to build only to existing customer locations.
- Customers located at the same service point (units in an apartment, different firms in the same building) are grouped so that a single record represents all customers at each unique location (each service point). The services for each of those grouped customers are collected together, and the customer service point record is made to point to a grouped set of services.
- For each of these service point locations, the nearest road point is determined (the specific road segment, and a distance from the beginning point of that segment, to which that customer location is closest).
- For each of these service point locations, the shortest distance from the switch along roads is calculated

[13] See BSTLM Model Methodology, page 22, Section 3.

The customer preparation step process results in two tables: one of customer service points (and their attributes); the other of the services for those service points.

Q. YOU MENTION THAT THE GEOCODED CUSTOMER DATA HAD TO BE RECTIFIED. WHY IS THIS DONE?

A. The bunching of geocoded locations toward the beginning of a road segment is a common problem in geocoding programs. As I described previously in my testimony, a geocoder is dependent on its underlying road data for the address range of each road segment. Remember that a road segment is typically a block in length. Very often, the address ranges are too broad in the underlying road data (for example, the address range of a segment may be recorded as xx01 to xx99 when the real range might be xx01 to xx25). When geocoding to exact address on a segment (location code AS0), a geocoder assigns the point to a distance from the start of the segment that is appropriate in the recorded address range. Thus, in the example given, all real addresses (xx01-xx25) would be placed in the first quarter of the segment.

On the basis that the BellSouth customer dataset generally represent the full range of addresses in each block, the code "rectifies" the bunched placement by the geocoder by *spreading* the geocoded locations along the block. This should yield a more realistic placement of these customers, and a more realistic set of model results.

Q. WHAT ARE THE OUTPUTS OF THE PREPROCESSING PROCEDURES?

A. At the completion of all the preprocessing steps, the data required by the GIS processes of the main module (with the required relationships in that data, and in the required form) have been produced for each wire center. This data includes the following:

- Road segments
- Any additional minimal segments required to form a complete graph
- The adjacency relationships of the intersections and segments
- The customer service points locations, with their road and switch relationships
- The services delivered to these customer service points.

In addition, on a statewide basis, a table of wire centers and their switches are produced, as required by the GIS processes of the main application.

Q. PLEASE CHARACTERIZE THE FLORIDA CUSTOMER INPUTS INCLUDING THE RATE OF GEOCODING SUCCESS THROUGHOUT THE STATE.

A. Approximately 5.05 million BST customer records were extracted from the Customer Records Information System and the Carrier Access Billing System databases to be used in this model. This number indicates the total number of known BST customers. Of that number, 4.05 million were geocoded to the address or AS0 level accuracy. A remaining .56 million records were geocoded to an acceptable ZIP+4 centroid, or Z*9a/b level of accuracy. An overall geocode success rate of 91% was achieved.

The following table summarizes the geocoding results found in Florida:

Florida Geocoding Results							
Geocode Success Rate	Number of Wire-centers	% of All BellSouth Florida Wire centers	Address or ZIP+4 Centroid Geocode	Surro-gated Locations	Total	% Address or ZIP+4 Centroid	% Surro-gate
>90%	120	61%	3,747,112	198,664	3,945,776	95%	5%
80 to 90%	34	17%	654,022	109,032	763,054	86%	14%
70 to 80%	14	7%	117,943	37,104	155,047	76%	24%
<70 %	28	14%	86,672	103,029	189,701	46%	54%
Total	**196**	**100%**	**4,605,749**	**447,829**	**5,053,578**	**91%**	**9%**

FIGURE 6: FLORIDA GEOCODING SUCCESS RATES

SECTION 5

BSTLM© MAIN MODULE – GIS MODULE

Q. PLEASE BRIEFLY DESCRIBE THE GIS PROCESS.

A. Within the Main BSTLM© model, the GIS module is responsible for modeling the network for a wire center. Network components required to serve the customers are determined, and cable routes are constructed that connect the components to the switch. The module uses datasets produced by GIS preprocessing (customer location and service information, switch locations, and road networks) and algorithms designed to adhere to standard loop engineering guidelines.

There are five steps the GIS module performs to model the network for a wire center. Before these five steps occur, all locations whose service requirements demand an on-site DLC (e.g., office buildings or apartment buildings) are identified. These locations are eliminated from the distribution terminal (DT)/building terminal (BT) placement and clustering steps (steps 1-4) outlined below. In the fifth step, these locations and their customers return to the modeling process when feeder cable is routed to all DLCs, including these on-site DLCs.

1. DT/BT Placement: Customer locations requiring a BT are identified and assigned a BT. All other customer locations are assigned to DTs using an algorithm that optimally places the DTs along roads. In the following steps, these DTs (and BTs) are the units for clustering. That is, when a DT is clustered, all of that DT's

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customers are implicitly clustered. (See IV.B.1 pg. 25 of the Model Methodology).

2. Allocation Area (AA) Clustering – DT/BTs that are within a user-defined distance of the switch – typically 12,000-ft – are clustered into AAs. The module measures all distances between entities of the network along roads. Therefore, the DT/BTs must be close enough to the switch, as measured along the roads, to fall into an AA. The module constructs the Minimum Spanning Road Tree (MSRT) for all candidate DT/BTs, then splits the tree into AAs. The MSRT is an optimized tree that connects the DT/BTs using paths that follow roads. The original MSRT is preserved and defines the distribution cable paths for the AAs. (See IV.B.2 pg. 27, of the Model Methodology).
3. Carrier Serving Area (CSA) Clustering and Digital Loop Carrier (DLC) Placement: All remaining DT/BTs (i.e., those too remote to be clustered into AAs) are clustered into CSAs. The module constructs the MSRT for all of these DT/BTs, then splits this MSRT into CSAs. A DLC is optimally placed for each CSA at the location closest to the switch that minimizes customers requiring thicker gauge distribution cable. The distribution cable paths for each CSA are defined by the original MSRT.
4. Feeder Distribution Interface (FDI) Placement: The module places one or more FDIs along the cable paths of each AA and CSA. The service demand and cable configuration of the AA/CSA dictate the number of FDIs that must be placed. (See IV.D.3 pg. 35, of the Model Methodology).

5. Feeder Routing: Feeder is routed to the AAs by building a constrained MSRT. The constraint requires that the feeder route to the AA must not produce customer loops longer than the design limit for copper. Next, the module constructs feeder routes to the DLCs in the CSAs. The wire center is divided into quadrants (N, S, E, and W) and a separate MSRT for the DLCs of each quadrant is built. This produces up to four distinct trunks of feeder cable emanating from the switch. (See IV.D.1 page 37, of the Model Methodology).

Upon completion of these steps, the engineering layout of the wire center network is defined. The module enriches the data by adding to it other cost-influencing factors. This includes tracking where feeder and distribution cable routes are shared and calculating the line density for each individual network component. (See IV.E and IV.F, page 38, of the Model Methodology).

The final task of the module is to prepare the data into two files for the succeeding processes of the model. Customers are related to a DT, BT, or on-site DLC; this information and the customer's associated services are saved as the first output of the module. The network components are related to one another using a parent chain that defines the distribution and feeder cable routes. This association along with the DT/BTs of a CSA, the route-length to the DLC, as well as the route-length to the central office (CO) is saved as the second output of the module.

The following illustrations show the network modeled by the GIS process for the Dunnellon, FL wire center – DNLNFLWM – using a design limit for copper distribution of 12,000-ft, a hard limit of 13,000-ft for AAs, a hard limit of 18,000-ft for CSAs, and a line design limit of 1,800 lines.

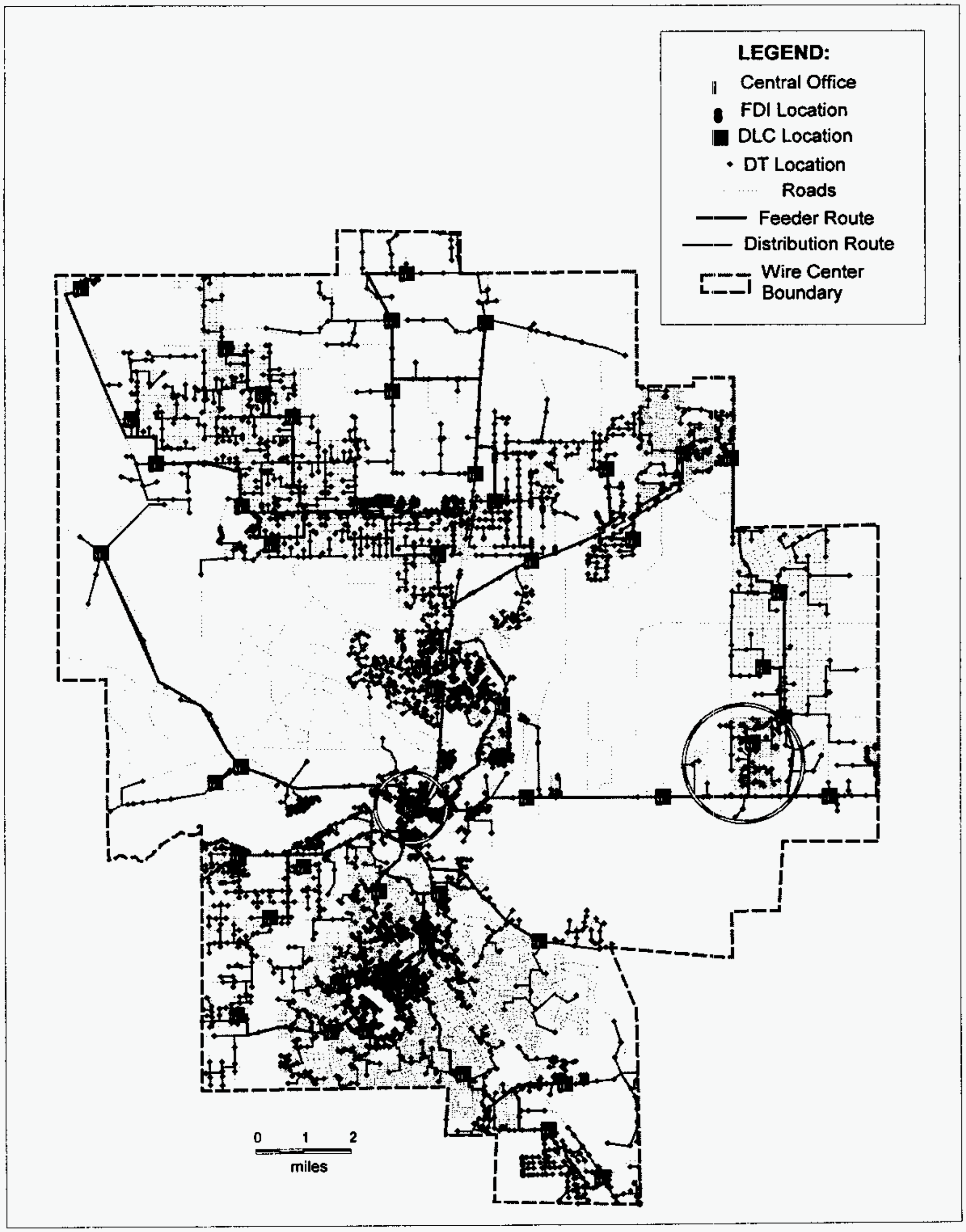

FIGURE 7: ILLUSTRATION OF BSTLM© MODEL FOR DUNNELLON

Below are two close-ups of the circled areas in the preceding picture. The first illustrates the area around the switch, where AAs are modeled. The second shows a CSA and its distribution network.

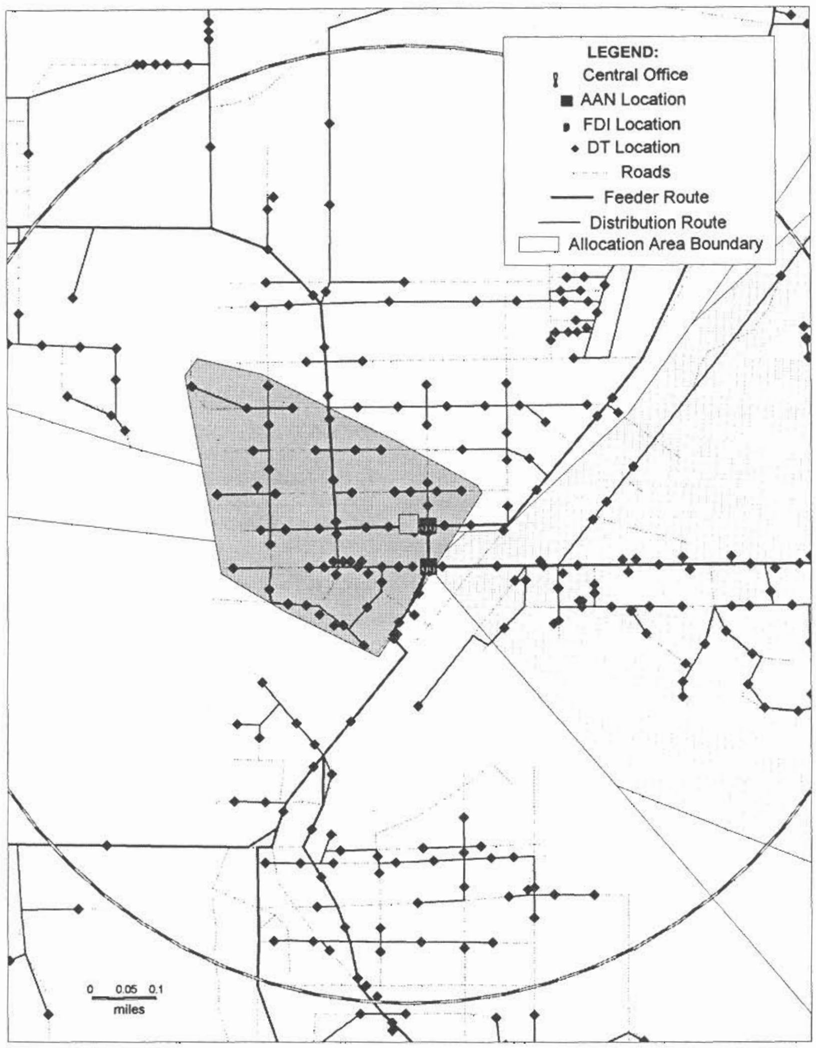

FIGURE 8: ILLUSTRATION OF ALLOCATION AREA (AA) DESIGN

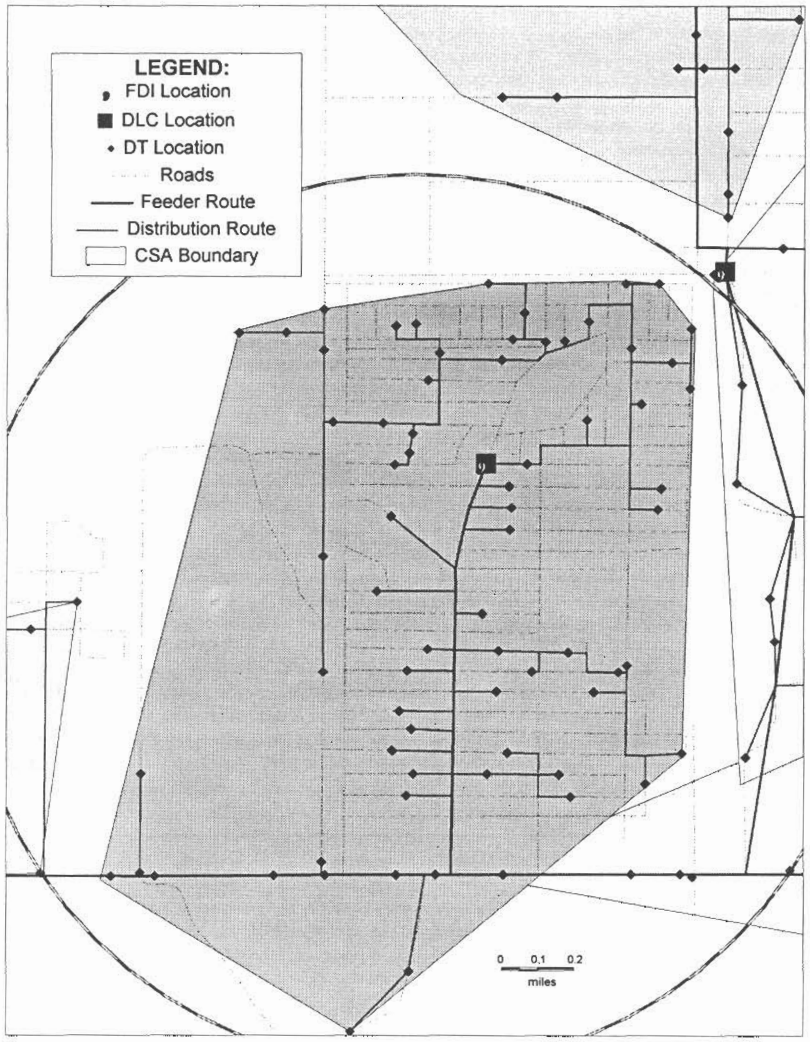

FIGURE 9: ILLUSTRATION OF CARRIER SERVING AREA (CSA) DESIGN

Q. EARLIER YOU DISCUSSED THE MSRT. PLEASE DESCRIBE THE APPLICATION OF THE MSRT CONCEPT TO THIS PORTION OF THE MODEL.

A. The MSRT represents the shortest path connecting a set of points using road segments. When clustering AAs and CSAs, the set of points are the DT/BTs of the wire center. For constructing feeder routes, the DLC locations define the set of points.

The MSRT provides a realistic representation of cable routes because it follows roads, which typically parallel the rights-of-way that must be followed when designing a network. This approach is superior to MST tests or rectilinear routing in that it produces the most accurate and realistic representation of the minimum cable distance that would be required.

The following illustrations compare the MSRT of a CSA from the Dunnellon wire center to its MST. Note how the MSRT paths follow roads. The total length of the MSRT is 61,010-ft, compared to 46,853-ft for the MST. The MSRT is 30% greater than the MST in this example. If the MST were utilized to estimate or test route distances, then the route distances would be understated, in this example, by more than 14,157-ft. The MST distance could only be realized if one could ignore rights-of way constraints and build the network "as the crow flies" right through private property. The use of the MSRT appears to be more accurate and more realistic.

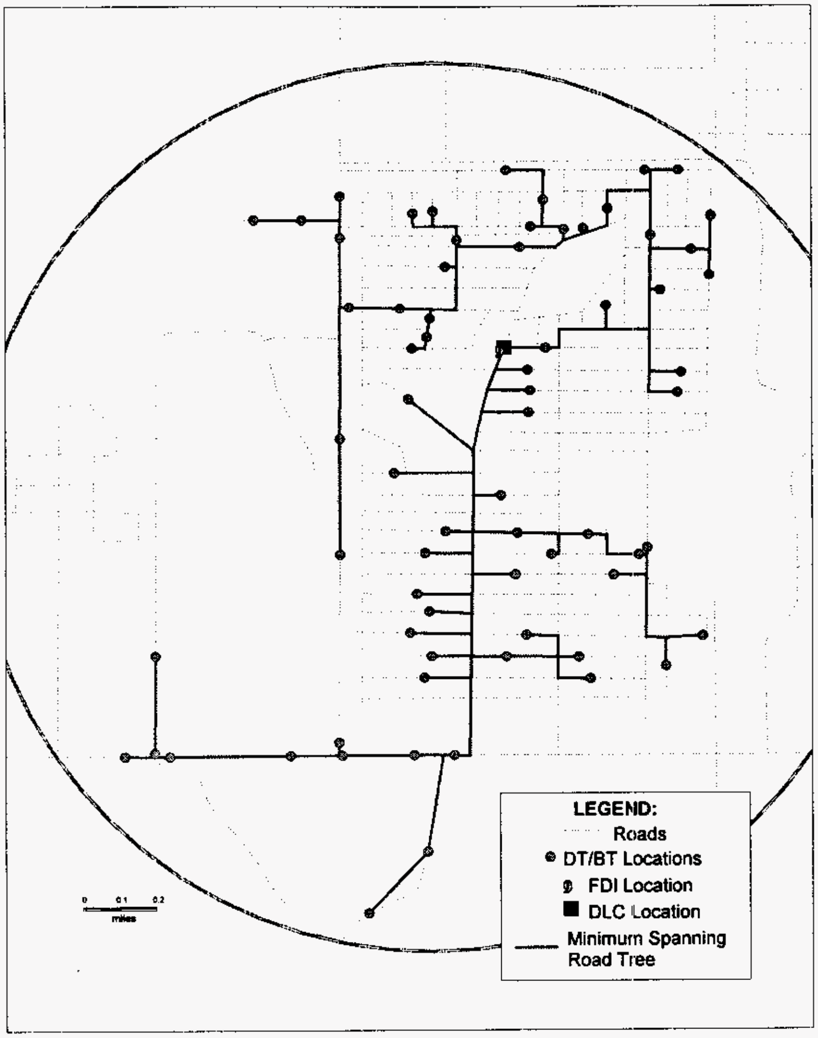

FIGURE 10: MSRT DESIGN

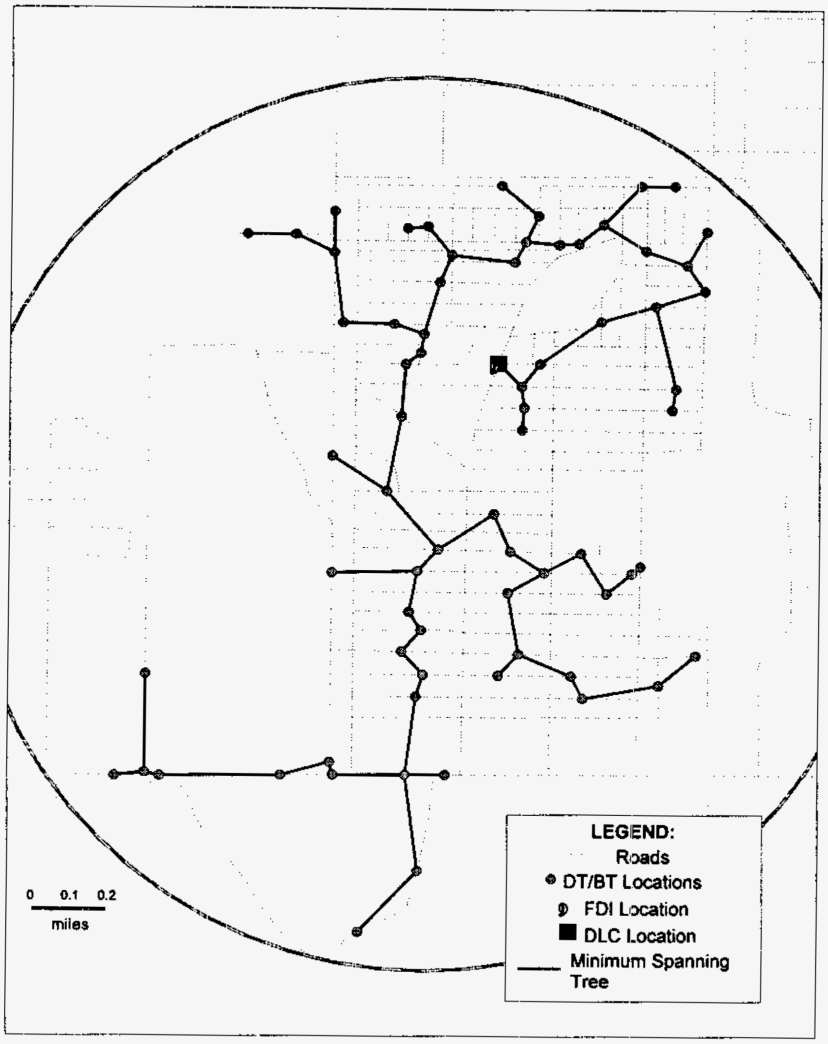

FIGURE 11: MST DESIGN

The MSRT also has the advantage of measuring the proximity of points along roads. This helps the model produce more realistic clusters. For example, consider two DTs that are 3,000-ft apart as the crow flies. A model using straight-line distances is likely to cluster these two DTs together. However, if a river separates the two DTs and the shortest road-based route between the two uses a bridge that crosses the river 6,000-ft upstream, the total distance for this route is 15,000-ft. This is the distance the MSRT uses making it less likely that these two DTs will be clustered together.

To further illustrate the point, imagine if DTs were clustered to the CSA from the above example using straight-line (as the crow flies) distances to measure proximity. Using a 13,000-ft limit, the size of the CSA effectively doubles in size from 71 DTs to 150 DTs. The following graphic shows the CSA clustered using straight-line distances along with the original CSA clustered using the MSRT.

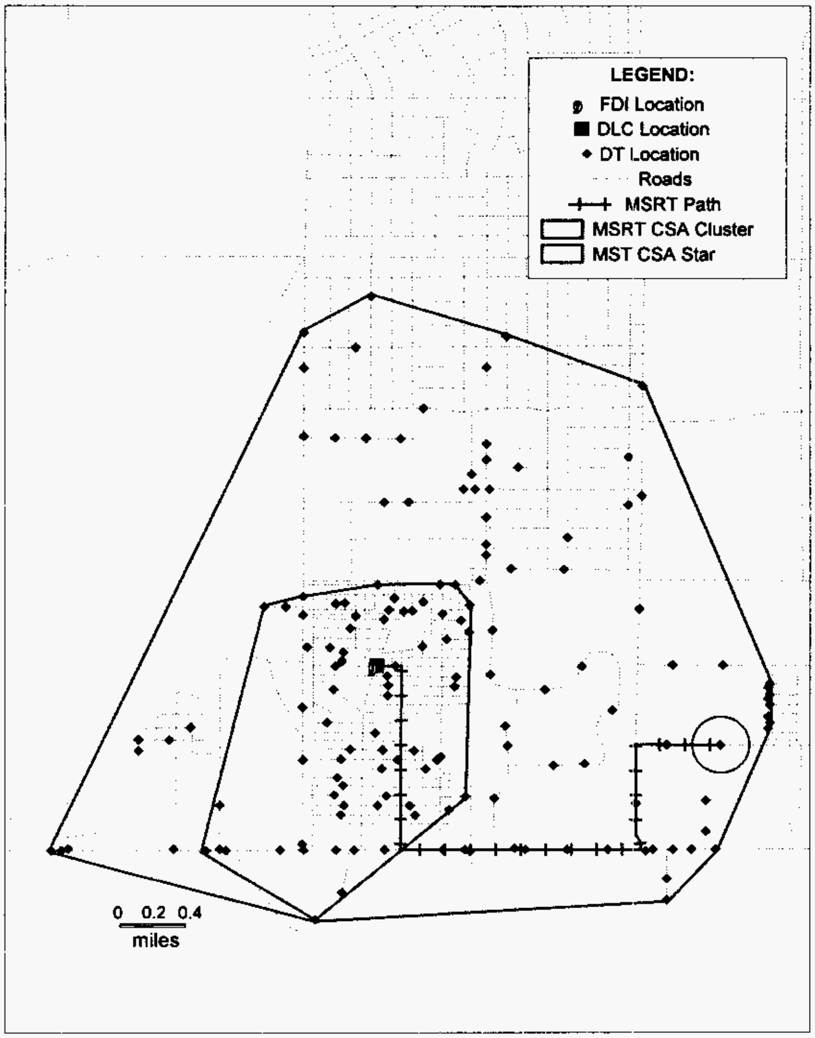

FIGURE 12: MSRT –VS- MST CLUSTERING

Note the circled DT – it is only 11,300-ft from the DLC measured straight-line. However, its shortest path to the DLC along roads, depicted by a hatched line, is 20,780-ft – a distance much too long for distribution cable.

In contrast to previous loop models, the MSRT also builds unique distribution routes along the roads from the FDI to the actual location of the DT, which is placed based on the actual location and demand of the customers. The following illustrates the distribution cable modeled for a DA using the MSRT.

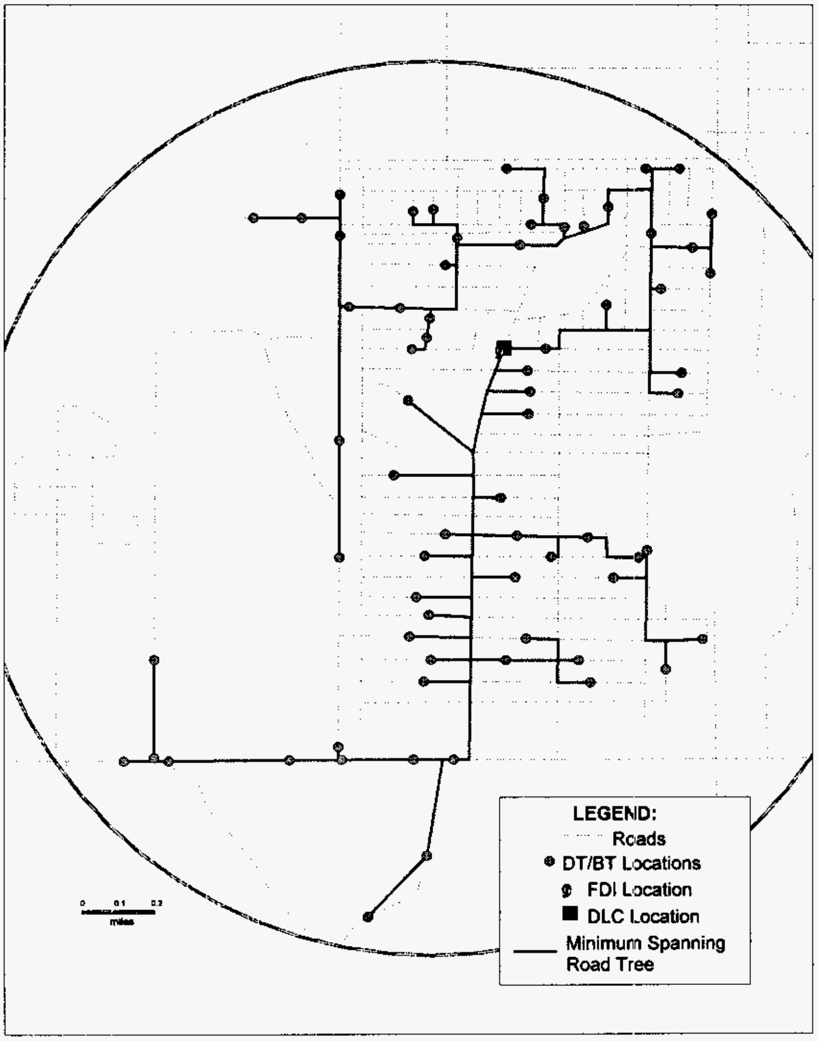

FIGURE 13: MSRT DISTRIBUTION AREA (DA) DESIGN

Below is the same DA modeled using the rearrangement of customers that has been used in prior models (e.g., the HAI Model).

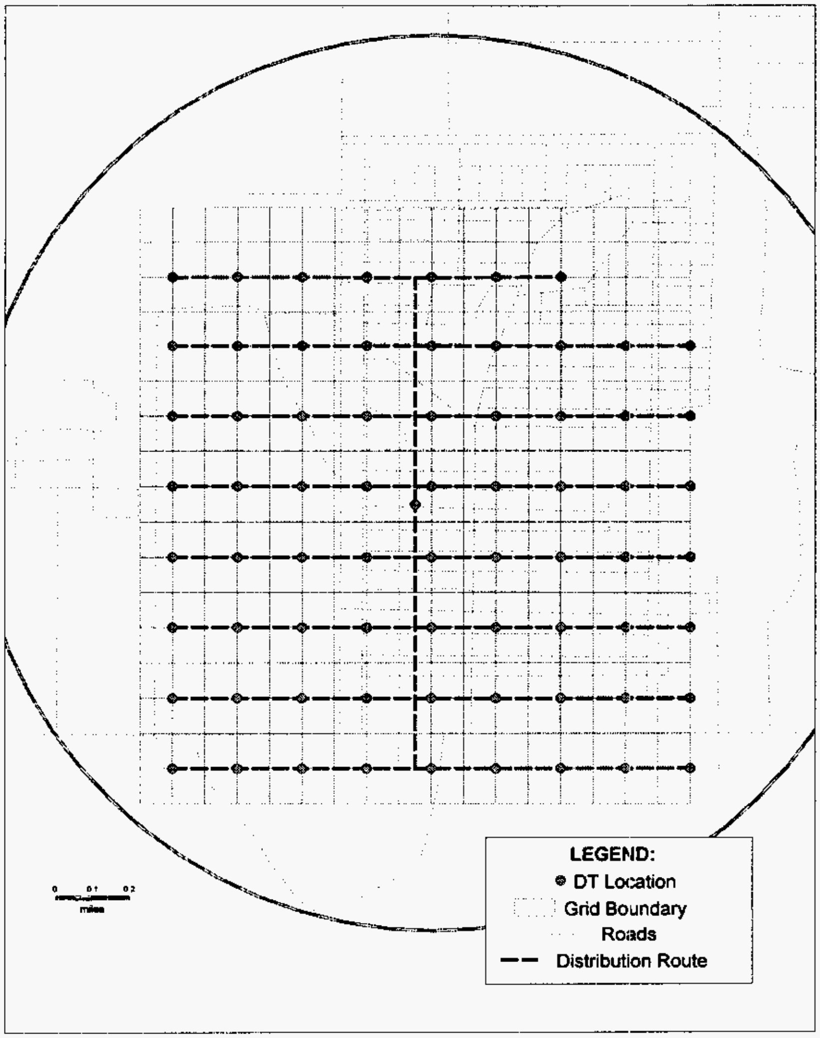

FIGURE 14: EXAMPLE OF DA DESIGN IN OTHER MODELS

Finally, the MSRT adds another level of realism to the modeling process not present in prior models. The distribution network in the BSTLM© is built to the customer instead of moving the customer to the network. The proxy models determined the engineering area from the customer location data. Once these areas were defined (Road Reduced Quadrant of an Ultimate grid in the BCPM, rectangle with area of the Cluster in the HAI, and Grid in the HCPM), the models ignored the actual customer location and dispersion and built a network in these areas assuming equal customer dispersion.

SECTION 6

OVERVIEW OF CONFIGURATION PROCESS

Q. PLEASE EXPLAIN THE CONFIGURATION PROCESS.

A. When the GIS Process is complete, the initial network has been "constructed". Network components are placed and either feeder or distribution media connect the components. The configuration process refines this network by sizing cable based upon demand, and placing appropriate electronic equipment. Customers that require special provisions due to distance from the switch or DLC are identified.

The configuration process does this by examining each network component and selecting the appropriately sized component. Each span along the network is examined and then sized in accordance with generally accepted engineering algorithms and user inputs.

Q. PLEASE BRIEFLY DESCRIBE HOW THE CONFIGURATION PROCESS WORKS.

A. The configuration process goes through a series of functional steps or procedures. I will briefly outline them below. More detail is provided in the BSTLM© Methodology Manual.

The configuration process begins with the output of the GIS Process. Every record in the complete wire center network is examined. For a wire center, this may mean examining between 1,000 and 100,000 records Each record represents either a plant component or a service location. The following steps are performed:

- o Identify service points requiring extended range provisioning from a DLC. These customers are identified with an "X" after their service code.
- o Determine the density zone and density group of each record. This is done as a look up from the GIS data to the user adjustable density table.
- o Determine the direct and cumulative cable counts to all network components. Each network component (Network Interface Device, DT/BT, FDI, etc) is sized using the pair and single channel (DS0) equivalents demanded upon that component. Network routes (copper and fiber sizing) are determined using the cumulative count of pair and DS0 equivalents.
- o Determine the cable type on the route, fiber or copper.
- o Determine the cable gauge based upon the longest loop in each distribution area and the value of the CSA24/26GaugeXover or AA24/26GaugeXover.
- o Determine the plant mix. This determination is made based upon the user adjustable rules presented in the plant mix table and the characteristics of each examined component.
- o Determine the appropriate size for cable and network components. Types, as well as sizes, for DLC, FDI, DT/BT, and Network Interface Devices are also determined.
- o Determine feeder rings, gather DLC-RT locations and place them on feeder rings.

The configuration process concludes by setting indicators needed for the reporting process. When this is complete, the data is ready for investment determination.

SECTION 7

OVERVIEW OF INVESTMENT PROCESS

Q. PLEASE BRIEFLY DESCRIBE HOW THE INVESTMENT PROCESS WORKS?

A. The investment process uses Excel logic to determine the material and other capital related costs of the loop network (referred to as the engineered, furnished and installed - EFI investment). The process takes information on the size, type, length and other information on network components from the configuration process. For most of the network components, the process is fairly simple and straightforward. Based on the network component and either the length, size, or type of plant, the investment logic looks up the user supplied inputs for material costs. It then multiplies this user input by the length for media for copper and fiber costs. For DTs and BTs, the calculation is simply a lookup of the material cost based on the required size.

While most of the network component costing is relatively straightforward, the DLC and SONET costing in the model are quite dynamic. For DLC costing, previous loop models used a simple approach by allowing the user to input only the system costs for a few standard sizes of DLCs. In addition to these standard system costs, the user input a single per channel termination costs (Plug-in costs). In contrast, the BSTLM© sizes the DLC equipment at each site specific to the services and demand that exist at the site. This includes establishing specific types of line cards needed for each service. The figures attached as exhibits JWS-2 and JWS-3 provide an example of the DLC sizing that occurs for each system. As you can see from these figures, the DLC equipment is sized appropriately for the services and the demand. A similar approach is use in the SONET calculations.

Once the investment process develops the total material costs and the total engineered, furnished and installed costs, it then determines the per unit costs. The material and/or EFI per working unit (labeled as Mat@Act and EFI@Act) are derived by dividing the total costs by the working service counts. This is the material and/or EFI associated with the Total Element Long-Run Incremental Costs (TELRIC).

The use of the Investment worksheets by each of the configuration components is overviewed in the table attached to my testimony as exhibit JWS-4.

SECTION 8

OVERVIEW OF SUMMARY PROCESS

Q. CAN YOU BRIEFLY DESCRIBE THE SUMMARY PROCESS?

A. The summary process performs three functions. First, it links the Configuration and Investment files together. Second, it aggregates data. In aggregating costs, the model retains the network configuration and investment of every network component and customer on each segment. Although the segment level data is not available in reporting, it is used in the calculation of aggregated investment.

Third, the summary process determines material investments specific to each service and/or UNE. The development of service and/or UNE specific costs allows the user to understand the cost differences of services and/or UNEs served throughout the service territory. For example, DS1 UNE customers may be located close to the central office while 2Wire Analog Voice Grade UNE customers are spread throughout the wire center. In aggregating costs, the model retains the network configuration and investment of every network component and customer on each segment.

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SECTION 9

OVERVIEW OF REPORTING

Q. PLEASE BRIEFLY DESCRIBE THE REPORTING PROCESS IN THE BSTLM©.

A. The reporting process can also be described as a reporting engine because of the similarity to a database engine. That is, the reporting process works by allowing the user to define the exact query, rather than producing a limited set of reports. The reporting process was designed to provide flexibility in reporting. This flexibility is derived through a Reporting Service (or Rservice) definition.

The Rservice is a user-defined combination of Network Elements and Services. The user can select any combination of UNEs/services and either all or specific elements of the network needed to support a study. For example, an Rservice could be defined as the distribution portion of the network which would include the NID, the DROP, the DTBT, the DT-FDI, the BLDGCABLE, and the FDI elements for POTS or POTS like services only. This Rservice definition would generate a report showing costs specific to this Rservice definition.

In addition to the Network Element and Service Selection, the user can also define specific types of loops to study. The available options include: customer type; distance from the switch or DLC; and local loop or local channel designation.

Q. PLEASE PROVIDE AN EXAMPLE OF HOW A REPORT IS CREATED.

A. The user selects the "Reports" button from the main menu. The BSTLM© presents the user with the following menu.

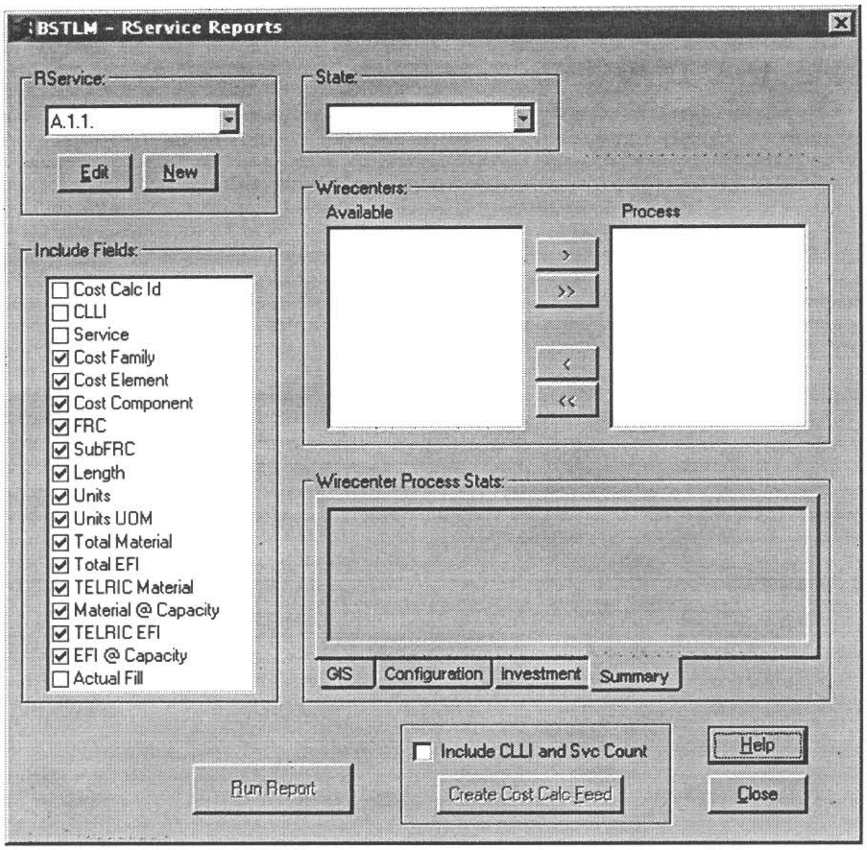

FIGURE 15: REPORTING MAIN SCREEN

Working through this screen, the upper left frame allows the user to select the Rservice definition. This provides a pull down menu allowing the user to select the appropriate pre-defined Rservice. In this example, each Rservice corresponds to a different UNE.

An Rservice is defined using the "New" button. Upon selecting "New" button, the form presented is shown below.

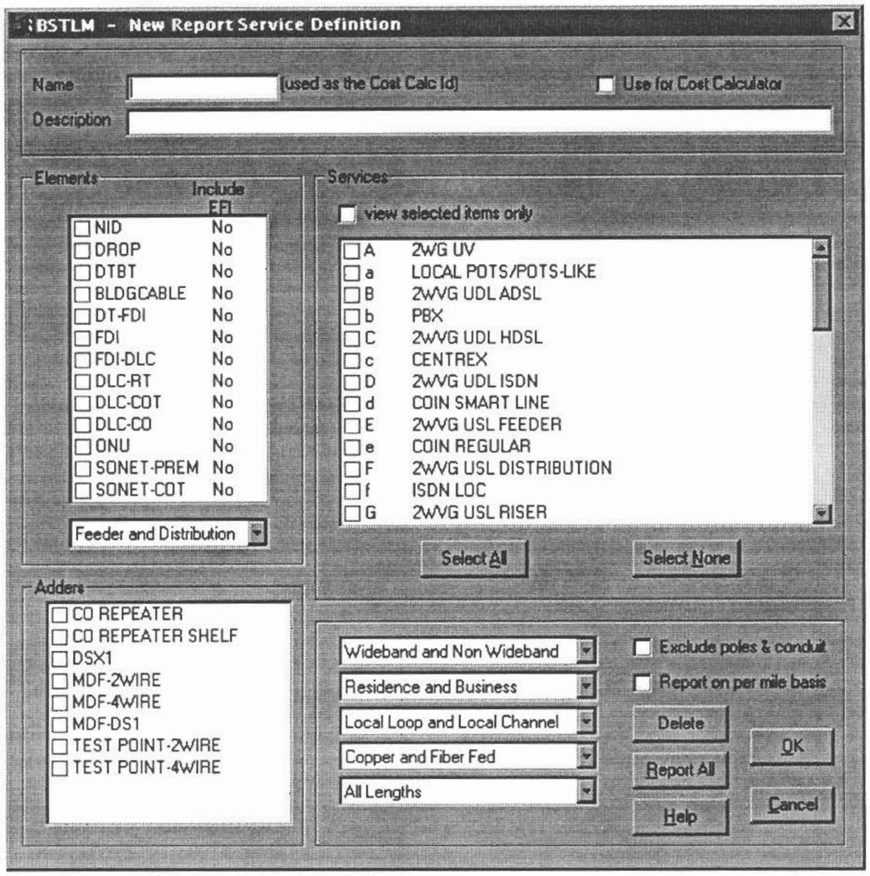

FIGURE 16: R-SERVICE SCREEN

Starting at the top of the form, the user can provide a name and description for the Rservice. The "Use for Cost Calculator checkbox," toward the upper-right, provides a means to identify those Rservices, which will be exported in cost calculator format. That is, the Rservice definition creates a file that is available to the BellSouth Cost Calculator© for expense calculation.

The Elements frame (shown below) allows the user to capture those network elements used in reporting. Only those elements with a selected checkbox will be included in the investment calculation and report. If Engineered Furnished and Installed Investment (EFI) is to be included with an element, the user double clicks to toggle the option.

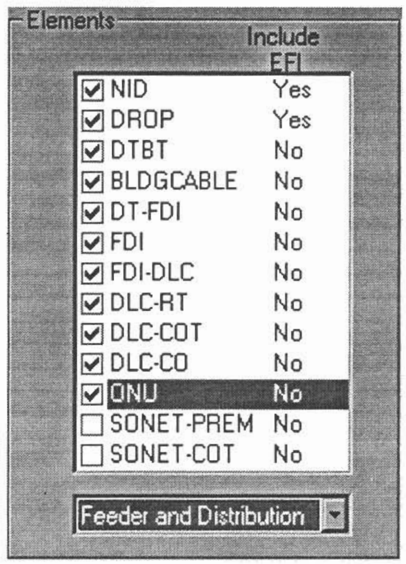

FIGURE17: ELEMENT SELECTION

With regard to EFI, when reviewing reports the EFI column represents only the investment necessary for EFI. It does not include the material investment. Material and EFI investment is the sum of both columns.

The pull down box below the elements list allows the user to select specific plant families. The pull down specifies reporting for only Feeder, Distribution or Feeder and Distribution plant families.

Adjacent to the Element's Frame is the service checkbox. Checking a service will include those specific service records and their associated investment in the results of the selected Rservice. It is possible to select more than one service in each Rservice definition, as shown below.

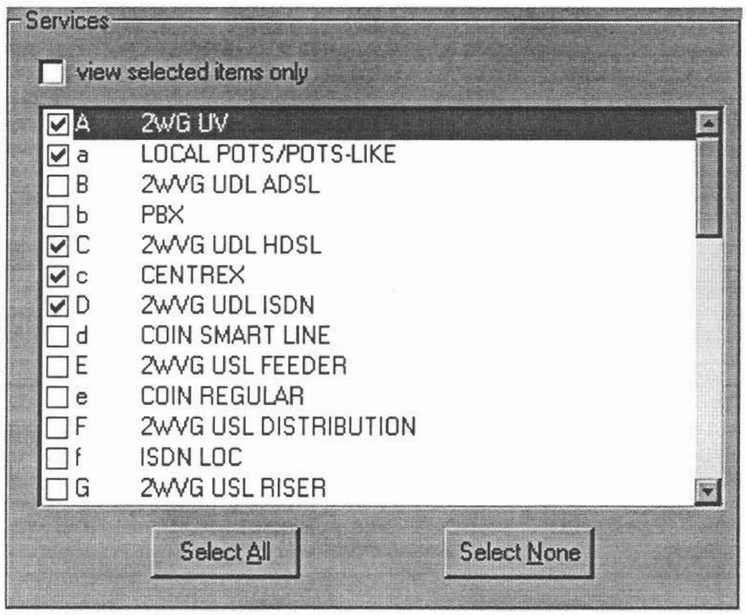

FIGURE 18: SERVICE SELECTION

After the services are selected, the user can select different reporting options. The bottom of the Rservice definition form has a number of pull-down menus. Each menu allows the user to define a specific segment of loops to study. These options include the following:

- Residence and business: This option allows the user to report on residence loops, business loops or both.

- o Local Loop and Local Channel: This option allows the user to report on services that are designated as either local channel, local loop or both.
- o Copper and Fiber Fed: This option allows the user to segment the report on loops that are fed by either copper, fiber or both.
- o All lengths: This option allows the user to segment the report on all loops or loops that are less than 9, 12, 18 or over 18 Kilofeet.

Within the Rservice definition, the user can also select any appropriate adders[14]. The user can also elect to exclude pole and conduit investment, if appropriate. An option to report on a per mile basis is available. Selecting this option will calculate investment for the DT-FDI, FDI-DLC and DLC-CO on a per mile basis for the on-screen reports and for all FRC/Sub-FRCs on the BellSouth Cost Calculator© feed. Cost Elements which are reported on a per mile basis will have an "*" placed next to their name.

After the Rservice is created, clicking the OK button saves the definition. The BSTLM© will then return to the Report window.

At this point, the user should specify the geographic area for reporting. This is done by first selecting the state and then the appropriate wire centers. Finally, the user can select the fields to display on the output report, shown below.

[14] Adders refer to network component costs that are not modeled in the logic of the BSTLM but are simply "added" onto the costs of the modeled services.

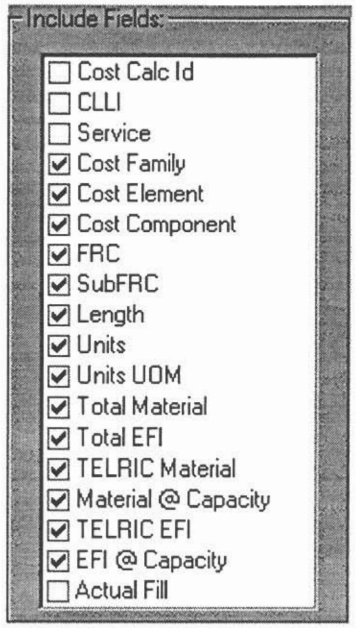

FIGURE 19: REPORTING FIELDS

The field's frame specifies the columns to display on the output report. That is, these checkboxes control the columns on the output report. If a user wishes to see both Total Material and Total Engineered Furnished and Installed categories in the report, these check boxes must be selected. To assist in some higher-level analyses, the first three options serve as group-by's. If the Cost Calc ID, CLLI (Common Location Language Identifier), and/or Service are selected, the report output will be grouped by these categories.

After these options are specified, the user can select the "Run Report" button to generate output. Or, if desired, the "Create Cost Calc Feed" button can be selected. Pressing this button will generate output files for all Rservices with the "User for Cost Calc Feed" check box selected.

SECTION 10

<u>COMPARISON TO OTHER MODELS</u>

Q. HOW DOES THE BSTLM© COMPARE TO OTHER MODELS?

A. As I noted earlier, BSTLM© represents the "next generation" loop model. It was designed to include the best features of all the models and includes new approaches that have addressed some of the past model deficiencies. In addition, it is based on more actual data that any model to date. Finally, it recognizes all of the services and UNEs provided by BellSouth. This recognition occurs in the proper engineering, the services dispersion, and the capturing of the resulting costs.

Q. THE DOCUMENTATION HAS A TABLE THAT COMPARES THE MODEL TO OTHER MODELS, IS THERE AN ADDITIONAL COMPARISON AVAILABLE?

A. Yes, I was recently at a Tennessee proceeding where a representative of AT&T presented a table summarizing the existing models available at the time. I have taken this summary and added a summary of the BSTLM© (my additions are shaded). This table is attached to my testimony as exhibit JWS-5. As you can see in the attached table, based on the key items listed by AT&T, the BSTLM© compares favorably to the other models.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes it does.

List of Acronyms

AA	Allocation Area (area within certain distance of the central office served over copper loop)
BCPM	Benchmark Cost Proxy Model (universal service model)
BSTLM	BellSouth Telecommunications Loop Model
BT	Building Terminal
CABS	Carrier Access Billing System
CO	Central Office
CRIS	Customer Records Information System
CSA	Carrier Serving Area (that portion of a local loop extending from a digital loop carrier site to the distribution area drop terminal)
DLC	Digital Loop Carrier (includes equipment to translate signals from optical to electrical)
DS0	Digital Signal Zero (a measure of single channel equivalence)
DT	Distribution Terminal
EFI	Engineered Furnished and Installed
FDI	Feeder Distribution Interface
GIS	Geographic Information System
HAI	Previously Hatfield & Associates Inc proxy model
HCPM	Hybrid Cost Proxy Model (created by the FCC)
ID	Identification
MST	Minimum Spanning Tree (provides a theoretical minimum distance for any network connecting points).
MSRT	Minimum Spanning Road Tree (provides a practical minimum distance to connect customers along a road network)
NID	Network Interface Device
RLAC	Regional Landbase Administration Center
Rservice	Reporting Service
TELRIC	Total Element Long-Run Incremental Cost
UNE	Unbundled Network Element
USPS	United States Postal Service

DLC Common Equipment Calculation

Remote Terminal Common Equipment Cost	CostPer	CapacityPer	Total Placing Hours	EquipCat	UOM	Units	MaterialCost
RT CE Optical Bank/Shelf	$ 100	2,016	-	Hardwired	All	1	100
CE Bank/Shelf Common Equip. (Integrated)	$ 2,500	2,016	-	Common	All	1	2,500
CE Bank/Shelf Common Equip. (Universal)	$ 2,500	2,016	-	Common	All	-	-
TSI	$ 1,500	672	-	Common	All	1	1,500
TSIProtect	$ 1,500	672	-	Common	All	1	1,500
RT channel bank /Shelf (Metallic)	$ 850	224	-	Hardwired	All	2	1,700
Channel Bank/Shelf CE	$ 1,250	224	-	Common	All	2	2,500
ADSL Common Equipment	$ -	1	-	Common	ADSL	-	-
HDSL Common Equipment	$ -	1	-	Common	HDSL	-	-
Optical ONU Bank/Shelf	-	24	-	Hardwired	All	-	-
Optical Shelf CE	-	24	-	Common	ONU	-	-
Optical Line Units	-	-	-	Common	ONU	-	-
DSX Panel	$ -	56	-	Hardwired	All	5	-
Batteries, Environ. Equip., Etc.	$ 3,000	672	-	Hardwired	All	-	-
Bay	$ 1,500	672	-	Hardwired	All	-	-
ONU Cabinet (e.g. CAD-12)	$ -	-	-	Hardwired	All	-	-
Cabinet Small (includes Batt. Etc.)	$ 15,000	448	-	Hardwired	All	1	15,000
Cabinet Medium (includes Batt. Etc.)	$ 25,000	672	-	Hardwired	All	-	-
Cabinet Large (includes Batt. Etc.)	$ 50,000	1,344	-	Hardwired	All	-	-
Cabinet Xtra Large (includes Batt. Etc.)	$ 75,000	2,240	-	Hardwired	All	-	-
Mini-Hut	$ -	7,257	-	Hut	All	-	-
Maxi-Hut	$ -	9,792	-	Hut	All	-	-
CEV 16	$ -	8,064	-	CEV	All	-	-
CEV 24	$ -	12,096	-	CEV	All	-	-
TOTAL RT ELECTRONIC EQUIPMENT							24,800

DLC Plug-in Calculation

Remote Terminal Channel Unit Cost	CostPer	CapacityPer	Total Placing Hours	EquipCat	UOM	Units	MaterialCostCU
POTS	$ 200	4	-	Plug-in	POTS	36	$ 7,200
POTSX	400	4	0	Plug-in	POTSX	0	$ -
COIN	$ 450	4	0	Plug-in	COIN	6	$ 2,700
COINX	900	4	0	Plug-in	COINX	0	$ -
BRI-ISDN	$ 500	4	0	Plug-in	BRI-ISDN	0	$ -
BRI-ISDNX	750	4	0	Plug-in	BRI-ISDNX	0	$ -
CENTREX	$ 200	4	0	Plug-in	CENTREX	17	$ 3,400
CENTREXX	400	4	0	Plug-in	CENTREXX	0	$ -
SW-VGSS	$ 400	4	0	Plug-in	SW-VGSS	0	$ -
SW-VGSSX	600	4	0	Plug-in	SW-VGSSX	0	$ -
NSW-VGSS	$ 400	4	0	Plug-in	NSW-VGSS	0	$ -
NSW-VGSSX	600	4	0	Plug-in	NSW-VGSSX	0	$ -
4-WIRE	$ 500	2	0	Plug-in	4-WIRE	0	$ -
4-WIREX	750	2	0	Plug-in	4-WIREX	0	$ -
DS1	$ 250	1	0	Plug-in	DS1	0	$ -
DS1X	500	1	0	Plug-in	DS1X	0	$ -
HDSL	$ 500	1	0	Plug-in	HDSL	0	$ -
HDSLX	750	1	0	Plug-in	HDSLX	0	$ -
ADSL	$ -	1	0	Plug-in	ADSL	0	$ -
ADSLX	0	1	0	Plug-in	ADSLX	0	$ -
PBX	$ 400	4	0	Plug-in	PBX	4	$ 1,600
PBXX	600	4	0	Plug-in	PBXX	0	$ -
Total RT Channel Unit							$ 14,900

Investment Process Logic Worksheets

Network Node Field	Media	Process	Cost Elements and Investment Number of Records
NID	All Types	Send Record through Drop and NID worksheet	2 Elements, 2-4 Records: NID (Components of NIDCU and/or NIUCU) and DROP (components of AerialCU and/or BuriedCU)
DT/BT	CU	Send Record through DT/BT worksheet if Working lines is less than 2*AvgLinesperFloor	1 Element with up to 3 Records: DT/BT (Components of AerialCU, BuriedCU, UndergroudCU)
	All Types	Send record through Building Cable worksheet if this is on a customer Lot, and the working lines is greater than 2*AvglinesperFloor	Up to 2 Elements with up to 4 records: BLDGCable (BuildingCU and/or IntrabuildingCU), DT/BT.
	FO	Send Record through DLC-RT sheet	1 Element with multiple records: ONU (with subcomponent detail)
	All Types	Send records through Media sheet.	1 Element with possibly 12 records: DT-FDI (Components for AerialCU, AerialCU24G, AerialFO, BuriedCU, BuriedCu24G, BuriedFO, UndergroundCU, UndergroundCU24G, UndergroundFO, Pole, Conduit, and BuriedTrench
FDI	CU	Send Record through FDI sheet	1 Element with up to 6 records: Split into Distribution and Feeder. FDI (AerialCU, BuriedCU, and UndergroundCU, or IndoorCU)
	All Types	If this is on a customer Lot, then send through Building Cable sheet.	Up to 3 Elements with up to 4 records: BLDGCable (BuildingCU and/or IntrabuildingCU), DT/BT, FDI.
	FO	If this is on a customer Lot, then send through DLC-RT. Else, no output.	1 Element with multiple records: ONU (with subcomponent detail)
	All Types	Send records through Media sheet.	1 Element with possibly 12 records: FDI-DLC (Components for AerialCU, AerialCU24G, AerialFO, BuriedCU, BuriedCu24G, BuriedFO, UndergroundCU, UndergroundCU24G, UndergroundFO, Pole, Conduit, and BuriedTrench
DLC	All Types	Send Record through DLC-RT sheet	1 Element with multiple records: DLC-RT (with multiple sub-components)
	All Types	If this is on a Customer Lot, then send through Building Terminal sheet.	Up to 3 Elements with up to 4 records: BLDGCable (BuildingCU and/or IntrabuildingCU), DT/BT, FDI.

Network Node Field	Media	Process	Cost Elements and Investment Number of Records
	All Types	Send records through Media sheet.	1 Element with possibly 12 records: DLC-CO (Components for AerialCU, AerialCU24G, AerialFO, BuriedCU, BuriedCu24G, BuriedFO, UndergroundCU, UndergroundCU24G, UndergroundFO, Pole, Conduit, and BuriedTrench
AAN	All Types	Send records through Media sheet.	1 Element with possibly 12 records: DLC-CO (Components for AerialCU, AerialCU24G, AerialFO, BuriedCU, BuriedCu24G, BuriedFO, UndergroundCU, UndergroundCU24G, UndergroundFO, Pole, Conduit, and BuriedTrench
COT	All Types	Send Record through DLC-COT Sheet	1 Element with multiple records: DLC-COT (with multiple sub-components)
JCTN	The Junction Record requires no equipment. However, Cable is routed through. Therefore it is handled just like the AAN records with one slight difference. The location of the JCTN will determine whether the investment records are tagged as distribution or feeder.		

003158

Comparison of BSTLM to Proxy Models

Issue	HAI Model 5.0	BCPM	Synthesis	BSTLM	Cost Impact	Evaluation
Customer Location						
1st Source	Geocode	Road Allocate	Road Surrogate	Geocode of Actual BellSouth Data with Geocode Bunching Addressed	Moderate	While the FCC believes Geocode data is preferable, a publicly-available source is not yet available. The FCC and the HAI Model use actual latitude and longitude coordinates
2nd Source	CB Surrogate	N/A	N/A	CB Random Surrogation	Minimal	
Serving Areas						
Methodology	Cluster	Ultimate Grid, Based on Latitude and Longitude	Cluster	MSRT Cluster	Significant	FCC chose to cluster customers without any limitation based on artificial latitude and longitude constraints. While the specific algorithms are slightly different, they use the same concepts as the HAI Model and improve the processing speed.
DLC Locations	Geographic Center of Main Clusters	Population Centroid of Ultimate Grids	Line-weighted Center of Cluster	Optimized placement to reduce distance and need for heavier gauge cable.	Moderate	FCC combined the HAI Model methodology of placing DLCs within distribution areas rather than in between distribution areas while using the BCPM methodology of placing the DLC toward the population center of the cluster rather than the geographic center.

003159

Issue	HAI Model 5.0	BCPM	Synthesis	BSTLM	Cost Impact	Evaluation
SAI Locations	Geographic Center of Clusters, Collocated with DLCs	In Road Reduced Distribution Areas, Collocated with DLCs, or In Between	Line-weighted Center of Cluster, Collocated with DLCs	1 to many, Collocated (with a user defined stub length distance) or on set on roads	Minimal	FCC chose the HAI Model methodology of collocating SAI's with the DLC.
Distribution Areas						
Max. Distance	18,000	12,000	18,000	User Defined. Correctly captures impact of gauge, extended range line cards. Provides an ability to use CSA guidelines but extend the distance to reduce total clusters.	Significant	FCC chose the HAI Model's use of an 18,000 maximum copper analog distances.
Methodology	Cluster	Road Reduced Areas based on Ultimate Grid Quadrants	Cluster	MSRT Cluster with DA's defined using user inputs and layout of roads and customer dispersion	Significant	FCC chose the HAI Model methodology to cluster customers without any limitation based on artificial latitude and longitude constraints rather than assuming the distribution areas equal an arbitrary 1,000 feet times the road distance in an arbitrary area.
Distribution Plant						
Modeled Location	Evenly Distribute over Cluster Area	Evenly Distribute over Road Reduced area	Evenly Distributed over 360 Foot Distribution Grids	Actual Location (Customer is not moved to Modeled network)	Moderate	FCC uses its own methodology of keeping customers generally to within 360 feet of their original geocoded location.

003160

Issue	HAI Model 5.0	BCPM	Synthesis	BSTLM	Cost Impact	Evaluation
Cable Requirements	Backbone & Branch	Backbone & Branch	Lesser of Backbone & Branch or Rectilinear MST	MSRT to Actual Locations	Moderate	FCC uses its own methodology and chooses the cheaper of two alternative estimation processes.
Drop Cables	User Adjustable Input Based on Assumption that Drops are Toward Front of Lot	Calculated as Being in Middle of Lot with a Maximum of 500 Feet	Calculated as Being Between the Front and the Middle of a Lot	Calculated as distance from Distribution Terminal (that is placed realistically) and customers geocoded location (which is offset from road)	Moderate	FCC combined the HAI Model assumption that customers are located toward the front of lots with the BCPM assumption that customers are located in the center of lots.
Connecting Distribution Areas within a Serving Area						
Technology	Copper or T-1 on Copper, Based on Technological Constraints	Copper	Copper or T-1 on Copper, based on Technological Constraints	Copper. Gauge change occurs in DA based on comparison of user input and distance of longest customer loop. No need for other approaches due to the use of the same MSRT to cluster as used in routing.	N/A	FCC methodology connects multiple SAIs within a cluster in a similar fashion that the HAI Model connects multiple SAIs within a cluster.
Methodology	Connects Outlier Cluster to Main Clusters through Daisy-Chaining	Connects Road Reduced Distribution Areas within an Ultimate Grid.	Connects Multiple SAIs within a Main Cluster	Connects Multiple FDIs within a Main Cluster using MSRT	N/A	FCC users its own methodology because all clusters and distribution areas are generally the same as clusters.

003161

Issue	HAI Model 5.0	BCPM	Synthesis	BSTLM	Cost Impact	Evaluation
Connecting Serving Areas (Feeder Network)						
Technology	Copper or Fiber Based on Least Cost and Technological Constraints	Copper for Fiber Based on Technological Constraints	Copper or Fiber Based on Least Cost and Technological Constraints	Copper or Fiber based on Technological constraints and location of high line density buildings	Moderate	FCC uses a least cost design to select the more efficient technology, similar to the HAI model.
Methodology	Uses Rectilinear Routing Based on 4 Main Feeders, (Option for Feeder Steering)	Uses Rectilinear Routing or Feeder Steering and Splitting on a Wire Center Basis	Uses a modified Minimum Steiner Tree to Connect Serving Areas	Uses an MSRT for the 4 Quadrants of the Wire Center. Minimizes distance node to node between the clusters.	Significant	FCC uses its own feeder design methodology that connects the serving areas using a rectilinear minimum spanning tree with some extra Steiner locations to minimize distance. This methodology incorporates components of the HAI Model by allowing daisy-chaining of serving areas similar to the HAI Model's daisy-chaining of main and outlier clusters and also incorporates components of the BCPM's subfeeder sharing.