BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

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

DIRECT TESTIMONY OF DR. MARK T. BRYANT

on behalf of

AT&T COMMUNICATIONS OF THE PACIFIC NORTHWEST, INC., AND WORLDCOM, INC.

June 26, 2003

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Mark T. Bryant. My business address is 4209 Park Hollow Court, Austin, Texas.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am a self-employed consulting economist.

Q. HAVE YOU ATTACHED TO THIS TESTIMONY A SUMMARY OF YOUR EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS?

A. Yes, Attachment A to this testimony is a summary of my educational and professional qualifications.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING?

A. I am testifying on behalf of AT&T Communications of the Pacific Northwest, Inc. ("AT&T") and WorldCom, Inc. ("MCI").

Q. WHAT IS THE PURPOSE OF THIS TESTIMONY?

A. The purpose of this testimony is to introduce the HAI Model, Release 5.3 ("HM 5.3") to this Commission. My testimony provides the Commission with a description of HM 5.3 as the cost model most appropriate for determining the forward-looking economic costs for Qwest Communications - Washington ("Qwest") and Verizon Northwest, Inc. ("Verizon") to provide unbundled network elements (UNEs) in Washington. I also present the results of running the

Model using inputs appropriate for determining Qwest's and Verizon's costs in this state.

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. My testimony introduces HM 5.3 as an appropriate TELRIC-based methodology for determining the cost of UNEs in Washington.

The Model estimates the costs of a number of UNEs associated with the loop, local switching, interoffice transport, interoffice signaling, and the total UNE "platform" (UNE-P) It produces results by line density range,[1] a useful tool for understanding how results vary from rural to suburban to urban areas, and by individual wire center. For example, Qwest's monthly loop costs as determined by the HAI Model in Washington by density zone and wire center are summarized in Table 1, and monthly loop costs for Verizon are summarized in Table 2:

Table 1: Qwest's Monthly per Line Loop Cost

Monthly Total Loop Cost		
	Density Zone	**Wire Center**
Lowest	$3.25	$2.43
Highest	$66.29	$72.55
Average	**$6.70**	

1 Line density is defined as the number of lines per square mile. Low density corresponds to rural areas; high density, to urban areas.

Table 2: Verizon's Monthly per Line Loop Cost

Monthly Total Loop Cost		
	Density Zone	**Wire Center**
Lowest	$3.61	$4.65
Highest	$78.84	$357.37
Average	**$8.67**	

The local switch cost is another UNE of importance and interest. The monthly cost for the switch port for Qwest is shown in Table 3, and the monthly cost for the switch port for Verizon is shown in Table 4:

Table 3: Qwest's Unbundled Local Switching Costs

Switching Costs	
Switch port per line per month	**$2.67**

Table 4: Verizon's Unbundled Local Switching Costs

Switching Costs	
Switch port per line per month	**$3.48**

The HAI Model also estimates cost for tandem switching as $0.00038 per minute of use for Qwest and $0.00116 per minute of use for Verizon. UNE costs for common transport, tandem switching and direct transport can be combined into another element crucial to UNE-P called shared transport. In Qwest's region Qwest charges a blended shared transport rate on all interoffice calls. This blended rate includes toll calls connecting to an interexchange carrier (IXC) through Qwest's tandem, calls that stay on Qwest's network and are connected through Qwest's tandem and calls connected directly between two Qwest offices. Changes in the tandem switching rate will impact the shared transport cost estimate. Table 5 summarizes these costs.

Table 5: Qwest's Shared Transport UNE Costs

Shared Transport Cost Calculation - Qwest			
Connection	**Transport**	**Tandem Switching**	**Weight**
IXC through Tandem	$0.00032[1]	$0.00038	13.0%
Qwest End Offices through Tandem	$0.00063[2]	$0.00038	1.7%
Qwest End Offices Direct	$0.00030[3]	-----	85.3%
Blended Shared Transport	**$0.00036**		
[1]Uses one leg of common transport. [2]Uses two legs of common transport. [3]Uses one leg of direct transport.			

Similar rates for Verizon are detailed in Table 6 below:

Table 6: Verizon's Shared Transport UNE Costs

Shared Transport Cost Calculation - Verizon			
Connection	**Transport**	**Tandem Switching**	**Weight**
IXC through Tandem	$0.00068[1]	$0.00116	19.4%
Qwest End Offices through Tandem	$0.00136[2]	$0.00116	1.5%
Qwest End Offices Direct	$0.00061[3]	-----	79.1%
Blended Shared Transport	**$0.00088**		
[1]Uses one leg of common transport. [2]Uses two legs of common transport. [3]Uses one leg of direct transport.			

UNE costs for local switching usage, tandem switching, interoffice transport and interoffice signaling are rolled into the cost of local network interconnection and, separately, IXC access at the local switch and the tandem switch. Table 7 and 8 summarize these per-minute costs:

Table 7: Qwest's per Minute Network Interconnection Costs

Per Minute Network Interconnection Costs			
	At Local Switch	**At Tandem Switch**	**Average**
Local Network	$0.00002	$0.00071	
IXC Access	$0.00017	$0.00087	**$0.00031**

Table 8: Verizon's per Minute Network Interconnection Costs

Per Minute Network Interconnection Costs			
	At Local Switch	**At Tandem Switch**	**Average**
Local Network	$0.00008	$0.00192	
IXC Access	$0.00044	$0.00228	**$0.00081**

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. My testimony is divided into five parts. Part I introduces the testimony. Part II provides an overview of the HM 5.3. This overview makes extensive reference to the HM 5.3 documentation provided in several exhibits to this testimony. Part III summarizes recent changes made to the HM 5.3 that are part of the ongoing process of the HAI Model to refine calculations and model operation as new data and modeling techniques are developed. Part IV describes, in some detail, the customer location and clustering process, and how the Model uses the resulting data. Part V discusses the use of HM 5.3 to estimate the costs of Qwest and Verizon UNEs, and presents the results calculated by the Model. Part VI discusses the deaveraging of rates for unbundled local loops. Finally, Part VII presents my conclusions and ultimate recommendations to this Commission.

Q. ARE THERE ANY EXHIBITS TO YOUR TESTIMONY?

A. Yes. My testimony contains the following exhibits.

Exhibit MTB-1

Output of the HAI Model, Release 5.3, summarized by line density zone.

Exhibit MTB-2

Output of the HAI Model, Release 5.3, summarized by wire center, together with summary of a proposed deaveraged rate structure.

Exhibit MTB-3

The "Actuals" worksheet from the HAI Model.

Exhibit MTB-4

CD-ROM containing:

1) The HAI Model, Release 5.3 executable for Washington.

2) Documentation: The HAI Model Release 5.3, Model Description, Automation Description and User Guide

3) Documentation: The HAI Model Release 5.3, Inputs Portfolio

II. OVERVIEW OF THE HAI MODEL, VERSION 5.3

Q. PLEASE PROVIDE A GUIDE TO THE DOCUMENTATION YOU HAVE ATTACHED AS EXHIBITS TO YOUR TESTIMONY THAT PROVIDE A DETAILED EXAMINATION OF THE NATURE AND CONTENT OF HM 5.3.

A. Section 1.2 and Appendix A of the HM 5.3 Model Description contained in Exhibit MTB-4 discusses the evolution of the HAI Model over the past eight years. This evolution has occurred in response to ongoing intensive internal reviews of the Model, scrutiny of past versions by various parties as well as more recent scrutiny of this version, new developments in modeling techniques and data sources, and new regulatory requirements. Section 2 of the Model Description summarizes the changes between HM 5.3 and HM 5.0a, which was the version of the Model originally submitted to the FCC for its use in estimating the costs of universal service. Part III of this testimony summarizes the most recent changes to HM 5.3.

Section 3 of the Model Description presents the basic local network structure assumed by the Model; it is the same structure assumed by earlier versions of the Model. The same can be said of the overall Model organization and structure described in Section 4. Sections 5 and 6 describe in some detail the Model's database and the operation of the individual modules of the Model, respectively. Finally, Section 7 summarizes the Model description.

Appendix B of the Model Description describes the creation of the distance files, used by the interoffice calculations in the model. The document titled "HM 5.3 Automation Description and User Guide" explains the computer system requirement to run HM 5.3, and how to install and run the Model. The description of how to run the Model includes the mechanism for changing the default values of user inputs, and for invoking various features and capabilities of the Model. The HM 5.3 Inputs Portfolio ("HIP"), also included in Exhibit MTB-4 provides the rationale and support for the default values of inputs used in HM 5.3.

Q. PLEASE DESCRIBE THE FUNDAMENTAL NATURE OF HM 5.3.

A. Like earlier versions of the HAI Model, HM 5.3 is a bottom-up economic-engineering costing model of basic local exchange service developed by HAI at the request of AT&T and MCI. Broadly speaking, the model looks at the locations of current Qwest and Verizon customers and the locations of current Qwest and Verizon wire centers, then designs a telecommunications network to serve the customers efficiently. This process includes the design of access loops to connect customers to the wire center locations, the design of switches to enable customers to call other customers within the same wire center or to other customers in other wire centers, and the design of interoffice facilities to connect each wire center to other wire centers. Having designed the network, the model then uses publicly-available information to determine the quantities of material needed to deploy the network and the cost of each item of equipment deployed as well as the labor to place the equipment in service. At the end of the process, the HAI Model provides estimates of the costs that an efficient local exchange carrier (LEC) would incur to provide narrowband, voice-grade telephone services in a manner that is also capable of providing access to advanced services.

Q. WHAT DO YOU MEAN WHEN YOU SAY HM 5.3 IS A BOTTOM-UP ENGINEERING AND ECONOMIC MODEL?

A. HM 5.3 constructs a network based on detailed and granular information as to service demand, network component capacities and costs, and expenses, then builds from the "bottom-up" a network to serve existing total demand for all services offered by incumbent telephone companies. The Model thus contrasts with models that try to assign total embedded costs or revenues of incumbent telephone companies to individual services. The latter models are often referred to as "top-down."

Specifically, the Model process has the following seven major steps. First, information on the amount and location of current demand for local exchange service, network elements, and network interconnection for the Incumbent Local Exchange Carrier ("ILEC") and jurisdiction under study is obtained. This input data consists of geocoded[2] customer location data when available, combined with a method of assigning surrogate locations when geocoded location information is not available for all customers. This step is described in Section 5.3 of the Model Description, and reflects a state-of-the-art approach to precisely determining customer locations.

Second, as a second step in formulating model inputs, groups, or "clusters," of adjacent customers are formed, and those clusters are then associated with serving areas that efficiently can be served by available local exchange technology. The size, shape, location, number of lines, and serving wire center of each such cluster are then determined. This clustering process is described in Section 5.4 of the Model Description. Once these clusters are identified, the data input process incorporates jurisdiction- and/or company-specific data on local terrain attributes

2 A geocoded customer location is one where a customer address can be precisely located (*i.e.* latitude and longitude can be determined).

and assigns these attributes to the customer clusters according to the cluster locations to identify circumstances in which the terrain attributes will cause installation costs to increase over their normal levels. It is important to note that these first two steps are not properly a part if the HAI Model itself, but are undertaken to develop a suitable set of inputs upon which the model can operate. The model can operate on any properly-formatted set of data that describes specific customer locations, and the model has been operated in the past using proprietary customer location data provided by ILECs.

Third, based on the forward-looking network architecture being deployed by ILECs today, the model determines the amounts of various network components needed to support the known demand for the elements and services in question. In doing so, it employs numerous optimization routines that ensure 1) the use of outside plant structures that are technically and economically most suited to particular local conditions; 2) the appropriate economic choice of feeder technology between copper cable and fiber-based digital loop carrier systems; 3) at the user's option, the appropriate economic choice between wireline and wireless distribution systems; and 4) efficient interoffice fiber optics transport rings based on the widely-used Synchronous Optical Network ("SONET") family of standards.

Fourth, the Model estimates the investment required to purchase and install the requisite quantities of each identified component considering detailed engineering design, material, and labor costs. The ability to set meaningful values for these inputs has been greatly aided by the exhaustive analysis of inputs undertaken by the Federal Communications Commission (FCC) in connection with its work on the universal service subsidy model.

Fifth, the Model determines the cost of operating and maintaining the network, taking into account all relevant capital carrying costs, network operations, maintenance, customer operations, and corporate overhead costs (with forward-looking adjustments where appropriate). Again, various parameters required to make these calculations are provided to the Model through user inputs and as appropriate the user can specify whether expenses are to be allocated on a per-line or on the basis of relative investment-driven costs.

Sixth, the Model calculates per-unit UNE costs, network interconnection costs, and the cost of universal service. At the user's discretion, these results can be displayed by line density range or by wire center.[3]

Finally, the Model produces outputs and associated intermediate results that are available for public scrutiny, both in hard copy and electronic form.

[3] Line density refers to the number of lines served per square mile. Many aspects of telephone network design, and associated investments and cost, are dependent on line density -- meaning they differ according to whether the area served is rural (low density), suburban (medium density) or urban (high density). Density zones in the model range from 0-5 lines per square mile at the low end to greater than 10,000 lines per square mile at the high end.

Q. HOW ARE THE VARIOUS COMPONENTS OF THE MODEL RELATED?

A. The model consists of separate modules for the estimation of loop distribution costs, loop feeder costs, and switching and interoffice costs. Separate expense modules calculate capital-related costs and operating expenses at the level of the individual wire center and at the level of line density zones. An important aspect of the operation of the HAI Model is that it is a fully integrated process. Any changes made to user inputs will flow through to all aspects of the network affected by such changes. As an example, a change in the user input for the depreciation life of fiber optic cable most directly impacts calculations in the expense modules, but may also affect least-cost optimization routines in the distribution and feeder modules. The integration of all components of the model ensures that cost estimates produced for each network component are consistent with the cost estimates for all other components.

The integrated nature of the model also permits the consideration of synergies that exist in the provision of various network components. Feeder cable routes and interoffice cable routes, for example, both originate at ILEC wire centers, and thus can occupy the same supporting structures, such as poles or conduit. An integrated model permits the explicit design of an integrated network in a manner that would not be possible in a model that considers each component of the network in isolation.

Q. WHAT IS THE ROLE OF USER INPUTS IN THIS PROCESS?

A. The Model provides the user with the ability to specify over 2,100 inputs through a set of graphical user interface screens. These inputs represent, for instance,

- "on-off" switches that allow the user to invoke certain alternative model algorithms;
- the prices of network components;
- certain attributes of the local exchange network under study, such as the designation of which switches are hosts, remotes and stand-alone units and the amount of different types of outside plant by line density zone;
- operations costs, specified on a per-line or per-investment-dollar basis; and
- parameters related to capital carrying costs, such as the percentages and cost of debt and equity, depreciation lives and net salvage values, and tax rates.

These inputs allow the user to reflect specific local conditions and circumstances, and/or to permit sensitivity analyses to be performed. Default values are set for each of these inputs that reflect industry practices, suitably adjusted to be consistent with the forward-looking orientation of the Model. The HAI Inputs Portfolio defines, gives the default value, and provides the rationale and support for each of these inputs.

III. RECENT CHANGES TO THE HAI MODEL

Q. WHAT CHANGES HAVE BEEN MADE TO THE HAI MODEL SINCE IT WAS LAST PRESENTED TO THE WASHINGTON COMMISSION?

A. In the original generic cost proceeding in Washington, AT&T and MCI presented an earlier version of the HAI Model, at that time known as the Hatfield Model, version 3.1. Since that time, numerous improvements have been made to the model. The history of the development of the HAI Model is presented in Appendix A to the HAI Model Description (contained in Exhibit MTB-4), and a detailed description of more recent modifications to the model is presented in Section 2 of the HAI Model Description.

In the course of the FCC's Universal Service proceeding and in numerous state proceedings where the HAI Model has been presented, two major updates to the model have been made, along with several minor "point" releases.

The most significant changes to the HAI Model since the model was last presented in Washington occurred in version 5.0, released in January of 1998. In that release, a major change was made to the method by which the model uses customer location information. In previous releases, the model relied upon population estimates produced by the U.S. Bureau of the Census to determine the location of customers within each ILEC wire center. These estimates were available at the level of the Census Block or Census Block Group, a geographic unit used by the Census Bureau for the collection and aggregation of population data. A criticism of the use of these data was that, while Census Blocks in urban areas encompass a very small geographic area, census blocks in rural areas encompass much larger geographic areas. Consequently, the accuracy of customer location information derived from Census Blocks is questionable. Beginning with version 5.0, the HAI Model turned to the use of customer location information based on commercial mailing list databases. The use of this information permitted the HAI Model to employ highly accurate "geocoded" customer location data, which in turn permitted much more accurate placement of telecommunications network facilities to serve those customer locations than had been the case in earlier versions of the model.

Version 5.2 of the HAI Model incorporated many recommendations that issued from the FCC's decision in its Universal Service proceeding, and adopted many of the input values that had been established by the FCC in that proceeding.

The latest version of the HAI Model – version 5.3 – was released in October of 2002. The most significant change in this version of the model is the addition of the capability to include higher-capacity loops, such as DS-1 and DS-3 loops, in the integrated network design, and to accurately model the transport facilities associated with those loops. Previous versions of the HAI Model had been criticized for using data that presented higher capacity loops in terms of voice-grade equivalent channels rather than modeling explicitly the type of facilities required to provision these loops. The current version of the model lays this criticism to rest.

Q. WHY ARE OCCASIONAL CHANGES MADE TO THE MODEL?

A. First, it should be recognized that the identified changes to HM 5.3 do not reflect a fundamental change in the Model's approach to estimating costs. Modifications were made because during the Model's evolution over a number of years, the Model developers have taken advantage of the intense scrutiny to which the Model has been subjected by HAI and its clients, by regulators, and by other, often hostile, parties. One of the strengths of the HAI Model has been its developers' willingness to use this scrutiny to identify and develop new modeling techniques and to adopt modifications in calculations and source data when such modifications can be verified to improve the accuracy and/or operation of the Model. The changes listed above reflect issues identified by the developers, or by other parties, during review of the Model in proceedings where HM 5.3 and its predecessors has been introduced.

Q. HOW IS THE HAI MODEL RELATED TO THE FCC SYNTHESIS MODEL?

A. The FCC Synthesis Model is used by the FCC for determining Federal Universal Service support. The HAI Model serves as the framework for the FCC Model. The HAI subscriber database is the prototype for the FCC database. The FCC Synthesis Model adopted a clustering methodology similar to that used by the HAI Model. The interoffice and expense modules used by the FCC Synthesis Model were taken from the HAI Model, and the user interface is adapted from the HAI Model.

The Synthesis Model uses a set of route-optimization algorithms that determine distribution and feeder cable route distances. HM5.3 has a corresponding strand-distance adjustment that allows it to approximate the Synthesis Model's route distance optimization methodology.

Although use by the FCC of the HAI Model as the framework for the FCC Synthesis Model validates the HAI Model, the FCC Synthesis Model cannot be used in this proceeding because it is not designed to produce UNE costs, and cannot do so without modification. The FCC Model was developed to produce USF costs at the wire center level. Furthermore, it cannot calculate costs below the wire center level; *i.e.*, at the density zone or cluster level.

IV. CUSTOMER LOCATION AND CLUSTERING

Q. WHAT IS THE PURPOSE OF THE CUSTOMER LOCATION AND CLUSTERING PROCESS?

A. The customer location process ensures that customers are located to the highest degree of specificity and accuracy possible, based on available data. The clustering algorithm ensures that the identified customer locations are served by outside plant that is configured to be economically efficient and consistent with design guidelines that are based on the characteristics of currently available outside plant technology.

Q. PLEASE SUMMARIZE THE CUSTOMER LOCATION PROCESS.

A. This process is described in detail in Section 5.3 of the Model Description. Sections 5.1 through 5.3 are also useful in understanding how residential and business line counts are determined by wire center.[4]

Briefly, HM 5.3 utilizes the most precise customer location data that are available. Wherever customer locations have been precisely determined by geocoding, that information is used. Geocoding, as applied in HM 5.3, locates customers fifty feet from the center of the roads on which they are located.

For those locations for which no geocoding information is available, the Model uses the next most precise information source available: the U. S. Census Bureau's location of residential households by census block ("CB"). In HM 5.3, surrogate locations are distributed uniformly along the roads they lie on and within the boundaries of the CB. The road information is determined from the U.S. Census Bureau's Topologically Integrated Geographic Encoding and Referencing ("TIGER") files. Roads where customers are unlikely to reside have been eliminated from consideration.[5] The uniform distribution of customer locations along roads in this fashion is still likely to overestimate the actual dispersion of customers to some extent, because households and businesses are commonly clustered to at least some degree.

4 For Washington, Qwest's and Verizon's proprietary wire center specific line counts were used in HM 5.3.
5 This includes, for instance, limited access highway segments, road segments that are in tunnels or underpasses, vehicular trails and roads passable only by four-wheel-drive vehicles, and private driveways and roads.

Q. WHAT IS THE NATURE OF THE SOURCE INFORMATION USED TO DETERMINE CUSTOMER LOCATIONS?

A. As described in Section 5.3 of the HAI Model Description, the sources of the information used in determining customer locations are commercial mailing list databases maintained by Metromail for residential locations and by Dun & Bradstreet for business locations. These companies are in the business of maintaining such databases for sale to companies that are engaged in direct marketing through the mailing of catalogs or other marketing pieces to individual households or businesses.

Q. SHOULD THE COMMISSION BE CONCERNED ABOUT THE USE OF THIS PROPRIETARY INFORMATION IN CONJUNCTION WITH THE HAI MODEL?

A. The primary goal of the HAI model developers in adopting the use of commercial customer location data was to improve the accuracy of the model in estimating costs in less densely populated areas. As I noted earlier, previous versions of the model used information provided on an aggregate basis by the U.S. Bureau of the Census. It's important to recognize that the source data upon which the Census Bureau's reports are based also are not available to public scrutiny. The Census Bureau does not report information on individual households in order to preserve the privacy of U.S. citizens. Some information is reported only for census blocks, while other information is deemed to be so sensitive that it is reported only for the larger Census Block Group. The fact is that the more disaggregated and discrete the data, the more valuable those data, and the more sensitive with regard to privacy concerns.

The process relied upon by the HAI Model to obtain customer location information is a method to obtain disaggregated and discrete information about customer locations below the smallest geographic unit reported by the Census Bureau without damaging the commercial value of the information and without raising privacy concerns.

Because the mailing list marketers have strong incentives to ensure the accuracy and reliability of the data that they maintain, and because those firms certainly have no interest in the process of estimating the cost of telecommunications networks, the Commission can have a high degree of confidence in the source data used for determining customer locations as an input to the HAI Model.

Q. PLEASE SUMMARIZE THE CUSTOMER CLUSTERING PROCESS.

A. This process is described in Sections 5.4 and 5.5 of the Model Description. Its purpose is to identify subsets of the customer locations determined from the customer location that are close enough together to be efficiently engineered as a single telephone plant serving area. Customer locations must meet the following criteria to be considered members of a particular cluster:

- No point in a cluster may be more than 17,000 feet distant (based on right angle routing) from the cluster's centroid (the geometric center of the cluster);

- Clusters are targeted not to exceed 6,451 lines in size;[6] and
- No point in a cluster may be farther than two miles from its nearest neighbor in the cluster.

Clusters that contain twenty or more line equivalents or at least one all-fiber loop are classified as "main" clusters. Clusters that contain 19 or fewer line equivalents and have no all-fiber loops are called "outlier" clusters. Outlier clusters may be linked to their "home" main cluster via "chains" that string together other outlier clusters that home on the same main cluster.

Once main clusters are identified in this fashion, the clustering algorithm calculates and records a rectangle whose 1) centroid and location are the same as the convex polygon that defines the cluster;[7] and 2) aspect ratio is the same as the aspect ratio of the minimum rectangle that bounds the original cluster shape. Thus, customers belonging to main clusters end up within the confines of a "rectangularized" cluster shape that allows the Model to estimate the type and amount of outside plant required to serve each cluster. The aspect ratio is calculated based on the actual orientation of the bounding rectangle, rather than being projected onto north-south and east-west axes. The cluster type and shape information, as well as other data about each cluster as listed in the Cluster Input Data Table in Section 6.1.1 of the Model Description, including the strand

6 This number results from 80% utilization of an 8,064 line DLC Remote Terminal and a 7200 line SAI (Feeder plus Distribution pairs terminated). It is a target maximum size, but the final count of lines in a cluster may exceed 6,451 lines due to the final gross-up of geocode data to the study area line counts and the addition of special access lines and public telephones. If this occurs, the model adds sufficient remote terminals and SAIs to serve the actual line count, taking excess capacity into account.
7 A convex polygon is one whose internal angles are less than 180 degrees, meaning that it "bulges

distance calculated by HM 5.3, become the demographic input data for the Model calculations.

Q. WHAT DOES THE MODEL DO WITH THE INFORMATION THAT RESULTS FROM THE LOCATION AND CLUSTERING PROCESS?

A. HM 5.3 treats each main cluster identified during the clustering process, along with its associated "outlier" clusters, as a serving area. As described in Section 6.3 of the Model Description, the Model extends copper or fiber feeder cable to each main cluster. From there, copper distribution cable extends throughout the main cluster to reach the customers in the main cluster. If the distances involved exceed the maximum copper loop distance set by the user, the main cluster is divided into two or more sub-clusters, and fiber feeder is extended to terminals and Serving Area Interfaces located in each of the sub-clusters. Copper cables, including, as necessary, additional fiber-fed DLC systems also extend from the feeder termination in the main cluster to the remote clusters associated with the main cluster.

Q. WHAT IS THE NATURE OF THE STRAND DISTANCE THAT IS CALCULATED FOR EACH CLUSTER AND INCLUDED IN THE DATA RECORD FOR THAT CLUSTER?

A. The strand distance is an independent measure of an amount of route mileage required to connect all the points that represent customer location to each other. It is related to a graph theory concept referred to as a Minimum Spanning Tree

outward" at each of its vertices.

("MST") of the points that represent the customer locations. But unlike a true MST, which would calculate distances based on connecting points with straight lines, the strand distance used in the Model provides for the extra distance required to connect points via "right angle routing," in which the connection between any two points follows a "horizontal, then vertical" path in a Cartesian coordinate system.[8]

Q. WHAT IS THE SIGNIFICANCE OF THE STRAND DISTANCE FOR A GIVEN CLUSTER?

A. It represents the amount of distribution route distance ("DRD"), which is the sum of all distribution and connecting cable components that the Model should produce in each cluster.

Q. HOW DO YOU ANSWER THE CRITICISM THAT THE STRAND DISTANCE IS AN ABSOLUTE MINIMUM MEASURE OF THE APPROPRIATE DRD, AND THE DRD SHOULD ACTUALLY EXCEED THE STRAND DISTANCE?

A. For a variety of reasons, the MST, while serving as an indicator of what the DRD might be, does not represent the true minimum DRD the Model should produce. This is because:

8 In other words, the MST calculates the distance between two points as the sum of the length of the legs of a right triangle connecting the two points rather than the hypotenuse of the triangle, which represents the "airline" distance.

- The methodology used to determine surrogate customer locations when geocoded information is not available is likely to overly disperse those locations, because it assumes a uniform spacing of customer locations along roads that does not reflect clusters of customers that often exist, such as in small towns, settlements, and the like. Since MST takes surrogate locations as fact, strand distances based on these locations will also be over-estimated in this case.
- While the graph theory on which the MST concept is based assumes that branches can occur only at the nodes of the graph, which in this case are the customer locations, telephone plant will almost always have branching points at places other than at a customer location. Such "Steiner networks" are capable of connecting points with less cable than is required by MST assumptions.
- The strand distance may not account for all the cable used to connect customer locations to the feeder. Specifically, one must also account for the drop cables that connect the distribution cables to the individual customer premises, and the substantial amounts of cable required to connect outlier clusters to main clusters, and to connect customers within outlier clusters.

Q. HOW IS THE STRAND DISTANCE USED IN HM 5.3?

A. The strand calculation is turned on in the model as filed with this testimony. HM 5.3 includes the optional ability to normalize the DRD produced by the Model to the calculated strand distance, taking appropriate account of the drop cable lengths included in the strand distance estimate but not considered to be part of the DRD.

The user interface includes two parameters that can be set independently for each density zone. The first is a logical "on-off switch" that determines if the strand distance provided as part of the cluster information database is to be used in that density zone. The second is a multiplier of the strand distance that can be used to correct any systematic biases in the strand distance. It can, for instance, be used to lower the strand distance to correct for the effect of conservatively over-dispersing customer locations in the low-density zones.

These parameters are used as follows. If the switch is off, the DRD is not normalized to the strand distance. If it is on, the strand distance provided in the cluster data record is multiplied by the second parameter, then the ratio of the adjusted strand distance to the DRD is computed, and finally each component of the DRD is multiplied by that ratio so the overall DRD will now equal the adjusted strand distance.[9] This process is explained in detail in Section 6.3.4 of the Model Description, which also describes the default values for these and another relevant parameters.

9 The default user input value is –999, which causes the Model to use a multiplier of 1; if the user replaces, through the interface forms, the –999 indicator with a practical multiplier value, the Model will override its

Q. ARE ANY ADJUSTMENTS TO THE DRD MADE IF THE STRAND DISTANCE NORMALIZATION IS TURNED OFF?

A. Yes. Even if the user does not invoke the normalization option, the Model nevertheless ensures that the DRD in each cluster is large enough for cable to reach the corners of the cluster rectangle that may be occupied by customers, using right angle routing. For a cluster with two customer locations, this minimum distance is the sum of the height and width of the rectangle less two drop lengths for the cluster's density zone, under the assumption that customers are located at diagonally opposite corners of the rectangle. With this minimum, there is enough cable to connect opposite corners of the rectangle. For instance, starting, say, at the upper left corner, such a cable would extend to the right along the upper edge of the rectangle to the mid-point of the upper side, drop straight down through the middle of the rectangle to the bottom edge (intersecting the SAI along the way), and then travel towards the right along the bottom edge of the rectangle. For a cluster with three customer locations, the minimum distance is the sum of the height and 1.5 times the width, assuming customers are located at three corners of the rectangle; the additional amount of cable is sufficient to also extend from the middle vertical cable segment to the upper right or lower left corner. Finally, for a cluster with four or more customer locations, the minimum distance is the sum of the height and twice the width of the rectangle, assuming customers are located at all four corners of the rectangle; this provides sufficient cable to extend to all four corners from the middle vertical cable segment.

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default factor with the user-selected one.

Q. TO WHAT EXTENT DOES THE USE OF STRAND DISTANCE LEAD TO A CONSERVATIVE ESTIMATE OF THE REQUIRED AMOUNT OF STRUCTURE DISTANCE?

A. The Model assumes that all structure, and hence cable, is routed in a right-angle fashion. In practice, pole and trench routes run diagonally to follow roads that do not run N-S or E-W. Such diagonal routing will generally lead to structure distances that are less than those obtained under the right-angle assumption. In addition, in testimony filed in Florida in July 2000, HM5.3's predecessor model, HM5.0a, was found to estimate significantly more loop structure distance than that computed by the BellSouth Telecommunications Loop Model ("BSTLM"), which is based on BellSouth's actual customer locations. In this case, the HM calculated 28% greater distribution distance and 436% (more than five times) more feeder distance than that estimated by BSTLM.[10]

Q. WHAT WOULD HAPPEN TO THE HAI COST MODEL ESTIMATES IF QWEST'S AND VERIZON'S RECORDS OF CUSTOMER LOCATIONS WERE USED TO CREATE THE CLUSTER DATA USED BY THE MODEL?

A. If Qwest's and/or Verizon's records of customer locations were used to create the cluster data relied upon by the HAI Model cost estimates would likely decrease. This is because the original data used in the HAI Model used surrogate locations for approximately 40% of the customers, and using surrogates spreads customers

10 Rebuttal Testimony of John C. Donovan and Brian F. Pitkin, Florida Public Service Commission Docket No. 990649-TP, July 31, 2000, Exhibit JCD/BFP-3.

out uniformly on the roads in occupied census blocks. Such uniform spreading of customers increases cost estimates because it assumes additional distribution cable to serve more customers at a greater distance from the wire center even though fewer customers actually are located at those distances. Using Qwest's or Verizon's recorded customer locations should result in a much smaller surrogate rate. With fewer surrogate locations (and a corresponding reduction in uniform spreading of customers), the costs should decrease. This experiment occurred in the Arizona Cost Case (Docket No. T-00000A-00-0194). Qwest provided current customer location data, which was processed by TNS. The surrogate rate using Qwest's customer location data was only 6.1%. Using Qwest's customer location data the unbundled loop cost fell by 4.0% which confirms that use of the customer location data used in the HAI Model is conservative and that the costs produced by the HAI Model are an upper bound on forward looking economic cost estimates.

Q. PLEASE SUMMARIZE WHERE IN THE EXHIBITS TO YOUR TESTIMONY THE CUSTOMER LOCATION, CLUSTERING, AND DISTRIBUTION NETWORK DESIGN ALGORITHMS ARE DESCRIBED IN DETAIL.

A. Sections 5.3 and 5.4 of the Model Description provide a detailed portrayal of the customer location and clustering algorithms, respectively. These processes in turn require an accurate determination of LEC wire centers and customer line counts by type. The process of obtaining these data is described in Sections 5.1 and 5.2.

Sections 6.3 and 6.4 describe how the model engineers outside plant to provide service to the identified clusters of customers.

Q. DO THE DATABASES USED IN THE MODEL RESULTS FILED WITH YOUR TESTIMONY REFLECT THE DESCRIPTION OF THE CLUSTERING METHOD YOU HAVE DESCRIBED ABOVE?

A. The database used to estimate UNE costs for Qwest reflect the description that I have provided here. Unfortunately, problems occurred in the processing of customer location data for Verizon that prevented completion of a version 5.3-compatible database in time for filing with this testimony. Consequently, the cost results for Verizon presented here are based on an earlier version of the customer location database, updated with current Verizon line counts. This earlier version of the database was constructed using somewhat different parameters for forming clusters of customer locations, including a smaller maximum line size for clusters, and a smaller minimum line size for main clusters. Work is continuing to resolve the problems in processing customer location data for Verizon, and an update to the Verizon database should be available in the near future.

Q. PLEASE DESCRIBE THE MECHANISM BY WHICH USERS MAY SET EXPENSE TO INVESTMENT RATIOS FOR VARIOUS PLANT CATEGORIES.

A. By default, the model uses the expense to investment ratios adopted by the FCC in the Universal Service Inputs Order. The user, however, can override the default E/I values by entering an E/I value for that category in the “Actuals” Worksheet.

Q. PLEASE DESCRIBE SPECIFICALLY HOW A USER CAN ENTER SUCH E/I RATIOS.

A. I will do so by reference to the "Actuals" Worksheet included as Exhibit MTB-3. Focusing on Rows 3-51 of that worksheet, one observes various plant categories. Column F, labeled "calculated or user-defined factor," shows the E/I ratio for each plant category that is subsequently used by the Model to calculate operating expenses. For a given plant category, if Column H (which is labeled "User-Defined Factor") were blank, then Column F would contain an E/I calculated from the investments and expenses shown in Columns C and E (which are picked up from the ARMIS Inputs sheet). When there is an entry in Column H, however, the value entered in Column H overrides the normal E/I calculation, and Column F will be set equal to the Column H entry and used in subsequent calculations. For example, in Row 19 (ARMIS account 2212, Digital Electronic Switching), the value .0558 entered in Column H causes Column F to be .0558, rather than the FCC value. In this fashion, the user is able to input E/I ratios for any and all plant categories.

To change the E/I ratios from the default values, a user should allow the Model to execute, enter one or more values in Column H, and depress the F9 key to recalculate.

Q. WHAT IS THE PURPOSE OF COLUMNS I AND J AT ROWS 44-46 OF THE "ACTUALS" WORKSHEET?

A. These additional columns, called Alternative Cable Maintenance Factors, allow the user to enter separate fiber cable and copper cable E/I ratios for each type of outside plant structure – aerial, underground, and buried. While it might appear from the exhibit that the copper cable values set in Column J control the value in Column H, and hence in Column F, in actuality, for these plant categories, the Model will automatically select the Column I entries when calculating fiber cable expenses, and Column J entries when calculating copper cable expenses.

Q. EXHIBIT MTB-3 SHOWS A NON-ZERO VALUE FOR EVERY PLANT CATEGORY IN COLUMN H. ARE THEY THE ACTUAL VALUES USED TO PRODUCE THE RESULTS FOR QWEST AND VERIZON?

A. Yes, and they are the values that are set in the "Actuals" worksheet in the Model that is being filed electronically with this testimony. Therefore, the user does not need to take any action to have the Model calculate results with the set of ratios shown.

Q. PLEASE IDENTIFY THE SOURCE OF THE VALUES THAT APPEAR IN COLUMN H-J OF EXHIBIT MTB-3.

A. The values in Exhibit MTB-3 are those that the FCC determined to be appropriate. They appear in the *USF Inputs Order*.[11]

11 Mechanism for High Cost Support for Non-rural LECs, CC Docket 97-160, Tenth Report and Order, FCC 99-0304, (Rel. Nov. 2, 1999) ("*USF Inputs Order*").

V. RESULTS OF APPLYING HM 5.3 TO QWEST AND VERIZON

Q. WHAT INPUTS HAVE BEEN ADJUSTED TO REFLECT QWEST AND VERIZON CUSTOMERS IN WASHINGTON?

A. The HAI Model uses Washington specific customer location data, terrain data, and switch locations. In addition, I used the following inputs specific to Qwest and Verizon in Washington.

1) End of Year 2002 ARMIS expense and network usage data.

2) Switching Investments. This data is based on prices adopted by the FCC in the *USF Inputs Order*. The FCC values represent the best publicly available, non-proprietary information available on recent prices paid by ILECs for end office switches. The inputs reflect Qwest's and Verizon's specific proportion of host and remote switches. The switching investments include the costs of software necessary for vertical features. The model also sizes switches with the necessary capacity to account for usage of features. As a result, the cost of features is already being recovered in the switching unbundled network elements.

3) A Washington specific labor factor of 0.92. This factor adjusts a specific proportion of certain investments to reflect Washington specific labor rates.

4) State Prescribed depreciation lives and net salvage values as listed in Tables 9 and 10:

Table 9: Qwest specific Economic Lives and Net Salvage Percents

Plant Type	Economic Life	Net Salvage %
Motor vehicles	9.6	16.0
Garage work equipment	14.0	0.0
other work equipment	16.0	9.0
buildings	33.0	4.0
furniture	20.0	0.0
office support equipment	15.0	0.0
company comm. equipment	9.9	0.0
general purpose computers	5.8	5.0
digital electronic switching	17.0	0.0
operator systems	12.0	0.0
digital circuit equipment	12.0	1.0
public telephone term. Equipment	10.0	5.0
poles	28.0	-75.0
aerial cable, metallic	24.0	-24.0
aerial cable, non metallic	28.0	-24.0
underground cable, metallic	25.0	-22.0
underground cable, non metallic	30.0	-22.0
buried cable, metallic	22.0	-7.0
buried cable, non metallic	28.0	-7.0
intrabuilding cable, metallic	20.0	-20.0
intrabuilding cable, non metallic	28.0	-20.0
conduit systems	55.0	-10.0

Table 10: Verizon specific Economic Lives and Net Salvage Percents

Plant Type	Economic Life	Net Salvage %
Motor vehicles	9.3	20.0
Garage work equipment	18.0	5.0
other work equipment	15.0	10.0
buildings	43.0	0.0
furniture	20.0	10.0
office support equipment	15.0	10.0
company comm. equipment	8.0	2.0
general purpose computers	8.0	5.0
digital electronic switching	16.5	3.0
operator systems	12.0	-2.0
digital circuit equipment	12.0	4.0
public telephone term. Equipment	8.0	10.0
poles	28.0	-75.0
aerial cable, metallic	21.0	-27.0
aerial cable, non metallic	30.0	-5.0
underground cable, metallic	26.0	-15.0
underground cable, non metallic	30.0	-5.0
buried cable, metallic	23.0	-5.0
buried cable, non metallic	30.0	-5.0
intrabuilding cable, metallic	20.0	-30.0
intrabuilding cable, non metallic	20.0	-30.0
conduit systems	50.0	-5.0

The depreciation rate for the NID, Drop and SAI was assumed to be the average of the Aerial – Non-Metallic and Buried – Non-Metallic accounts.

5) Qwest and Verizon specific cost of capital as was ordered in prior cost dockets.

Table 11: Qwest Specific Cost of Capital

Cost of Capital (Qwest)	
Debt fraction Cost of debt Cost of equity	0.4800 0.0727 0.1180
Weighted average Cost of capital	0.0963

Table 12: Verizon Specific Cost of Capital

Cost of Capital (Verizon)	
Debt fraction Cost of debt Cost of equity	0.4440 0.0790 0.1125
Weighted average Cost of capital	0.0976

6) Washington specific tax rate of 35.0%.

7) Washington specific "Other Tax Factor" as follows:

Table 13: Qwest Specific Other Taxes Factor

Other Taxes Factor (Qwest)
4.83%

Table 14: Verizon Specific Other Taxes Factor

Other Taxes Factor (Verizon)
4.65%

8) Washington-specific "Network Operations Factor" as follows:

Table 15: Qwest Specific Network Operations Factor

Network Operations Factor (Qwest)
30.45%

Table 16: Verizon Specific Network Operations Factor

Network Operations Factor (Verizon)
29.42%

Beginning with HM 5.3, a change was made in the calculation of forward-looking Network Operations expense. First, the ratio of ARMIS network operations costs to the total of ARMIS network operations, plant specific, and general support expenses is calculated. Call this ratio R – these are the values that appear in the above input tables. Second, the Model calculates the amount of forward- looking plant specific and general support costs associated with a given service category. Call these amounts F and G, respectively. Third, it calculates the amount of network operations expenses to be assigned to that service category according to the formula $N = R * (F + G + N)$. Solving this equation for N yields the result $N = R/(1- R) * (F + G)$. Finally, N is multiplied by a user-adjustable efficiency factor to arrive at the final network operations expense to be assigned to the service category. The efficiency factor can be set to a value that reflects expected gains in network operations efficiency. There have been significant reductions in per- line network operations over the past several years, presumably due to the fact that the set of activities classified as network operations has been and continues to be particularly subject to the beneficial effects of new operations technology and other productivity factors. The efficiency factor is currently set to 1.0, although there are many examples of new operations technology that are coming into play that will continue to cause Network Operations expenses to decrease.

8) Finally, a number of input values relating to plant structure placement fractions were calculated based on Washington-specific information. These inputs are described in the testimony of Mr. John Donovan.

Q. PLEASE PROVIDE AN OVERVIEW OF THE OUTPUTS OF THE HM 5.3 EXPENSE MODULES.

A. The outputs of the Model appear in a set of spreadsheets produced by the expense module selected for a particular run by the user. There are different expense modules depending on whether the user selects results to be displayed by density zone, wire center, or individual customer cluster. Each also displays study area totals.

There are numerous worksheets produced by the expense modules; they contain many intermediate and final results of the Model's calculations and list various inputs to the Model. The sheets and their contents are too numerous for me to describe in detail here. However, there are four sheets of particular importance in the model runs I have made for this testimony. I refer to them by the names that appear on the Excel "tab" at the bottom of each sheet. The four sheets are as follows:

- Scenario Inputs: shows the entire list of changes to the user inputs, if any, that have been made by the user for the run in question.
- User Adjustable Inputs: Shows the values of the complete set of all 2,100+ user inputs, whether they have been changed or not. This sheet is less useful than the Scenario Input, but is still a good way of reviewing the entire set of input values used in case, for instance, the user does not have a copy of the Model Description or HIP that identifies each input and its default value.
- Unit Cost: appears as a worksheet in the density zone expense module showing the cost of each Unbundled Network Element by entity, as well as the number of lines by density zone.
- Investment Input: appears as a worksheet in the expense modules summarizing the network investment by category. In the case of the wire center expense module, the results are broken out by individual wire center, whose CLLI code is listed in Column A. Columns B through H show the number of lines in each customer category. Numerous columns then follow to show, first, the investments calculated by other modules and input to the expense module, and, second, the resulting costs calculated by the expense module. Of key interest are columns HA through HT, which show the UNE unit cost results. These columns contain information equivalent to that

provided in the cost detail worksheet of the density zone expense module output.

Q. PLEASE DESCRIBE THE RESULTS PRESENTED IN EXHIBITS MTB-1 AND MTB-2.

A. Exhibit MTB-1 contains the unit cost worksheet of the density zone expense module output, showing loop-related UNEs by density zone on page 1, and other switching and interoffice transport UNEs on page 2. Exhibit MTB-2 contains the wire center expense module output, limited to Columns A-H (line counts by wire center) of the Investment Input worksheet and Columns U-AP (UNE costs by wire center) of the Unit Cost 2 worksheet.

At the beginning of this testimony, I summarized the results presented in Exhibits MTB-1 and MTB-2. The Expense Module produces many more worksheets than just the few shown in these paper exhibits, and a wealth of detail is available to the user.[12]

VI. DEAVERAGING LOOP COSTS PROPERLY

Q. WHAT IS DEAVERAGING AND WHY IS IT IMPORTANT?

A. Deaveraging is the pricing of unbundled network elements unique to their underlying cost characteristics in multiple geographic areas within a company's service territory. The purpose of deaveraging is to allow for the price of the unbundled loop to more closely reflect its underlying cost. This will send the appropriate signals to the market and facilitate efficient competition.

Q. HOW SHOULD PROPER COST-BASED ZONES BE DEFINED?

A. While there are a variety of different methodologies for defining zones for deaveraging, the most practical way to deaverage is to group wire centers with similar costs into cost-based zones.[13] Other deaveraging methods that have been proposed are: density zones, distance from the wire center (known as a doughnut approach),[14] central office size, and communities of interest.[15] However, these other methods present implementation concerns, and they do not depict costs in the most accurate way.

When establishing zones, it is important to keep in mind that the purpose of deaveraging is to facilitate efficient competition by allowing the prices of UNEs to more closely represent their underlying cost. Thus, the decision on how to group customers into zones should be made based on cost differences between customers, rather than some proxy representing cost differences, such as density, doughnuts, or switch size.

Another important issue is the ease of identifying customers with zones. For example, suppose a CLEC wishes to make a bid to provide local service to a business operating throughout the State of Washington, such as a gas station or

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[12] The complete model output is included on the CB-ROM provided with this testimony.
[13] As competition develops, further deaveraging will inevitably be necessary. The state and type of competition will help the Commission determine future methods of deaveraging.
[14] The doughnut approach draws a circle around each wire center and creates two zones in each wire center, an "in-town" zone and an "out-of-town" zone.
[15] The communities of interest approach groups areas (clusters or wire centers) that are relatively near to each other into the same zone. Though the "communities of interest" approach typically creates urban, suburban and rural communities, it is technically not a cost-based approach.

restaurant chain. The CLEC should be easily able to determine in which zone the business is located. The CLEC should not have to rely on its competitor's operational support systems to perform a records lookup in order to determine the zone of this customer. The deaveraging methodology utilized should not impose unnecessary expenses on a CLEC in order to compete. Deaveraging on a wire center basis would alleviate this concern.

Q. WOULD YOU RECOMMEND THAT THE COMMISSION DEAVERAGE COSTS BELOW THE WIRE CENTER LEVEL?

A. No. The first, and most important step in the deaveraging process is the creation of cost-based zones. The current deaveraged loop zones are not precisely reflective of cost. Wire Center zones have the following advantages.

- Costs vary significantly between wire centers in Washington. Establishing wire center zones will capture significant cost variances.

- CLECs can easily identify potential customers within wire centers through the customer's NPA-NXX. This will allow the CLEC to easily consider business plans, identify UNE rates for customers, and make efficient entry decisions. If customers are assigned to zones below the wire center level of aggregation, a simple, low-cost method must exist for CLECs to determine in which zone customers belong. No simple, low-cost system exists today.

- Actual line counts for the Qwest territory by wire center are taken from Qwest's ICONN publicly available database available and can be used to calculate the cost of each wire center. Precise line counts at the sub-wire center level are not available.

- Some parts of the loop are shared between customers in different areas of the wire center, such as feeder cable. When deaveraging below the wire center it is important that loop elements shared between different areas in the wire center are appropriately allocated to each area. A misallocation (though correct calculation) of feeder cost would distort deaveraged prices in a doughnut zone approach and thus could have unintended consequences on competition. Since no part of the loop is shared between wire centers, the wire center is an ideal level at which to calculate loop costs for the purposes of creating cost-based zones.

- Since each loop is uniquely assigned to a wire center, the wire center is the most practical and simple method of identifying customers. Thus, utilizing zones based on cost differences between wire centers is the most appropriate method to begin the deaveraging process

Q. DOES THE COMMISSION NEED TO DEAVERAGE ELEMENTS OTHER THAN THE LOCAL LOOP?

A. No, at this time the Commission only need be concerned with properly deaveraging the unbundled loop. Though this Commission has deaveraged elements other than the unbundled loop it is not necessary to continue this practice at this time. The unbundled loop is the most significant cost a CLEC faces and has the greatest variance across wire centers. Thus, at this time it is not necessary to unbundled additional elements. However, if the Commission wishes to continue deaveraging elements other than the unbundled loop the HAI Model can be easily used for this purpose.

Q. DO YOU HAVE ANY CONCERNS WITH THE CURRENT DEAVERAGED LOOP ZONES USED IN WASHINGTON?

A. In its final order in Phase III of the original generic cost proceeding, the Commission established cost-based deaveraged loop zones, but these zones should be updated to reflect more current cost estimates. These more current estimates may cause some change in the distribution of wire centers across cost zones relative to the currently-established zones in Washington.

Q. WHAT ARE THE MECHANICS BEHIND CALCULATING THE DEAVERAGED UNBUNDLED LOOP COST?

A. First, the Commission should determine the unbundled loop cost by wire center. I have used the HAI Model, Version 5.3.

Second, these data should be sorted by cost so that wire centers can be grouped according to similarities in cost into wire center cost-based zones.

Exhibit MTB-2 provides wire center loop cost estimates for Qwest and Verizon. This Exhibit also contains proposed deaveraged loop zones and costs.

Third, wire centers with similar costs should be grouped into zones. In order to group wire centers into cost-based zones, I present a three-zone and five-zone proposal. For comparison purposes, I have included cost results using the Commission's current deaveraged zones in the table below.

The results are summarized in Table 17 and Table 18:

Table 17: Summary of Zone Deaveraging Proposal for Qwest

		Loop Cost	Percent of Total Lines
AT&T/MCI - 3 Zones		**$ 6.70**	
46 Wire Centers	Zone 1	$ 5.14	74.5%
28 Wire Centers	Zone 2	$ 8.57	19.7%
37 Wire Centers	Zone 3	$20.36	5.8%
AT&T/MCI - 5 Zones		**$ 6.70**	
15 Wire Centers	Zone 1	$ 3.95	23.8%
16 Wire Centers	Zone 2	$ 5.32	24.1%
15 Wire Centers	Zone 3	$ 6.04	26.5%
28 Wire Centers	Zone 4	$ 8.57	19.7%
37 Wire Centers	Zone 5	$20.36	5.8%
Current Commission Zones		**$ 6.70**	
2 Wire Centers	Zone 1	$ 2.63	5.2%
13 Wire Centers	Zone 2	$ 4.79	18.5%
14 Wire Centers	Zone 3	$ 5.30	21.5%
8 Wire Centers	Zone 4	$ 5.85	13.7%
74 Wire Centers	Zone 5	$ 9.08	41.1%

Table 18: Summary of Zone Deaveraging Proposal for Verizon

		Loop Cost	Percent of Total Lines
AT&T/MCI - 3 Zones		**$ 8.67**	
46 Wire Centers	Zone 1	$ 5.72	63.5%
28 Wire Centers	Zone 2	$ 9.62	28.7%
37 Wire Centers	Zone 3	$ 29.54	7.7%
AT&T/MCI - 5 Zones		**$ 8.67**	
15 Wire Centers	Zone 1	$ 5.13	18.3%
16 Wire Centers	Zone 2	$ 5.56	21.1%
15 Wire Centers	Zone 3	$ 6.30	24.1%
28 Wire Centers	Zone 4	$ 9.62	28.7%
37 Wire Centers	Zone 5	$ 29.54	7.7%
Current Commission Zones		**$ 8.67**	
2 Wire Centers	Zone 1	$ 5.26	26.4%
13 Wire Centers	Zone 2	$ 5.90	25.3%
14 Wire Centers	Zone 3	$ 6.72	9.7%
8 Wire Centers	Zone 4	$ 8.44	19.1%
74 Wire Centers	Zone 5	$ 18.08	19.5%

Q. HOW WERE THE ZONES DETERMINED IN TABLES 17 AND 18?

A. The zones were determined by running a deaveraging optimization program. This program searches for the set of wire center assignments to zones that is the most reflective of cost.[16]

Q. WHAT IS THE PURPOSE OF THE DEAVERAGING OPTIMIZATION PROGRAM?

A. The purpose of the deaveraging optimization program is to find the appropriate assignment of wire centers to zones that creates deaveraged rates that most closely represent their underlying cost.

[16] The program as currently developed optimizes results for three zones. The five zone proposals were

In order to establish wire center UNE zones that reflect their underlying cost, wire centers with similar costs should be grouped together. The question that remains in this process is the level at which to distinguish between zones.

The attractiveness of looking for natural breaks, or targeting a certain percentage of customers in each zone, is that it allows an objective methodology to be applied to establish zones. Qwest has historically criticized the methodology of grouping similar cost wire centers together alleging that the demarcation point between zones is poorly defined. Qwest raises concerns that a CLEC doing business in an exchange near the border between two zones may try to manipulate the break point in order to advantage its short-term business plans.

In response to this Qwest criticism, and to establish wire center zones that are *most* reflective of cost, AT&T developed a deaveraging program that searches for the set of wire center zone assignments that minimizes the total deviation of costs within zones. The program is included on the CD ROM, Exhibit MTB-4. Since the program minimizes the overall deviation of costs within each zone, the program produces the set of wire center zones that are *most* reflective of their underlying cost.

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developed by taking the first zone of the three-zone approach and splitting it into three equal parts.

Q. HOW DOES THE DEAVERAGING OPTIMIZATION PROGRAM WORK?

A. The following simple example illustrates how the program determines zones. Suppose we want to create two zones from three wire centers. For simplification, assume each wire center has the same number of lines. Those wire centers have the following costs:

wire center A -- $15

wire center B -- $25

wire center C -- $45

There are three possibilities for putting these three wire centers into two zones:

Table 19: Sample Deaveraging Wire Center Combinations

	Zone 1	**Zone 2**
Option 1	A and B	C
Option 2	A and C	B
Option 3	B and C	A

Table 20 demonstrates the calculations for these three options:

Table 20: Demonstration of Deaveraging Optimization Methodology

		Option 1			**Option 2**			**Option 3**		
WC	**Cost**	**Zone**	**Avg Cost**	**Deviation / Mean**	**Zone**	**Avg Cost**	**Deviation**	**Zone**	**Avg Cost**	**Deviation**
A	$15	1	$20	5 / 15	1	$30	15 / 15	2	$15	0
B	$25	1	$20	5 / 25	2	$20	0	1	$35	10 / 25
C	$45	2	$45	0	1	$30	15 / 45	1	$35	10 / 45
Average Deviation				**0.18**			**0.44**			**0.21**

Avg Cost – the average of the wire center costs assigned to the zone

Deviation / Mean – the positive difference between the wire center cost and average cost divided by the mean of that wire center

The option that produces the lowest average deviation is the set of zone definitions that is most reflective of cost, given the number of zones.[17] Thus, Option 1 should be selected as most optimal.

Q. HAVE ANY OTHER STATES USED THE DEAVERAGING OPTIMIZER TO CREATE THEIR DEAVERAGED ZONES?

Yes, several. For example, the deaveraging optimizer has been widely used since it was first filed in Iowa.[18] Iowa was the first state to use the program to create its deaveraged zones. Commissions in Arizona and Colorado are also using the program. In addition, in the recent wholesale pricing cases heard in late 2001 and decided this year in Arizona and Colorado, Qwest did not oppose the use of the deaveraging optimization program, and in both cases Qwest filed deaveraging proposals based on the program.

VII. CONCLUSION

Q. WHAT ARE YOUR RECOMMENDATIONS TO THE COMMISSION?

A. I recommend that the Commission adopt the HAI Model, version 5.3, for the purpose of costing the unbundled network elements necessary for the provision of the UNE-platform.

[17] The given number of zones is important, since the deaveraging proposal most reflective of cost would be

The HAI Model is a precise, flexible tool that estimates the forward-looking cost for Qwest and Verizon to serve their customers in Washington. The model relies on the location of actual customers in Washington, as well as the location of Qwest and Verizon switches. This, along with Washington specific line counts and geographic information, allows the model to accurately estimate the cost to serve these customers.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

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to place each area with a distinct cost into a distinct zone.

[18] The program has been filed in Iowa, Nebraska, Arizona, Colorado and Minnesota.