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PUBLIC NOTICE

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

News media information 202 / 418-0500
Fax-On-Demand 202 / 418-2830
Internet: http://www.fcc.gov
ftp.fcc.gov

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COMMON CARRIER BUREAU SEEKS COMMENT ON MODEL PLATFORM DEVELOPMENT

CC Docket Nos. 96-45, 97-160

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

In the *Universal Service Order*, the Commission stated that it would select a federal mechanism to calculate the forward-looking economic cost of non-rural carriers serving rural, insular, and high cost areas.[1] The Commission determined that it would select the "platform" (fixed assumptions and algorithms) of the mechanism in one stage, and that it would select other parts of the mechanism, including all input values, in a second stage.[2] Three models have been submitted to the Commission for consideration as the platform for the federal mechanism: the Benchmark Cost Proxy Model (BCPM), the HAI Model (HAI), and the Hybrid Cost Proxy Model (HCPM).[3] These models have been subject to extensive review by Commission staff and outside parties, and thousands of pages of comments have been filed regarding their relative merits and problems. Recent *ex parte* meetings between Commission staff and the model sponsors suggest that certain areas of agreement now exist on the optimal approach to designing a platform for the federal mechanism. In an effort to move towards a

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[1] Federal State Joint Board on Universal Service, CC Docket No. 96-45, *Report & Order*, 12 FCC Rcd 8776, 8899 paras. 224-25 (1997) (*Universal Service Order*), as corrected by Federal State Joint Board on Universal Service, CC Docket 96-45, *Errata*, FCC 97-157 (rel. June 4, 1997), *appeal pending, Texas Office of Public Utility Counsel v. FCC*, No. 97-60421 (5th Cir. filed June 25, 1997).

[2] *Id.*

[3] Multiple versions of the models have been filed throughout the model development process. Those most recently filed with the Commission are: BCPM 3.0, dated December 11, 1997 by BellSouth, U S WEST, and Sprint (BCPM Dec. 11 submission); HAI 5.0a, dated February 3, 1998 by AT&T and MCI (HAI Feb. 3 submission); and HCPM 2.5, released on February 6, 1998 by C.A. Bush, M. Kennet, J. Prisbrey, and W.W. Sharkey, staff members of the Commission (HCPM Feb. 6 submission). As discussed herein, concurrently with this *Public Notice*, Commission staff is making available on the Commission's World Wide Web site certain interfaces and additional algorithms for HCPM. HCPM was developed by individual Commission staff members and does not represent the views of the Commission or any Commissioner on the issues in this proceeding.

result that combines the best ideas of all parties considering these complex issues, this *Public Notice* seeks comment on approaches to a model platform that combine specific aspects from the customer location and outside plant modules of the models under consideration.

In a *Further Notice of Proposed Rulemaking (Further Notice)*, the Commission raised the possibility that the platform for the federal mechanism may represent a synthesis of approaches from different sources.[4] Such a synthesis would capitalize on the strengths of the algorithms and approaches of the models under consideration. As the Commission stated in the *Further Notice*, the goal of this model development process is to determine the platform design components and input values that will most accurately estimate carriers' forward-looking economic costs.[5] With this goal in mind, we note that a synthesis of the approaches taken in the models under consideration may result in a model platform with significant advantages over each of the individual models.

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

Customer Location Data. HAI uses data provided by PNR Associates to identify customer locations by latitude and longitude (actual geocode data) and creates surrogate geocodes for those customer locations that cannot be identified (surrogate geocode data). HAI then uses an algorithm, also provided by PNR, to identify clusters of customers. BCPM and HCPM, on the other hand, identify customer locations using publicly available data about the number of customers in each Census Block. BCPM combines the Census block data about customer location with road network data, and places customers in microgrids based on the assumption that people are more likely to be located along roads. In the *Further Notice*, the

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[4] *Federal-State Joint Board on Universal Service, Forward-Looking Mechanism for High Cost Support for Non-Rural LECs*, Further Notice of Proposed Rulemaking, CC Docket Nos. 96-45, 97-160, 12 FCC Rcd 18514 (1997).

[5] *Id.* at 18531, para. 34.

Commission requested comment on the availability, feasibility, and reliability of using geocode data to determine the distribution of customers in the federal mechanism.[6] Many commenters from across the spectrum of the industry agree that geocode data that identify the actual geographic locations of customers are preferable to algorithms intended to estimate customer locations based on information such as census block data.[7] Although comments on this issue have already been received, this *Public Notice* provides a final opportunity for parties to comment on how a model platform may use the most accurate customer location data available, which in some cases may be geocode data, in the most effective manner. We also seek comment on how the expenses for obtaining geocode data for high cost universal service mechanisms should be recovered.

As many commenters have noted, actual geocode data appear to be incomplete, particularly in low-density areas.[8] A model, therefore, will have to make assumptions about where non-geocoded customers are likely to be located. Currently, the BCPM developers create surrogate geocodes on the assumption that those customers in a census block that cannot be geocoded are distributed along both the internal and peripheral roads in the Census block.[9] HAI believes that a more accurate assumption would place surrogate geocodes along the boundary of that Census block. Another option would be to distribute surrogate geocodes randomly throughout an entire Census block, rather than just along its boundaries or roads.[10] Although comments on this issue have already been received, this *Public Notice* provides a final opportunity for parties to comment on the algorithm or combination of algorithms that would locate most accurately those customers without actual geocodes, and on the empirical

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[6] *Further Notice*, 12 FCC Rcd at 18535-36, 18580-81, paras. 44, 176.

[7] *See* Aliant Sep. 2 comments at 2; Ameritech Sept. 2 comments at 6; AT&T Sept. 2 comments at 7-8; RUS Sept. 2 comments at 2; AT&T Sept. 10 reply comments at 12-13.

[8] *See* GTE Sept. 2 comments at 11-12; Bell Atlantic Sept. 10 reply comments at 3-4; GTE Sept. 10 reply comments at 4-5; SBC Sept. 10 reply comments at 6-7. HAI puts residential and business address databases through geocoding software to identify latitude and longitude coordinates for each customer location. Some customers are not geocoded because their addresses are not contained in the databases. or because those addresses in the databases do not reflect the physical locations of the customers with specificity. *See* HAI Feb. 3 submission, Model Documentation at 29-30; BCPM Dec. 22 submission, Geocoding and Hatfield 5.0 at 1.

[9] BCPM proposes to distribute customers uniformly along all roads in a national database from the U.S. Census Bureau (Topologically Integrated Geographic Encoding and Referencing/Line files). *See* Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated Jan. 28, 1998; BCPM Dec. 11 submission, Model Methodology at 26. The HAI proponents have also described a possible surrogating algorithm that can distribute customers along roads in varying densities. Letter from Michael Lieberman, AT&T, to Magalie Roman Salas, FCC, dated Mar. 2, 1998.

[10] As discussed below, we are releasing sample geocode data that were developed by randomly generating geocode points throughout census blocks. By this, we do not mean to endorse this approach as a surrogate method. The sample data are intended to facilitate the testing and analysis of the algorithms discussed in this *Public Notice*.

basis for such comments. If commenters propose a different approach than one of those described above, we seek detailed comments on how such an approach should be implemented.

Grouping Customers. After determining where customers are located using actual or surrogate geocodes, a model platform must group customers into serving areas to design feeder and distribution plant efficiently to those customers. In this *Public Notice*, we consider a model platform that groups customers using a clustering approach because it appears to have advantages over gridding approaches. HAI has placed the computer code for its clustering algorithm on the record in this proceeding.[11] We are also releasing a clustering algorithm and a set of cluster outputs generated from sample, surrogate geocode data.[12] These clusters were generated using a clustering algorithm, developed by Commission staff, that differs somewhat from the clustering algorithm used in HAI. We seek comment on the relative merits of HAI's clustering algorithm and the Commission staff's clustering algorithm described in the "Test Data" section, below. We also intend that parties will use these cluster outputs to test the various algorithms for designing distribution and feeder plant that are discussed herein.

Designing Distribution and Feeder Plant. After identifying groups of customers, a model must design distribution plant from the digital loop carrier (DLC) or serving area interface (SAI)[13] to the customers, and feeder plant from the central office to the DLC or SAI. In order to design distribution plant, both BCPM and HAI create square or rectangular distribution areas and assume that the customers in each group are uniformly spread throughout the distribution areas.[14] While these approaches create a predictable pattern of

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[11] Only the sizes and locations of HAI's serving areas and the number of customers associated with each serving area are released publicly. *See* HAI Feb. 3 submission, Model Description at 24-27.

[12] The data have been clustered according to an algorithm that differs somewhat from that used by HAI. The HAI clustering algorithm is a "nearest neighbor" algorithm that forms clusters by joining customer locations to the nearest adjacent locations. HAI Feb. 3 documentation, Model Description at 31-33. The test data are grouped according to a "divisive" clustering algorithm in which new clusters are successively split from a main cluster that initially contains all customer locations. Under this approach, new clusters are determined on the basis of the relative distance of customers from the line-weighted centroid of the new and old clusters. A line-weighted centroid takes into account both the locations and concentrations of lines.

[13] The SAI is the interface point between the distribution and feeder cable. Feeder cables terminate on one or more SAIs in each serving area, where they are cross-connected to copper distribution cables.

[14] Regardless of the source of customer location data, both BCPM and HAI use simplified algorithms that redistribute customer locations before laying distribution cable. HAI creates a rectangular distribution area that has the same area and aspect ratio of the cluster. The rectangle is centered over the cluster, and the rectangle is divided into evenly-sized lots based on the number of customers located in the cluster. HAI then designs distribution plant to each lot in the rectangle. HAI Feb. 3 submission, Model Description at 42-43. BCPM identifies serving area grids according to certain population and technological constraints. After dividing a serving area grid into quarters, BCPM creates a square distribution area within each quadrant based on the number of road miles in the quadrant. Like HAI, BCPM then divides the square into evenly-sized lots based on the number of customers located in the quadrant, and designs distribution plant to the lots. BCPM Dec. 11

customer lots to which the models may design distribution plant, both also appear to distort the actual locations of customers when such locations can be identified with specificity.[15] HCPM appears to be capable of designing plant with less distortion to customer locations. By reducing the size of its microgrids, HCPM can associate those latitude and longitude coordinates of each customer with a small microgrid (the version that is currently available uses grids 360 feet on each side). With customers grouped by a clustering algorithm, HCPM can build loop plant directly to individual microgrids in which customers are located.[16] Thus, HCPM could build plant directly to every customer with an error of no more than a few hundred feet from the actual or surrogate geocode specified for any individual customer.[17] We seek comment on a model that synthesizes this approach with the use of geocode data and a clustering algorithm. We also seek comment on the appropriate microgrid size to utilize in building distribution plant to latitude and longitude coordinates, and on the methods used by HCPM to subdivide microgrids into lots.

The feeder modules of both HAI and BCPM use a modified "pine tree" algorithm that deploys main feeder routes in each of four quadrants surrounding the central office switch, with subfeeder routes connecting each serving area interface to the closest main feeder.[18] In effect, HAI and BCPM build an individual subfeeder route to nearly every serving area (or cluster). The feeder module of HCPM allows for more sharing among subfeeder routes by using a modified "spanning tree" algorithm. The spanning tree algorithm finds the minimum

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submission, Model Methodology at 25-32, 41-45.

[15] For example, Sprint claims that HAI understates the true cost of serving customers due to the manner in which it converts the areas in which geocoded customers are located into rectangular serving areas. *See* Letters from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated April 17, 1997 and April 24, 1997. Commission staff compared the level of dispersion before and after the application of an HAI-like algorithm to randomly generated customer locations. The results indicate a possible bias in HAI's algorithm that may lead to reduced customer dispersion, especially in clusters with a small number of customer locations. *See* United States Government Memorandum, from Jeffrey Prisbrey, FCC, to Magalie Roman Salas, FCC, dated May 13, 1998 (May 13 Memo). In response to the claims of Sprint and the Commission staff's analysis, the HAI proponents have used their own actual raw cluster data to perform further analyses. These additional tests appear to suggest that HAI's algorithm may underestimate customer dispersion, particularly in clusters with few customers, and may also overestimate customer dispersion. *See* Letter from Chris Frentrup, MCI, to Magalie Roman Salas, FCC, dated April 23, 1998; Letters from Richard Clarke, AT&T, to Magalie Roman Salas, FCC, dated May 5, 1998 and June 8, 1998; HAI June 22 *ex parte*.

[16] C.A. Bush et al., *Computer Modeling of the Forward-Looking Economic Cost of Local Exchange Telecommunications Networks: An Optimatization Approach* (June 1, 1998) (HCPM June 1 Report) at 9.

[17] HCPM June 1 Report at 3 n.4.

[18] HAI Feb. 3 submission, Model Documentation at 50; BCPM Dec. 11 submission, Model Methodology at 35-37.

distance necessary to connect a set of remote locations to a central point.[19] As applied to feeder plant, this algorithm connects SAIs to the switch.[20] HCPM has modified the spanning tree algorithm to consider explicitly the amount of traffic that must be carried and factors such as the costs of cable and structures. We seek comment on these different approaches to designing feeder plant, including on the feeder algorithm that should be used if the Commission also adopts a model platform that includes HCPM's distribution algorithm.

Test Data. As noted above, to enable parties to evaluate fully the synthesis discussed herein, particularly the HCPM distribution and feeder algorithm, the Bureau has made available on the Commission's World Wide Web site a set of sample geocode data and customer clusters, and the clustering algorithm used to generate those clusters. In addition, an interface that converts the output of the HCPM clustering algorithm to an appropriate input for the HCPM distribution and feeder algorithms has been placed on the public record. These latter algorithms overlay a grid on top of each cluster, and then assign each customer location in the cluster to a microgrid cell within the grid for the purpose of building distribution plant. A similar interface could be used for HAI's cluster data point outputs, or any other set of clustering outputs.[21] The sample geocode data represent points randomly distributed within the census blocks of several wire centers. Groups of the sample geocode data have been identified according to a clustering algorithm developed by Commission staff. By making a set of sample geocode points publicly available and grouping them into clusters, we hope to facilitate evaluation and analysis of this particular synthesis. We note that these data could also be used to evaluate other potential approaches.

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

Procedure for Filing:

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

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[19] In addition, HCPM considers additional routes that allow sharing of feeder plant by using junction nodes. HCPM also uses this algorithm to design distribution plant. *See* HCPM June 1 Report at 12, 17-19.

[20] In the distribution network, this approach connects customer locations to the SAI. HCPM June 1 Report at 12-14.

[21] The interface and test data are available via the World Wide Web at http://www.fcc.gov/Bureaus/Common_Carrier/Other/hcpm.

comments to the Commission's copy contractor, International Transcription Service, 1231 20th Street, N.W., Washington, D.C. 20036.

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

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

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

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

- Action by the Acting Chief, Common Carrier Bureau -