Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Federal-State Joint Board on Universal Service	)	CC Docket No. 96-45
	)	
	)	
Forward-Looking Mechanism for High Cost Support for Non-Rural LECs	)	CC Docket No. 97-160

FURTHER NOTICE OF PROPOSED RULEMAKING

Adopted: May 27, 1999 **Released: May 28, 1999**

By the Commission: Commissioner Furchtgott-Roth dissenting and issuing a statement at a later date.

Comment Date: July 2, 1999
Reply Date: July 16, 1999

TABLE OF CONTENTS

I. INTRODUCTION

1. In the Telecommunications Act of 1996 (1996 Act),[1] Congress directed this Commission and the states to take the steps necessary to establish support mechanisms to ensure the delivery of affordable telecommunications service to all Americans. In response to this directive, the Commission has taken action to put in place a universal service support system that will be sustainable in an increasingly competitive marketplace. In the *Universal Service Order*, the Commission adopted a plan for universal service support for rural, insular, and high cost areas to replace longstanding federal subsidies to incumbent local telephone companies with explicit, competitively neutral federal universal service support mechanisms.[2] The Commission adopted

[1] Pub. L. No. 104-104, 110 Stat. 56. The 1996 Act amended the Communications Act of 1934, 47 U.S.C. §§ 151 *et. seq.* (Act). Hereinafter, all citations to the Act will be to the relevant section of the United States Code unless otherwise noted.

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

the recommendation of the Federal-State Joint Board on Universal Service (Joint Board) that an eligible carrier's level of universal service support should be based upon the forward-looking economic cost of constructing and operating the network facilities and functions used to provide the services supported by the federal universal service support mechanisms.[3]

2. Our plan to adopt a mechanism to estimate forward-looking cost has proceeded in two stages. On October 28, 1998, with the release of the *Platform Order*, the Commission completed the first stage of this proceeding: the selection of the model platform. The platform encompasses the aspects of the model that are essentially fixed, primarily the assumptions about the design of the network and network engineering.[4] In this Further Notice, we move toward completion of the second stage of this proceeding, by proposing input values for the model, such as the cost of cables, switches, and other network components, in addition to various capital cost parameters. For the most important inputs, we provide a description of the methodology we have used to arrive at the proposed values.[5] In addition, we seek to supplement the record regarding certain inputs to the model.

3. The forward-looking cost of providing supported services estimated by the model will be used to determine high cost support for non-rural carriers beginning January 1, 2000.[6] The Commission is adopting a companion Order and Further Notice that establishes the framework for determining federal high cost support levels and seeks comment on the details of that mechanism.[7]

II. PROCEDURAL HISTORY

A. *Universal Service Order*

[3] *Universal Service Order*, 12 FCC Rcd at 8888, para. 199. The Commission also determined that high cost support for rural carriers should continue essentially unchanged and should not be based on forward-looking costs until 2001, at the earliest. *Universal Service Order*, 12 FCC Rcd at 8889, para. 203. The Commission adopted the Joint Board's recommendation to define "rural carriers" as those carriers that meet the statutory definition of a "rural telephone company." *Universal Service Order*, 12 FCC Rcd at 8943, para. 310 (*citing* 47 U.S.C. § 153(37)).

[4] *Federal-State Joint Board on Universal Service*, Fifth Report and Order, CC Docket Nos. 96-45, 97-160, 13 FCC Rcd 21323 (1998) (*Platform Order*).

[5] Appendix A contains a complete list of the input values that we propose in this Further Notice.

[6] *Federal-State Joint Board on Universal Service, Access Charge Reform*, Seventh Report and Order and Thirteenth Order on Reconsideration in CC Docket No. 96-45; Fourth Report and Order in CC Docket No. 96-262; and Further Notice of Proposed Rulemaking, CC Docket Nos. 96-45, 96-262, FCC 99-119 (rel. May 28, 1999) (*Companion Order*).

[7] *Id*.

4. Prior to the 1996 Act, three explicit universal service programs were in place to provide assistance to small incumbent local exchange carriers (LECs) and LECs that served rural and high cost areas: high cost loop support,[8] dial equipment minutes (DEM) weighting, and the Long-Term Support (LTS) program.[9] Other mechanisms also have historically contributed to maintaining affordable rates in rural areas, including subsidies implicit in geographic toll rate averaging, intrastate rates, and interstate access charges. In the 1996 Act, Congress codified the Commission's long-standing commitment to ensuring universal service and directed that "[c]onsumers . . . in rural, insular, and high cost areas should have access to telecommunications and information services . . . that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to [those] in urban areas."[10] The 1996 Act also directed the Commission to reform universal service support mechanisms to ensure that they are compatible with the pro-competitive goals of the 1996 Act. Section 254 required the Commission to institute a Joint Board on universal service and implement the recommendations from the Joint Board by May 8, 1997.[11] After receiving the recommendations of the Joint Board on November 7, 1996,[12] the Commission adopted the *Universal Service Order* on May 7, 1997.

5. In the *Universal Service Order*, the Commission adopted a forward-looking economic cost methodology to calculate support for non-rural carriers. Under this methodology, a forward-looking economic cost mechanism selected by the Commission, in consultation with the Joint Board, would be used to calculate non-rural carriers' forward-looking economic cost of providing the supported services in high cost areas.[13]

---

[8] Although the existing high cost loop fund has historically been known as the "Universal Service Fund," we will avoid this terminology because of the confusion it may create with the new universal service support mechanisms that the Commission has created pursuant to section 254 of the Communications Act.

[9] The Commission's rules governing these programs are set forth at 47 C.F.R. §§ 36.601 *et. seq.* (high cost loop fund); 47 C.F.R. § 36.125(b) (DEM weighting); and 47 C.F.R. §§ 69.105, 69.502, 69.603(e), 69.612 (LTS).

[10] 47 U.S.C. § 254(b)(3).

[11] 47 U.S.C. § 254(a).

[12] *Federal-State Joint Board on Universal Service*, Recommended Decision, CC Docket No. 96-45, 12 FCC Rcd 87 (1996) (*First Recommended Decision*).

[13] *Universal Service Order*, 12 FCC Rcd at 8890, para. 206. In the *Universal Service Order*, the Commission concluded that the federal universal service support mechanism would support 25 percent of the difference between the forward-looking economic cost of providing the supported service and a nationwide revenue benchmark. *See Universal Service Order*, 12 FCC Rcd at 8888, para. 201. In response to issues raised by commenters and state Joint Board members, the Commission referred back to the Joint Board questions related to how federal support should be determined. *See Federal-State Joint Board on Universal Service*, Order and Order on Reconsideration,

B. *Further Notice* and the Input Value Development Process

6. In a July 18, 1997 *Further Notice of Proposed Rulemaking*, the Commission established a multi-phase plan to develop a federal mechanism that would send the correct signals for entry, investment, and innovation.[14] The *1997 Further Notice* divided questions related to the cost models into "platform design" issues and "input value" issues.[15] The *1997 Further Notice* subdivided each of the platform and input issues into four topic groups, and sought comment on each group separately in order to develop a focused dialogue among interested parties. The four groups were: (1) customer location; (2) outside plant design; (3) switching and interoffice; and (4) general support facilities (GSF) and expense issues.[16]

7. After reviewing the comments received in response to the *1997 Further Notice*, the Common Carrier Bureau (Bureau) released two public notices to guide parties wishing to submit cost models for consideration as the federal mechanism.[17]

8. In addition to the 1997 *Further Notice*, the Bureau has solicited comment and allowed interested parties the opportunity to participate in the development of the input values to be used in the forward-looking mechanism. On May 4, 1998, the Bureau released a *Public Notice* to update the record on several input-related issues.[18] The Bureau also issued data requests

---

CC Docket No. 96-45, 13 FCC Rcd 13749 (1998) (*Referral Order*). *See also Federal-State Joint Board on Universal Service*, Second Recommended Decision, CC Docket No. 96-45, 13 FCC Rcd 24744 (1998) (*Second Recommended Decision*).

[14] *Federal-State Joint Board on Universal Service, Forward-Looking Mechanism for High Cost Support for Non-Rural LECs*, CC Docket Nos. 96-45, 97-160, Further Notice of Proposed Rulemaking, 12 FCC Rcd 18514 at 18519, para. 5 (1997) (*1997 Further Notice*).

[15] Generally, there is a platform component for each portion of the exchange network being modeled. Examples of platform design issues are the establishment of switch capacity limitations and the routing of feeder and distribution cables. Examples of input values are the price of various network components, their associated installation and placement costs, and capital cost parameters such as debt-equity ratios. *See 1997 Further Notice*, 12 FCC Rcd at 18516-18, paras. 17-18.

[16] *See generally 1997 Further Notice*.

[17] *Guidance to Proponents of Cost Models in Universal Service Proceeding: Switching, Interoffice Trunking, Signaling, and Local Tandem Investment*, Public Notice, CC Docket Nos. 96-45, 97-160, DA 97-1912 (rel. Sep. 3, 1997) (*Switching and Transport Public Notice*); *Guidance to Proponents of Cost Models in Universal Service Proceeding: Customer Location and Outside Plant*, Public Notice, CC Docket Nos. 96-45, 97-160, DA 97-2372 (rel. Nov. 13, 1997) (*Customer Location & Outside Plant Public Notice*).

[18] *Common Carrier Bureau Requests Further Comment On Selected Issues Regarding The Forward-Looking Economic Cost Mechanism For Universal Service*, Public Notice, CC Docket Nos. 96-45, 97-160, DA 98-848 (rel.

designed to acquire information that may be useful in determining the final input values,[19] and conducted a series of public workshops designed to elicit further comment from interested parties in selecting final input values.[20] Finally, the Bureau conducted numerous *ex parte* meetings with interested parties throughout this proceeding.[21]

C. *Platform Order* and *Second Recommended Decision*

9. In the *Platform Order* released on October 28, 1998, the Commission adopted the forward-looking cost model to be used in determining federal universal service high cost support for non-rural carriers.[22] The model platform that the Commission adopted combined elements from each of the three models under consideration in this proceeding: (1) the BCPM, Version 3.0 (BCPM);[23] (2) the HAI Model, Version 5.0a (HAI);[24] and (3) the Hybrid Cost Proxy Model, Version 2.5 (HCPM).[25] In the *Platform Order*, the Commission also specified several issues that would be addressed in the inputs stage of this proceeding. These issues include: (1) the geocode

May 4, 1998) (*Inputs Public Notice*).

[19] *Federal-State Joint Board on Universal Service*, Order, CC Docket No. 96-45, 12 FCC Rcd 9803 (1997) (*1997 Data Request*).

[20] *Common Carrier To Hold Three Workshops On Input Values To Be Used To Estimate Forward-Looking Economic Costs For Purposes Of Universal Service Support*, Public Notice, CC Docket Nos. 96-45, 97-160, DA 98-2406 (rel. Nov. 25, 1998) (*Workshop Public Notice*).

[21] *See, e.g.*, Letter from W. Scott Randolph, GTE, to Magalie Roman Salas, FCC, dated March 2, 1999; Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated, February 26, 1999; Letter from Chris Frentrup, MCI, to Magalie Roman Salas, FCC, dated February 9, 1999.

[22] *Platform Order*, 13 FCC Rcd at 21325, para. 4.

[23] Submission in CC Docket Nos. 96-45 and 97-160 by BellSouth Corporation, BellSouth Telecommunications, Inc., U S WEST, Inc., and Sprint Local Telephone Company (BCPM proponents), dated Dec. 11, 1997 (BCPM Dec. 11, 1997 submission).

[24] Letter from Richard N. Clarke, AT&T, to Magalie Roman Salas, FCC, dated Dec. 11, 1997 (HAI Dec. 11, 1997 submission). HAI was submitted by AT&T and MCI (HAI proponents). Versions of HAI filed before February 3, 1998, were known as the Hatfield Model. The proponents refer to the February 3, 1998 submission as HAI. We refer to this model as HAI throughout this Report and Order.

[25] HCPM was developed by Commission staff members William Sharkey, Mark Kennet, C. Anthony Bush, Jeff Prisbrey, and Commission contractor Vaikunth Gupta of Panum Communications. *Common Carrier Bureau Announces Release of HCPM Version 2.0*, Public Notice, DA 97-2712 (rel. Dec. 29, 1997). United States Government Memo from W. Sharkey, FCC, to Magalie Roman Salas, FCC, dated Feb. 6, 1998.

data source to determine customer locations;[26] (2) the road surrogate method to determine the location of non-geocoded customer locations;[27] and (3) the use of the local exchange routing guide (LERG) to identify the existing host-remote switch relationships.[28]

10. On November 25, 1998, the Joint Board released the *Second Recommended Decision*, in which it recommended that the Commission compute federal high cost support for non-rural carriers through a two-step process.[29] First, the Joint Board recommended that the Commission should estimate the total support amount necessary in those areas considered to have high costs relative to other areas. Second, the Commission should consider, in a consistent manner across all states, any particular state's ability to support high cost areas within the state.[30] The Joint Board recommended that federal support should be provided to the extent that the state would be unable to support its high cost areas through its own reasonable efforts.[31] In addition, the Joint Board recommended that the Commission continue to work with the Joint Board to select the input values to complete a forward-looking cost model and to finalize the methodology for distributing federal high cost support.[32]

III. ESTIMATING FORWARD-LOOKING ECONOMIC COST

A. Designing a Forward-Looking Wireline Local Telephone Network

11. To understand the assumptions made in the mechanism, it is necessary to understand the layout of the current wireline local telephone network.[33] In general, a telephone network must allow any customer to connect to any other customer. In order to accomplish this, a telephone network must connect customer premises to a switching facility, ensure that adequate

---

[26] *Platform Order*, 13 FCC Rcd at 21338, para. 34.

[27] *Platform Order*, 13 FCC Rcd at 21341, para. 41.

[28] *Platform Order*, 13 FCC Rcd at 21355, para. 76. The LERG is a database of switching information maintained by Bellcore that includes the existing host-remote relationships.

[29] *Second Recommended Decision*, 13 FCC Rcd at 24746, para. 5.

[30] *Second Recommended Decision*, 13 FCC Rcd at 24746, para. 5.

[31] *Second Recommended Decision*, 13 FCC Rcd at 24746-47, para. 5.

[32] *Second Recommended Decision*, 13 FCC Rcd at 24757, para. 28.

[33] We also note that technologies such as wireless services are likely to become more important over time in providing universal service. We will continue to review suggestions for incorporating such technologies into the forward-looking mechanism for future years. *See, e.g.*, Letter from David L. Sieradzki, on behalf of Western Wireless, to Magalie Roman Salas, FCC, dated January 26, 1999 (submitting the "Wireless Cost Model").

capacity exists in that switching facility to process all customers' calls that are expected to be made at peak periods, and then interconnect that switching facility with other switching facilities to route calls to their destinations. A *wire center* is the location of a switching facility. The wire center boundaries define the area in which all customers are connected to a given wire center. The *Universal Service Order* required the models to use existing incumbent LEC wire center locations in estimating forward-looking cost.[34]

12. Within the boundaries of each wire center, the wires and other equipment that connect the central office to the customers' premises are known as *outside plant*. Outside plant can consist of either copper cable or a combination of optical fiber and copper cable, as well as associated electronic equipment. Copper cable generally carries an analog signal that is compatible with most customers' telephone equipment, but thicker, more expensive cables or loading coils must be used to carry signals over greater distances. Optical fiber cable carries a digital signal that is incompatible with most customers' telephone equipment, but the quality of a signal carried on optical fiber cable is superior at greater distances when compared to a signal carried on copper wire. Generally, when a neighborhood is located too far from the wire center to be served with copper cables alone, an optical fiber cable will be deployed to a point within the neighborhood, where a piece of equipment will be placed that converts the digital light signal carried on optical fiber cable to an analog, electrical signal that is compatible with customers' telephones. This equipment is known as a digital loop carrier remote terminal, or DLC. From the DLC, copper cables of varying gauge extend to all of the customer premises in the neighborhood. Where the neighborhood is close enough to the *wire center* to serve entirely on copper cables, a copper trunk connects the wire center to a central point in the serving area, called the serving area interface (SAI), and copper cables will then connect the SAI to the customers in the serving area. The portion of the loop plant that connects the central office with the SAI or DLC is known as the *feeder plant*, and the portion that runs from the DLC or SAI throughout the neighborhood is known as the *distribution plant*.

13. The model's estimate of the cost of serving the customers located within a given wire center's boundaries includes the calculation of switch size, the lengths, gauge, and number of copper and fiber cables, and the number of DLCs required. These factors depend, in turn, on how many customers the wire center serves, where the customers are located within the wire center boundaries, and how they are distributed within neighborhoods. Particularly in rural areas, some customers may not be located in neighborhoods at all but, instead, may be scattered throughout outlying areas. In general, the model divides the area served by the wire center into smaller areas known as *serving areas*. For serving areas sufficiently close to the wire center, copper feeder

[34] The *Universal Service Order* established ten criteria to ensure consistency in calculations of federal universal service support. *Universal Service Order*, 12 FCC Rcd at 8913, para. 250. Criterion 1 requires that a model must include incumbent LECs' wire centers as the center of the loop network and the outside plant should terminate at incumbent LECs' current wire centers.

cable extends from the wire center to a SAI where it is cross-connected to copper distribution cables. If the feeder is fiber, it extends to a DLC terminal in the serving area, which converts optical digital signals to analog signals. Individual circuits from the DLC are cross-connected to copper distribution cables at the adjacent SAI.

14. The model assumes that wire centers are interconnected with one another using optical fiber networks known as Synchronous Optical Network (SONET) rings.[35] The infrastructure to interconnect the wire centers is known as the *interoffice* network, and the carriage of traffic among wire centers is known as *transport*. In cases where a number of wire centers with relatively few people within their boundaries are located in close proximity to one another, it may be more economical to use the processor capacity of a single switch to supervise the calls of the customers in the boundaries of all the wire centers. In that case, a full-capacity switch (known as a *host*) is placed in one of the wire centers and less expensive, more limited-capacity switches (known as *remotes*) are placed in the other wire centers. The remotes are then connected to the host with interoffice facilities. Switches that are located in wire centers with enough customers within their boundaries to merit their own full-capacity switches and that do not serve as hosts to any other wire centers are called *stand-alone* switches.

15. There are also a number of expenses and general support facilities (GSF) costs associated with the design of a forward-looking wireline telephone network.[36] GSF costs include the investment related to vehicles, land, buildings, and general purpose computers. Expenses include: plant specific expenses, such as maintenance of facilities and equipment expenses; plant non-specific expenses, such as engineering, network operations, and power expenses; customer service expenses, such as marketing, billing, and directory listing expenses; and corporate operations expenses, such as administration, human resources, legal, and accounting expenses.[37]

B. Synthesis Model

16. The "synthesis" model adopted in the *Platform Order* allows the user to estimate the cost of building a telephone network to serve subscribers in their actual geographic locations, to the extent these locations are known.[38] To the extent that the actual geographic locations of customers are not available, the Commission determined that the synthesis model should assume

[35] SONET is a set of standards for optical (fiber optic) transmission. It was developed to meet the need for transmission speeds above the T3 level (45 Mbps) and is generally considered the standard choice for transmission devices used with broadband networks. BCPM Dec. 11 submission, Model Methodology at 68.

[36] *See Platform Order*, 13 FCC Rcd at 21357-61, paras. 81-91.

[37] *Platform Order*, 13 FCC Rcd at 21357-58, para. 82.

[38] *Platform Order*, 13 FCC Rcd at 21337, para. 33. *See also* discussion of customer location data, *infra*.

that customers are located near roads.[39]

17. Once the customer locations have been determined, the model employs a clustering algorithm to group customers into serving areas in an efficient manner that takes into consideration relevant engineering guidelines.[40] After identifying efficient serving areas, the model designs outside plant to the customer locations.[41] In doing so, the model employs a number of cost minimization principles designed to determine the most cost-effective technology to be used under a variety of circumstances, such as varying terrain and density.[42]

18. The Commission concluded that the federal universal service mechanism should incorporate, with certain modifications, the HAI 5.0a switching and interoffice facilities module to estimate the cost of switching and interoffice transport.[43] The Commission noted that it would consider adopting the LERG at the inputs stage of this proceeding to determine the deployment of host and remote switches.[44] In addition, the Commission adopted the HAI platform module for calculating expenses and capital costs, such as depreciation.[45]

19. The Commission noted that technical improvements to the cost model will continue, both before implementation of the model for non-rural carriers and on an ongoing basis, as necessary.[46] The Commission therefore delegated to the Bureau the authority to make changes or direct that changes be made to the model platform as necessary and appropriate to ensure that the platform of the federal mechanism operates as described in the *Platform Order*.[47] As contemplated in the *Platform Order*, Commission staff and interested parties have continued to review the model platform to ensure that it operates as intended. As a result, some refinements

[39] *Platform Order*, 13 FCC Rcd at 21340-41, para. 40. *See also* discussion of road surrogating method, *infra*.

[40] *Platform Order*, 13 FCC Rcd at 21342, para. 44.

[41] *Platform Order*, 13 FCC Rcd at 21346, para. 55.

[42] *Platform Order*, 13 FCC Rcd at 21348, para. 61.

[43] *Platform Order*, 13 FCC Rcd at 21354-55, para. 75.

[44] *Platform Order*, 13 FCC Rcd at 21355, para. 76.

[45] *Platform Order*, 13 FCC Rcd at 21357, para. 81.

[46] *Platform Order*, 13 FCC Rcd at 21329, para. 13.

[47] *Platform Order*, 13 FCC Rcd at 21329, para. 13.

have been made to the model platform adopted in the *Platform Order*.[48]

C. Selecting Forward-Looking Input Values

20. In the *Universal Service Order*, the Commission adopted ten criteria to be used in determining the forward-looking economic cost of providing universal service in high cost areas.[49] These criteria provide specific guidance for our selection of input values for use in the synthesis model. Rather than reflecting existing incumbent LEC facilities, the technology assumed in the model "must be the least-cost, most-efficient, and reasonable technology for providing the supported services that is currently being deployed."[50] As noted below, existing LEC plant does not necessarily, or even likely, reflect forward-looking technology or design choices.[51] Similarly, the input values we tentatively select in this Notice are not intended to replicate any particular company's embedded or book costs. Criterion three directs that "costs must not be the embedded cost of the facilities, functions, or elements."[52] Rather, the model "must be based upon an examination of the current cost of purchasing facilities and equipment."[53]

21. As discussed in detail in sections V-VIII below, we generally have proposed using nationwide, rather than company-specific input values in the federal mechanism. In many cases, the only data for various inputs on the record in this proceeding are embedded cost, company-specific data. We have used various techniques to convert these data to forward-looking values. For example, we propose modifying the switching data to adjust for the effects of inflation and the cost changes unique to the purchase and installation of digital switches.[54] We propose nationwide averages, rather than company-specific values, to mitigate the rewards to less efficient companies.[55]

---

[48] *Common Carrier Bureau To Post On The Internet Modifications To The Forward-Looking Economic Cost Model For Universal Service Support*, Public Notice, CC Docket Nos. 96-45, 97-160, DA 98-2533 (rel. Dec. 15, 1998). All changes to the model platform have been posted on the Commission's Web site (http://www.fcc.gov/ccb/apd/hcpm).

[49] *Universal Service Order*, 12 FCC Rcd at 8913-16, para. 250.

[50] *Universal Service Order*, 12 FCC Rcd at 8913, para. 250 (criterion one).

[51] *See infra* at para. 50.

[52] *Universal Service Order*, 12 FCC Rcd at 8913, para. 250 (criterion three).

[53] *Universal Service Order*, 12 FCC Rcd at 8913, para. 250 (criterion three).

[54] *See infra* para. 166.

[55] *See, e.g., infra* paras. 198, 214.

22. Although the BCPM sponsors have provided nationwide default values, they and other LECs generally advocate company-specific input values. For purposes of determining federal universal service support amounts, we believe that nationwide default values generally are more appropriate than company-specific values. Under the new mechanism, support is based on the estimated costs that an efficient carrier would incur to provide the supported services, rather than on the specific carrier's book costs. There may be some categories of inputs, however, where company-specific or state specific input values might be appropriate for use in the federal mechanism. We seek comment on specific alternatives to nationwide values for certain input values, as discussed below.[56] We make no finding with respect to whether nationwide values would be appropriate for purposes other than determining federal universal service support.[57]

IV. DETERMINING CUSTOMER LOCATIONS

A. Background

23. The determination of customer locations relative to the wire center heavily influences a forward-looking cost model's design of outside plant facilities. This is because assumptions about the locations of customers will determine the predicted loop length, which in turn will have a large impact on the cost of service.[58] Each of the models under consideration in the *Platform Order* provided a methodology for determining customer locations.[59] The Bureau sought comment on these proposals and solicited alternative proposals for locating customers from interested parties.[60]

24. In the *Platform Order*, the Commission concluded that HAI's proposal to use actual geocode data, to the extent that they are available, and BCPM's proposal to use road network information to create "surrogate" customer locations where actual data are not available,

[56] *See infra* paras. 122, 199-200.

[57] State commissions, for example, may find that it is not appropriate to use nationwide values in determining state universal service support or prices for unbundled network elements and may choose instead to use statewide or company specific values.

[58] *See 1997 Further Notice*, 12 FCC Rcd at 18535, para. 44.

[59] *Platform Order*, 13 FCC Rcd at 21337, para. 31.

[60] *See, e.g.*, *1997 Further Notice*, 12 FCC Rcd at 18535, para. 44; *Inputs Public Notice* at 3-4; *Common Carrier Bureau Seeks Comment On Model Platform Development*, Public Notice, CC Docket Nos. 96-45, 97-160, DA 98-1587 (rel. Aug. 7, 1998) (*Platform Public Notice*) at 2-4.

provided the most reasonable method for determining customer locations.[61] The Commission concluded that "the source or sources of geocode data to use in determining customer location will be decided at the inputs phase of this proceeding."[62] The Commission also concluded that "the selection of a precise algorithm for placing road surrogates pursuant to these conclusions should be conducted in the inputs stage of this proceeding as part of the process of selecting a geocode data set for the federal mechanism."[63]

B. Issues for Comment

1. Geocode Data

25. While we affirm our conclusion in the *Platform Order* that geocode data should be used to locate customers in the federal mechanism, we tentatively conclude that at this time we cannot adopt any particular source of geocode data because interested parties have not had adequate access or time to review such data. We tentatively conclude below that a road surrogate algorithm will be used to locate customers in the federal mechanism until a source of geocode data is selected by the Commission. We reiterate our expectation, however, that we will identify and select a source of accurate and verifiable geocode data in the future for use in the federal mechanism.

26. In the *Platform Order*, we concluded that a model is most likely to select the least-cost, most-efficient outside plant design if it uses the most accurate data for locating customers within wire centers, and that the most accurate data for locating customers within wire centers are precise latitude and longitude coordinates for those customers' locations.[64] We noted that commenters generally support the use of accurate geocode data in the federal mechanism where available.[65] We further noted that the only geocode data in the record were those prepared for HAI by PNR Associates (PNR), but that "our conclusion that the model should use geocode data to the extent that they are available is not a determination of the accuracy or reliability of any

[61] *Platform Order*, 13 FCC Rcd at 21337, para. 31. Although surrogating methods, and even customer location data provided by the Census Bureau, constitute geocode data, for purposes of clarity, we will use the term "geocode" data to refer only to actual precise latitude and longitude data, unless we specifically refer to the data as "surrogate geocode" data.

[62] *Platform Order*, 13 FCC Rcd at 21337-38, para. 34.

[63] *Platform Order*, 13 FCC Rcd at 21340-41, para. 40.

[64] *Platform Order*, 13 FCC Rcd at 21337, para. 33.

[65] *Platform Order*, 13 FCC Rcd at 21337-38, para. 34.

particular source of the data."[66] Although commenters support the use of accurate geocode data, several commenters question whether the PNR geocode data are adequately available for review by interested parties.[67]

27. In the *Universal Service Order*, the Commission required that the "model and all underlying data, formulae, computations, and software associated with the model must be available to all interested parties for review and comment."[68] In an effort to comply with this requirement, the Commission has made significant efforts to encourage parties to submit geocode data on the record in this proceeding.[69] PNR took initial steps to comply with this requirement in December 1998 by making available the "BIN" files[70] derived from the geocoded points to interested parties pursuant to the *Protective Order*.[71] In addition, PNR has continued to provide access to the underlying geocode data at its facility in Pennsylvania. Several commenters, in petitions for reconsideration of the *Platform Order*, have argued that the availability of the BIN data alone is not sufficient to comply with the requirements of criterion eight, particularly in light of the expense and conditions imposed by PNR in obtaining access to the geocode point data.[72]

28. We tentatively conclude that interested parties have not had an adequate opportunity to review and comment on the accuracy of the PNR geocode data. We note that a nationwide customer location database will, by necessity, be voluminous, relying on a variety of underlying data sources. In order to comply with criterion eight, all underlying data must be reasonably available to interested parties for review. In light of the concerns expressed by several commenters relating to the conditions and expense in obtaining data from PNR, we find that no source of geocode data has been made adequately available for review. We anticipate that a source of accurate and verifiable geocode data can be selected for use in the federal mechanism in

---

[66] *Platform Order*, 13 FCC Rcd at 21338, para. 34.

[67] *Platform Order*, 13 FCC Rcd at 21338, para. 34.

[68] *Universal Service Order*, 12 FCC Rcd at 8915, para. 250 (criterion eight).

[69] *See Federal-State Joint Board on Universal Service*, Protective Order, CC Docket Nos. 96-45, 97-160, 13 FCC Rcd 13910 (1998) (*Protective Order*). *See also Inputs Public Notice* at 3-4.

[70] BIN files are the output of the clustering routine in the synthesis model platform derived from the actual geocode customer locations and, as such, do not reveal the actual geocoded customer locations. The BIN files allow users to run all aspects of the model except for the clustering. PNR has made the BIN files available to interested parties for a fee of $25.00, pursuant to the terms of the *Protective Order*. *See* Letter from William M. Newman, PNR, to Magalie Roman Salas, FCC, dated December 17, 1998 (PNR Dec. 17 *ex parte*).

[71] *See* PNR Dec. 17 *ex parte*.

[72] *See, e.g.*, Bell Atlantic Petition for Reconsideration at 5-6; BellSouth Petition for Reconsideration at 3-4; GTE Petition for Reconsideration at 21.

the future and we encourage parties to make continued efforts to ensure that all underlying geocode data are available for review. For example, we note that PNR has contacted its data vendors for the purpose of making additional underlying data more freely available to parties in this proceeding.[73] As noted in the *Platform Order*, we recognize that more comprehensive geocode data are likely to be available in the future and encourage parties to continue development of a data source that complies with the criteria outlined in the *Universal Service Order* for use in the federal mechanism.[74] We therefore seek further comment on a source of geocode customer locations that will comply with the Commission's criteria for use in the federal mechanism. In addition, we seek comment on the availability for review of the PNR geocode data, including any further measures necessary to ensure that the PNR geocode data are sufficiently available for review by the public.

2. Road Surrogate Customer Locations

29. We tentatively conclude that the road surrogating algorithm proposed by PNR should be used to develop road surrogate customer locations for the federal universal service mechanism. In the *Platform Order*, we concluded that, in the absence of actual geocode customer location data, BCPM's rationale of associating road networks and customer locations provides the most reasonable approach for determining customer locations.[75] As anticipated in the *Platform Order*, once a source of geocode data has been selected, the road surrogate customer locations will be used only in the absence of geocode customer location data.[76]

30. As noted in the *Platform Order*, "associating customers with the distribution of roads is more likely to correlate to actual customer locations than uniformly distributing customers throughout the Census Block, as HCPM proposes, or uniformly distributing customers along the Census Block boundary, as HAI proposes."[77] We therefore concluded in the *Platform Order* that the selection of a precise algorithm for placing road surrogates should be conducted in the inputs stage of this proceeding.[78]

31. Currently, there are two road surrogating algorithms on the record in this proceeding - those proposed by PNR and Stopwatch Maps. On March 2, 1998, the HAI

---

[73] PNR Dec. 17 *ex parte* at 1.

[74] *Platform Order*, 13 FCC Rcd at 21338, para. 34.

[75] *Platform Order*, 13 FCC Rcd at 21340-41, para. 40.

[76] *Platform Order*, 13 FCC Rcd at 21340-41, para. 40.

[77] *Platform Order*, 13 FCC Rcd at 21340-41, para. 40.

[78] *Platform Order*, 13 FCC Rcd at 21341, para. 41.

proponents provided a description of the road surrogate methodology developed by PNR for locating customers.[79] On January 27, 1999, PNR made available for review by the Commission and interested parties, pursuant to the terms of the *Protective Order*, the road surrogate point data for all states except Alaska, Iowa, Virginia, Puerto Rico and eighty-four wire centers in various other states.[80] On February 22, 1999, PNR filed a more detailed description of its road surrogate algorithm.[81]

32. In general, the PNR road surrogate algorithm utilizes the Census Bureau's Topologically Integrated Geographic Encoding and Referencing (TIGER) files, which contain all the road segments in the United States.[82] For each Census Block, PNR determines how many customers and which roads are located within the Census Block.[83] For each Census Block, PNR also develops a list of road segments. The total distance of the road segments within the Census Block is then computed. Roads that are located entirely within the interior of the Census Block are given twice the weight as roads on the boundary. This is because customers are assumed to live on both sides of a road within the interior of the Census Block. In addition, the PNR algorithm excludes certain road segments along which customers are not likely to reside.[84] For example, PNR excludes highway access ramps, alleys, and ferry crossings.[85] The total number of surrogate points is then divided by the computed road distance to determine the spacing between surrogate points. Based on that distance, the surrogate customer locations are uniformly distributed along the road segments.[86]

---

[79] Letter from Michael Lieberman, AT&T, to Magalie Roman Salas, FCC, dated March 2, 1998 (AT&T March 2 *ex parte*).

[80] Letter from William M. Newman, PNR, to Magalie Roman Salas, FCC, dated January 27, 1999 (PNR Jan. 27 *ex parte*). PNR has made available by mail to interested parties the road surrogate point data for a fee of $25.00, pursuant to the terms of the *Protective Order.*

[81] Letter from Charles A. White, PNR, to Magalie Roman Salas, FCC, dated February 22, 1999 (PNR Feb. 22 *ex parte*).

[82] PNR Feb. 22 *ex parte* at 1. A road segment is a length of road between two intersections. The Census Bureau classifies and numbers each of these road segments. PNR uses a slightly modified version of the Census Bureau road classifications. *Id.* at 2

[83] The PNR National Access Line Model is used to determine the number of residential and business customer locations in a given wire center. *See* PNR Feb. 22 *ex parte* at 1.

[84] PNR Feb. 22 *ex parte* at 2.

[85] PNR Feb. 22 *ex parte* at 2.

[86] PNR Feb. 22 *ex parte* at 2.

33. Stopwatch Maps has compiled road surrogate customer location files for six states suitable for use in the federal mechanism.[87] We tentatively conclude, however, that until a more comprehensive data set is made available, the Stopwatch data set will not comply with the *Universal Service Order's* criterion that the underlying data are available for review by the public. In addition, we note that the availability of only six states is of limited utility in a nationwide model.

34. We tentatively conclude that the PNR road surrogate algorithm is a reasonable method for locating customers in the absence of actual geocode data. We note that PNR's methodology of excluding certain road segments is consistent with the Commission's conclusion in the *Platform Order* that certain types of roads and road segments should be excluded because they are unlikely to be associated with customer locations.[88] In addition, we note that PNR's reliance on the Census Bureau's TIGER files ensures a degree of reliability and availability for review of much of the data underlying PNR's road surrogate algorithm, in compliance with criterion eight of the *Universal Service Order*.[89] We note that the HAI proponents contend that use of a surrogate algorithm may overstate the amount of plant necessary to provide supported services.[90] We seek comment on the validity of this contention. We also note that PNR has indicated that it intends to finalize a number of improvements to the road surrogate algorithm and data.[91] For example, PNR states that the new release will incorporate any new input requirements relating to an authoritative wire center list, housing units versus households, and treatment of phone penetration rates. In addition, the new release will include data for all fifty states, Washington, D.C., and Puerto Rico.[92] We seek comment on our tentative conclusion to adopt the PNR road surrogate algorithm to determine customer locations, and to adopt the PNR road surrogate data set for use in the model beginning on January 1, 2000. We also seek comment on any changes that should be made to the PNR methodology to improve the accuracy of the customer locations it generates.

---

[87] *See* Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated December 11, 1998 (Sprint Dec. 11 *ex parte*).

[88] *Platform Order*, 13 FCC Rcd at 21341, para. 41.

[89] We also note that PNR has made the road surrogate data points available to interested parties pursuant to the provisions of the *Protective Order* in this proceeding. *See* PNR Jan. 27 *ex parte*; PNR Feb. 9 *ex parte*; PNR Feb. 22 *ex parte*.

[90] *See* Letter from Chris Frentrup, MCI, to Magalie Roman Salas, FCC, dated February 19, 1999.

[91] Letter from William M. Newman, PNR, to Magalie Roman Salas, FCC, dated February 9, 1999 (PNR Feb. 9 *ex parte*).

[92] *See* PNR Feb. 9 *ex parte* at 1.

3. Methodology for Estimating the Number of Customer Locations

35. In addition to selecting a source of customer data, we also must select a methodology for estimating the number of customer locations within the geographic region that will be used in developing the customer location data. We also must determine how demand for service at each location should be estimated and how locations should be allocated to each wire center.

36. In the *Universal Service Order*, the Commission concluded that a "model must estimate the cost of providing service for all businesses and households within a geographic region."[93] In the *Inputs Public Notice*, the Bureau sought comment on the appropriate method for defining "households," or residential locations, for the purpose of calculating the forward-looking cost of providing supported services.[94] Model proponents and interested parties have proposed alternative methods to comply with this requirement.[95]

37. The HAI sponsors propose that we use the methodology devised by PNR, which is based upon the number of households in each Census Block, while the BCPM sponsors propose that we use a methodology based upon the number of housing units in each Census Block. A household is an occupied residence, while housing units include all residences, whether occupied or not.[96]

38. Specifically, the HAI sponsors advocate the use of the PNR National Access Line Model to estimate the number of customer locations within Census Blocks and wire centers.[97] The PNR National Access Line Model uses a variety of information sources, including: survey information, the LERG, Business Location Research (BLR) wire center boundaries, Dun &

---

[93] *Universal Service Order*, 12 FCC Rcd at 8915, para. 250 (criterion 6).

[94] *Inputs Public Notice* at 4-6.

[95] We note that the question of which residential and business locations should be included for purposes of estimating the forward-looking cost of providing the supported services is distinct from the question of which lines should be supported. *See Universal Service Order*, 12 FCC Rcd at 8829, paras. 95-96 (declining to adopt the Joint Board's recommendation to restrict universal service high cost support to primary residential and single-line businesses).

[96] These definitions reflect the Census Bureau's methodology for housing unit and household estimates. *See* http://www.census.gov/population/methods/sthhmet.txt.

[97] HAI Dec. 11, 1997 submission, Model Description at 21. PNR has agreed to review and explain the process used in developing the National Access Line Model with interested parties, pursuant to the terms of the *Protective Order*, at its location in Pennsylvania. *See* Letter from Charles A. White, PNR, to Thomas Mitchell, Collier, Shannon, Rill & Scott, dated April 29, 1999.

Bradstreet's business database, Metromail's residential database, Claritas' demographic database, and U.S. Census estimates. PNR's model uses these sources to estimate the number of residential and business locations, and the number of access lines demanded at each location. The model makes these estimations for each Census Block, and for each wire center in the United States.[98]

39. At the conclusion of PNR's process for estimating the number of customer locations: (1) PNR's estimate of residential locations is greater than or equal to the Census Bureau's estimate of households, by Census Block Group, and its estimate is disaggregated to the Census Block level, (2) PNR's estimate of demand for both residential and business lines in each study area is greater than or equal to the number of access lines in the Automated Reporting and Management Information System (ARMIS) for that study area, and the estimates are available by location at the Block level, and (3) each customer location is associated with a particular wire center.[99]

40. The BCPM sponsors rely on many of the same data sources as those used in PNR's National Access Line Model. For example, BCPM 3.1 uses wire center data obtained from BLR and business line data obtained from PNR.[100] In estimating the number of residential locations, however, the BCPM sponsors use Census data that include household and housing unit counts from the 1990 Census, updated based upon 1995 Census statistics regarding household growth by county. In addition, rather than attempting to estimate demand by location at the Block level, the BCPM model builds two lines to every residential location and at least six lines to every business.

41. The synthesis model currently calculates the average cost per line by dividing the total cost of serving customer locations by the current number of lines. Because the current number of lines is used in this average cost calculation, the HAI sponsors argue that the total cost should be determined by using the current number of customer locations. The HAI sponsors contend that "the key issue is the consistency of the numerator and denominator" in the average cost calculation. The HAI sponsors argue that other approaches are inconsistent because they select the highest possible cost numerator and divide by the lowest possible line denominator, and therefore result in larger than necessary support levels.[101] The HAI sponsors argue that, in order to be consistent, housing units must be used in the determination of total lines if they are used in

[98] HAI Dec. 11, 1997 submission, Model Description at 21.

[99] Customer locations in unserved areas, as reflected by BLR wire center boundaries, are not associated with particular wire centers. *See* Letter from Charles A. White, PNR, to Magalie Roman Salas, FCC, dated April 12, 1999.

[100] BCPM April 30, 1998 documentation, Model Methodology at 26-27.

[101] AT&T and MCI *ex parte*, Dec. 23, 1997.

the determination of total costs.[102] The HAI sponsors contend that "[i]f used consistently in this manner, building to housing units as GTE proposes is unlikely to make any difference in cost per line."[103]

42. In contrast, the BCPM sponsors and other commenters contend that the total cost should include the cost of providing service to all possible customer locations, even if some locations currently do not receive service.[104] Furthermore, the BCPM sponsors contend that if total cost is based on a smaller number of locations, support will not be sufficient to enable carriers to meet their carrier-of-last-resort obligations. The BCPM sponsors also argue that basing the estimate of residential locations on households instead of housing units will underestimate the cost of building a network that can provide universal service.[105] The BCPM sponsors, as well as some other commenters, contend that residential locations should be based on the number of housing units - whether occupied or unoccupied.[106] These commenters contend that only this approach reflects the obligation to provide service to any residence that may request it in the future.[107]

43. We tentatively conclude that PNR's process for estimating the number of customer locations should be used for developing the customer location data. We also tentatively conclude that we should use PNR's methodology for estimating the demand for service at each location, and for allocating customer locations to wire centers.[108] We believe that the PNR methodology is a reasonable method for determining the number of customer locations to be served in calculating the cost of providing supported services. To the extent that the PNR methodology includes the cost of providing service to all currently served households, we tentatively conclude that this is consistent with a forward-looking cost model, which is designed to estimate the cost of serving current demand. As noted by the HAI sponsors, adopting housing units as the standard would

---

[102] Letter from Chris Frentrup, MCI, to Magalie Roman Salas, FCC, dated March 5, 1999 (MCI March 5 *ex parte*).

[103] MCI March 5 *ex parte* (Issues 1 and 2).

[104] *See, e.g.*, BCPM Joint Sponsors *Inputs Public Notice* comments at 7; GTE *Inputs Public Notice* comments at 9; RUS *Inputs Public Notice* comments at 2.

[105] BCPM Joint Sponsors *Inputs Public Notice* comments at 6-7.

[106] *See, e.g.*, BCPM Joint Sponsors *Inputs Public Notice* comments at 7; GTE *Inputs Public Notice* comments at 9; RUS *Inputs Public Notice* comments at 2.

[107] *See, e.g.*, BCPM Joint Sponsors *Inputs Public Notice* comments at 7; GTE *Inputs Public Notice* comments at 9; RUS *Inputs Public Notice* comments at 2.

[108] *See* Appendix B for a complete description of the PNR methodology for estimating the number of customer locations.

inflate the cost per line by using the highest possible numerator (all occupied and unoccupied housing units) and dividing by the lowest possible denominator (the number of customers with telephones).[109]

44. In addition, we do not believe that including the cost of providing service to all housing units will promote universal service to unserved customers or areas. We note that there is no guarantee that carriers would use any support derived from the cost of serving all housing units to provide service to these customers. Many states permit carriers to charge substantial line extension or construction fees for connecting customers in remote areas to their network. If that fee is unaffordable to a particular customer, raising the carrier's support level by including the costs of serving that customer in the model's calculations would have no effect on whether the customer actually receives service. In fact, as long as the customer remains unserved, the carriers would receive a windfall. We recognize that serving unserved customers in such circumstances is an important universal service goal. As discussed in the companion Order and Further Notice adopted today, we will initiate a separate proceeding in July 1999 to investigate the issue of unserved areas.[110]

45. If we were to calculate the costs of a network that would serve all potential customers, it would not be consistent to calculate the cost per line by using current demand. In other words, it would not be consistent to estimate the cost per line by dividing the total cost of serving all potential customers by the number of lines currently served. We note, however, that the level and source of future demand is uncertain. Future demand might include not only demand from currently unoccupied housing units, but also demand from new housing units, or potential increases in demand from currently subscribing households. We also recognize that population or demographic changes may cause future demand levels in some areas to decline. Given the uncertainty of future demand, we are concerned that including such costs may not reflect forward-looking costs and may perpetuate the system of implicit support.

46. We recognize, however, that additional comment would be helpful with regard to certain issues. For example, if a currently vacant unit will again receive service in the near future, one might argue that it should be included in the calculation of total cost. It is also possible that housing stock is subject to a type of churn that could inflate the number of households used in determining total cost without affecting the total number of lines. That is, a certain percentage of housing units may be repeatedly vacated and then reoccupied, with the specific households involved constantly changing. At any given time, a certain number of housing units might be unoccupied as a result. Under the Census definition, such units are not considered households

[109] AT&T and MCI *ex parte*, Dec. 23, 1997.

[110] After developing more fully the record on this issue, we will be better able to determine whether such unserved areas should receive federal universal service support. *Companion Order* at para. 92.

and therefore may not be included in the number of residential locations estimated by PNR.[111] We seek comment on whether the costs associated with providing service to these housing units should be included in the total cost by identifying an additional number of unoccupied units. The PNR methodology may provide an estimate of the number of residential locations that is greater than the number that currently receive telephone service, however.[112] Therefore PNR's methodology may already account for at least some portion of housing units subject to this type of churn. We seek comment on this issue.

47. We also note that locations outside of existing wire centers will not be included under the PNR methodology.[113] Therefore the accuracy of the wire center boundaries is of importance in estimating the number of customer locations. PNR currently uses BLR wire center information to estimate wire center boundaries.[114] As noted above, the BCPM model also uses BLR wire center boundaries, as does Stopwatch Maps in its road surrogate customer location files.[115] PNR has indicated its intent to evaluate alternative sources of wire center boundaries to be used in the customer location data.[116] We therefore seek comment on the accuracy of the BLR wire center boundaries and any possible alternatives to establish more accurate wire center boundaries.

V. OUTSIDE PLANT INPUT VALUES

A. Background

48. As the Commission noted in the *Platform Order*, outside plant, or loop plant, constitutes the largest portion of total network investment, particularly in rural areas.[117] Outside plant investment includes the copper cables in the distribution plant and the copper and optical

[111] As explained in Appendix B, PNR uses two databases, Metromail and Claritas, to estimate the number of residential locations and uses whichever number is greater. Claritas uses updated Census estimates of the number of households, so in cases where the Claritas number is larger, PNR's estimate would not include unoccupied housing units. In cases where the Metromail number is larger, PNR's estimate could include unoccupied housing units, but these housing units would have an associated telephone number.

[112] As explained in Appendix B, the Metromail counts used by PNR have an associated telephone number. The Claritas household counts, on the other hand, are not restricted to households with telephones.

[113] *See supra* note 99.

[114] HAI Dec. 11, 1997 submission, Model Description at 21.

[115] *See* Sprint Dec. 11, 1998 *ex parte*, attachment at 1.

[116] Letter from Charles A. White, PNR, to Magalie Roman Salas, FCC, dated April 12, 1999.

[117] *Platform Order*, 13 FCC Rcd at 21335, para. 27.

fiber cables in the feeder plant that connect the customers' premises to the central office. Cable costs include the material costs of the cable, as well as the costs of installing the cable.[118]

49. Outside plant consists of a mix of aerial, underground, and buried cable.[119] Aerial cable is strung between poles above ground. Underground cable is placed underground within conduits for added support and protection. Buried cable is placed underground but without any conduit. A significant portion of outside plant investment consists of the poles, trenches, conduits, and other structure that support or house the copper and fiber cables. In some cases, electric utilities, cable companies, and other telecommunications providers share structure with the LEC and, therefore, only a portion of the costs associated with that structure are borne by the LEC. Outside plant investment also includes the cost of the SAIs and DLCs that connect the feeder and distribution plant.

50. The *Universal Service Order's* first criterion specifies that "[t]he technology assumed in the cost study or model must be the least-cost, most efficient, and reasonable technology for providing the supported services that is currently being deployed."[120] Thus, while the synthesis model uses existing incumbent LEC wire center locations in designing outside plant,[121] it does not necessarily reflect existing incumbent LEC loop plant. Indeed, as the Commission stated in the *Platform Order*, "[e]xisting incumbent LEC plant is not likely to reflect forward-looking technology or design choices."[122] If the prices of fiber cable and DLCs have decreased over time relative to the cost of copper cable, for example, the synthesis model would design outside plant with more fiber and DLCs and less copper cable than has been deployed historically in an incumbent LEC's network.[123]

B. Copper and Fiber Cable

[118] As discussed below, cable installation costs for buried cable often are included with the structure costs.

[119] The phrase "plant mix" refers to the ratio of outside plant that is aerial, underground, or buried in a network or particular area.

[120] *Universal Service Order*, 12 FCC Rcd at 8913, para. 250.

[121] *See supra* para. 11; *Universal Service Order*, 12 FCC Rcd at 8913, para. 250.

[122] *Platform Order*, 12 FCC Rcd at 21350, para. 66. "Instead, incumbent LECs' existing plant will tend to reflect choices made at a time when different technology options existed or when the relative cost of equipment to labor may have been different than it is today." *Id.*

[123] If we look at current deployment, an incumbent LEC may be deploying even more fiber and DLCs today than the optimizing routines in the synthesis model would predict. For example, a LEC building a network that is capable of delivering video and broadband services may deploy less copper than the synthesis model would estimate is the optimum amount needed to provide the services supported by the federal mechanism.

1. Background

51. In the *1997 Further Notice*, the Commission sought comment on the input values that the model should use for cable material and installation costs.[124] The Commission specifically sought comment on the accuracy of the default values in the BCPM and HAI models and encouraged companies to submit data to support their positions.[125] The Commission tentatively concluded that cable material and installation costs should be separately identified by both density zone and terrain type.[126] Because the Commission had received no documentation confirming that feeder and distribution cable installation costs should differ, the Commission tentatively concluded that the federal mechanism should adopt HAI's assumption that such costs are identical.[127]

52. In the *Inputs Public Notice*, the Bureau sought comment on the analysis of David Gabel and Scott Kennedy on data from the Rural Utilities Service (RUS) regarding the cost of installing cables.[128] On December 11, 1998, the Bureau held a public workshop designed to elicit comment on the input values for materials costs.[129] At the workshop, Dr. Gabel presented the methodology used by the Commission staff to derive preliminary values for cable costs based on his earlier analysis of the RUS data.

53. Commission staff sought to supplement the record with respect to outside plant structure and cable costs by requesting additional data from LECs, including competitive LECs.[130]

---

[124] *1997 Further Notice*, 12 FCC Rcd at 18544.

[125] *1997 Further Notice*, 12 FCC Rcd at 18544. The BCPM and HAI default values are the default input values for the user-adjustable input values in the BCPM and HAI models, respectively. Although we have chosen a model platform and therefore are no longer considering adoption of the BCPM and HAI models, we continue to consider the BCPM and HAI default input values in this phase of the proceeding. For some inputs, these are the only values on the record. Although the BCPM model includes nationwide default values, the BCPM sponsors generally advocate company-specific values and in some cases have proposed such values.

[126] *1997 Further Notice*, 12 FCC Rcd at 18544.

[127] *1997 Further Notice*, 12 FCC Rcd at 18544.

[128] *Inputs Public Notice* at 7. *See* David Gabel & Scott Kennedy, *Estimating the Cost of Switching and Cables Based on Publicly Available Data* (National Regulatory Research Institute NRRI 98-09, April 1998) (NRRI Study). Dr. Gabel and Mr. Kennedy are consultants for the Commission in this proceeding.

[129] *See Workshop Public Notice*. The December 1, 1998 workshop addressed issues relating to switching and expenses.

[130] After numerous discussions with industry during development of the survey, staff distributed a final version on December 14, 1998, and requested responses by January 14, 1999.

A copy of the outside plant structure and cable cost survey is attached in Appendix C. Ten companies eventually responded to the voluntary survey, somewhat fewer than the number that had indicated they would be willing to provide data.[131] Because of the delay in receiving the data and the time necessary to review and revise the data, staff has not completed its analysis of the survey data.

2. Issues for Comment

54. We now examine the inputs needed to determine outside plant cable costs in the synthesis model. The synthesis model uses several tables to calculate cable costs, based on the cost per foot of cable, which may vary by cable size (*i.e.*, gauge and pair size) and the type of plant (*i.e.*, underground, buried, or aerial). There are four separate tables for copper distribution and feeder cable of two different gauges, and one table for fiber cable. The engineering assumptions and optimizing routines in the model, in conjunction with the input values in the tables, determine which type of cable is used.

55. After the synthesis model has grouped customer locations in clusters, it determines, based on cost minimization and engineering considerations, the appropriate technology type for the cluster and the correct size of cables in the distribution network. Every customer location is connected to the closest SAI by copper cable. The copper cable used in the local loop typically is either 24- or 26-gauge copper. Twenty-four gauge copper is thicker and therefore is expected to be more expensive than 26-gauge copper. Twenty-four gauge copper also can carry signals greater distances without degradation than 26-gauge copper and, therefore, is used in longer loops. In the synthesis model, if the maximum distance from the customer to the SAI is less than or equal to the copper gauge crossover point, then 26-gauge cable is used. Feeder cable is either copper or fiber. Fiber is used for loops that exceed 18,000 feet, the maximum copper loop length permitted in the model, as determined in the *Platform Order*.[132] When fiber is more cost effective, the model will use it to replace copper for loops that are shorter than 18,000 feet.

a. Engineering Assumptions and Optimizing Routines

56. Before we consider our proposed input values for cable costs, we discuss certain

[131] BellSouth, Ameritech, Pacific Bell, Nevada Bell, Southwestern Bell, Sprint, GTE, Aliant, SNET, and AT&T submitted data in response to the structure and cable cost survey. Several companies requested additional time to complete and submit their data. After receiving and reviewing the data, staff found that, despite detailed survey instructions, further discussions with a number of companies were required before staff could assemble the data for comparison and analysis. In a number of cases, respondents filed revised data or clarified the data they had submitted.

[132] *Platform Order*, 13 FCC Rcd at 21352-53, para. 70.

input values related to the engineering assumptions and optimizing routines in the synthesis model that affect outside plant costs. Specifically, we must determine: (1) whether optimization in the synthesis model should be turned on or off; (2) whether the model should use T-1 technology; and (3) whether the model should use rectilinear or airline distances and the value of the corresponding "road factor."

i. Optimization

57. In the synthesis model, the user has the option of optimizing distribution plant routing via a minimum cost spanning tree algorithm discussed in the model documentation.[133] The algorithm functions by first calculating distribution routing using an engineering "rule of thumb" and then comparing the cost with the spanning tree result, choosing the routing that minimizes annualized cost.[134] The user also has the option of not using the distribution optimization feature, thereby saving a significant amount of computation time, but reporting network costs that may be significantly higher than with the optimization. In addition, the user has the option of using the distribution optimization feature only in the lowest density zones.

58. We tentatively conclude that the synthesis model should be run with the optimization turned on when the model is used to calculate the forward looking cost of providing the services supported by the federal mechanism. We point out that the optimization approach represents what a network planning engineer would attempt to accomplish in developing a forward-looking network. This approach also complies with criterion one's requirement that the model must assume the least-cost, most efficient, and reasonable technology for providing the supported service that is currently being deployed. We note, however, that the optimization can substantially increase the model's run time. Preliminary staff analysis of comparison runs with full optimization versus runs with no optimization indicate that, for clusters with line density greater than 500, the rule of thumb algorithm results in the same or lower cost for nearly all clusters.[135] We seek comment on whether an acceptable compromise to full optimization would be to set the optimization factor at "-p500," as described in the model documentation.[136] With this setting the model will optimize distribution plant whenever the density of a cluster is less than or equal to 500 lines per square mile. For purposes of further analysis of the proposed input values, we also

---

[133] The synthesis model always optimizes feeder plant. *See* C.A. Bush, et al., The Hybrid Cost Proxy Model Customer Location and Loop Design Modules, Dec. 15, 1998 (HCPM Dec. 15, 1998 documentation) at 13.

[134] *Id.* at 11.

[135] Since, under full optimization, the model chooses the least cost of the full optimization algorithm or the rule of thumb algorithm, a comparison run as described above can show how well the full optimization performs as a function of density.

[136] *See* C.A. Bush, et al., The Hybrid Cost Proxy Model Customer Location and Loop Design Modules (Dec. 15, 1998) at 30-31; *see also* Design History of HCPM, April 6, 1999 at http://www.fcc.gov/ccb/apd/hcpm.

anticipate that parties may wish to run the model without optimization turned on to save computing time. After staff has completed its analysis of comparison runs, we intend to make available a spreadsheet showing the estimated percentage change, for each non-rural study area, between running the model with the distribution optimization disabled and running the model with the distribution optimization enabled.

ii. T-1 Technology

59. A user of the synthesis model also has the option of using T-1 technology as an alternative to copper feeder or fiber feeder in certain circumstances. T-1 is a technology that allows digital signals to be transmitted on two pairs of copper wires at 1.544 Megabits per second (Mbps). If the T-1 option is enabled, the optimizing routines in the model will choose the least cost feeder technology among three options: analog copper, T-1 on copper, and fiber.[137] For serving clusters with loop distances below the maximum copper loop length, the model could choose among all three options; between 18,000 feet and the fiber crossover point, which earlier versions of HCPM set at 24,000 feet, the model could choose between fiber and T-1; and above the fiber crossover point, the model would always use fiber. In the HAI model, T-1 technology is used to serve very small outlier clusters in locations where the copper distribution cable would exceed 18,000 feet. The BCPM sponsors and other LECs contend that T-1 is not a forward looking technology and, therefore should not be used in the synthesis model. The HAI sponsors contend that current advertisements show that T-1 is being used currently.[138]

60. As noted, a number of parties contend that the T-1 on copper technology is not forward looking. Other sources indicate that advanced technologies, like HDSL, potentially can be used on T-1 technology to transmit information at T-1 or higher rates.[139] We seek comment on this issue. We also seek comment on the extent to which HDSL technology presently is being used on T-1.

61. The only input values for T-1 costs on the record in this proceeding are the HAI default values.[140] Because the synthesis model and the HAI model use T-1 differently, we tentatively find that the HAI default values would not be appropriate for use in the synthesis

---

[137] HCPM Dec. 15, 1998 documentation at 10.

[138] *See* Letter from Richard N. Clarke, AT&T, to Magalie Roman Salas, dated March 17, 1999, at Attachment A.

[139] HDSL (high data rate digital subscriber line) transmits 1.544 Mbps or 2.048 Mbps in bandwidths ranging from 80 kilohertz (kHz) to 240 kHz, rather than in a bandwidth of 1.5 megahertz (mHz) required for traditional T-1 services. *See* www.adsl.com/general_tutorial.

[140] The HAI sponsors provide default values for T-1 technology including the cost of repeaters and remote T-1 terminals. *See* HAI Inputs Portfolio at 45-48.

model. In light of the fact that T-1 may not be a forward looking technology and the lack of appropriate input values, we tentatively conclude that we should not use the T-1 option in the synthesis model. We seek comment on our tentative conclusion. We ask that parties who disagree with our tentative conclusion and recommend that the T-1 function be used in the synthesis model propose input values that will accurately estimate the cost of this technology, including what values are needed for the costs of shielded copper, repeaters, and terminals.

iii. Distance Calculations and Road Factor

62. We tentatively conclude that the synthesis model should use rectilinear distance, rather than airline distance, in calculating outside plant distances,[141] because this more accurately reflects the routing of telephone plant along roads and other rights of way. In fact, research suggests that, on average, rectilinear distance closely approximates road distances.[142] As a result, we tentatively conclude that the road factor in the model, which reflects the ratio between route distance and road distance, should be set equal to 1. We seek comment on these tentative conclusions.

63. We also note that airline distance could be used in the model, if we were to derive accurate road factors. We seek comment on this alternative. Specifically, we seek comment on whether we should use airline miles with wire center specific road factors.[143] Research has shown that the airline distance metric with an appropriate road factor is more accurate than the rectilinear metric.[144] We seek comment on this alternative approach.

b. Cost of Copper Cable

---

[141] In short, this means that telephone plant will be built on north-south and east-west routes, rather than "as the crow flies."

[142] *See* Robert F. Love, James G. Morris, and George O. Wesolowsky, *Facilities Location: Models and Methods*, Chapter 10 (Elsevier Science Publishing Co. 1988) (*Facilities Location Models)*.

[143] Such a road factor could be calculated as follows. First, using the wire center boundaries from the customer location data, we would determine which Census Blocks are contained within each wire center. Second, we would extract the TIGER files containing road coordinates and distances for each of these Census Blocks. Third, we would create a database matching a sample set of coordinates of road intersections within the wire center, the road distance to an adjoining intersection, and the coordinates of the adjoining intersection. Using a formula for approximating airline distance, *see Facilities Locations Models* at 270, we could create a column containing airline distances. Fourth, we would regress road distance on airline distance to obtain the appropriate road factor for the wire center.

[144] *See Facilities Location Models*, Chapter 10. The authors find that the goodness-of-fit of a model similar to airline distance is significantly better than one incorporating rectilinear distance.

i. Preliminary Issues

64. The synthesis model uses tables that show the cost per foot of copper cable, by pair size. In selecting input values for the cost of copper cables, we must first address a number of preliminary issues: the extent to which 24- and 26- gauge copper cable should be used in the synthesis model; whether cable installation costs should differ between feeder and distribution cable; and whether cable installation costs should vary for underground, buried, and aerial cable.

65. Use of 24- and 26-Gauge Copper. The HAI default values assume that all copper cable below 400 pairs in size is 24-gauge and all copper cable of 400 pairs and larger is 26-gauge.[145] The BCPM default values include separate costs for 24- and 26-gauge copper of all sizes. We tentatively reject the HAI sponsors' argument that 26-gauge copper costs should be used for all larger pair sizes of copper cable. We tentatively conclude that the model should use both 24-gauge and 26-gauge copper in all available pair-sizes. Based on a preliminary analysis of the results of the structure and cable cost survey, it appears that a significant amount of 24-gauge copper cable in larger pair sizes currently is being deployed. We seek comment on these tentative conclusions.

66. Distinguishing Feeder and Distribution Cable Costs. We reaffirm the Commission's tentative conclusion in the *1997 Further Notice* that the same input values should be used for copper cable whether it is used in feeder or in distribution plant. Although the BCPM sponsors previously disagreed with this tentative conclusion,[146] they have not provided persuasive data for this position. We seek comment on this tentative conclusion.

67. Distinguishing Underground, Buried, and Aerial Installation Costs. The HAI and BCPM sponsors both claim that their proposed values for cable costs include the cost of installation.[147] The BCPM defaults provide separate cost estimates for aerial, buried, and underground cable. The HAI default cable costs do not vary by type of plant and, therefore, appear to assume that installation costs are the same for aerial, underground, and buried cable. For buried copper cable, the HAI defaults include a multiplier to estimate the additional cost of the filling compound used in buried cable to protect the cable from moisture.[148] For underground

[145] HAI Inputs Portfolio at 20.

[146] BCPM Sept. 24, 1997 comments at 13. We also note that the BCPM default values now include the same costs for feeder and distribution copper cable.

[147] The HAI sponsors assert that these costs include "engineering, installation, and delivery, as well as the cable material itself." HAI Inputs Portfolio at 20. The BCPM sponsors represent that their default values for cable costs include the material cost, supply cost, taxes, placing, splicing, and engineering costs. BCPM, Loop Inputs Documentation at 15.

[148] HAI Inputs Portfolio at 23.

cable, HAI adds a per foot material cost for the conduit material.[149]

68. We tentatively conclude that we should adopt separate input values for the cost of aerial, underground, and buried cable. Based on our analysis of cable cost data, we have found considerable differences in the per foot cost of cable, depending upon whether the cable was strung on poles, pulled through conduit, or buried. We seek comment on this tentative conclusion.

ii. Cost Per Foot of Copper Cable

69. We now turn to the cost per foot of 24- and 26-gauge copper cable. Both the HAI and BCPM sponsors provide default input values for copper cable costs that are based upon the opinions of their respective experts, but without data that enable us to substantiate those opinions. In addition, the Commission received cable cost data from a number of LECs, including data received in response to the structure and cable cost survey developed by staff, which staff is continuing to analyze, as noted above.

70. At the December 11, 1998 workshop, Commission staff described how they had estimated the preliminary copper cable costs, by pair size and by plant type (*i.e.*, aerial, buried, or underground), that had been posted on the Commission's Web site prior to the workshop. For copper cable, the staff estimated high and low values for the cost of the smallest pair size of 26-gauge copper cable based on an analysis of the HAI default values and the values submitted by states filing cost models in this proceeding. These estimates were adjusted for larger pair sizes of 26-gauge cable and different structure types using estimates in Gabel and Kennedy's analysis of RUS data, which was published by the National Regulatory Research Institute (NRRI Study).[150] The cost of 24-gauge copper cable was estimated by applying a multiplier to the 26-gauge estimates based on the relative weight of the copper in these two gauges.[151]

71. While the HAI sponsors support using the publicly available RUS data in the NRRI Study to estimate cable costs,[152] Sprint questions the reliability and suitability of this data,

[149] HAI Inputs Portfolio at 24.

[150] *See supra* note 128.

[151] An earlier version of HCPM calculated 24-gauge copper cable by multiplying the values for 26-gauge copper cable by 1.17. *See* HCPM Dec. 15, 1998 model description at 19.

[152] Letter from Chris Frentrup, MCI Worldcom, to Magalie Roman Salas, FCC, dated Feb. 9, 1999 (MCI Feb. 9, 1999 *ex parte*).

and urges us instead to use the cable cost data provided by incumbent LECs.[153] As Sprint points out, the RUS data contain information from only the two lowest density zones.[154] Because loops are longer in sparsely populated areas, lower gauge copper often is used.

72. We tentatively conclude that we should use, with certain modifications, the estimates in the NRRI Study for the per foot cost of aerial, underground, and buried 24-gauge copper cable. As described below,[155] we also tentatively conclude that we should estimate the cost of 26-gauge copper cable by adjusting our 24-gauge estimates with ratios derived from cost data submitted by several non-rural LECs. The proposed cost estimates for 24- and 26-gauge aerial, underground, and buried copper cable in various pair sizes are shown in Appendix A. We seek comment on these tentative conclusions and proposed values.

73. Although the RUS data were collected from the two lowest density zones, we note that none of the models considered by the Commission has the capability of varying cable costs by density zones. Nor have parties proposed cable cost values that vary by density zone. We also believe that Sprint has mischaracterized the analysis of the RUS data in the NRRI Study. For example, Sprint challenges the validity of the study because some of the observations have zero values for labor or material, while failing to recognize that these values were excluded from Gabel and Kennedy's regression analysis.[156] Similarly, Sprint's complaint that Gabel and Kennedy do not analyze the components of total cable costs, labor and material, separately overlooks that Gabel and Kennedy's regression analysis is designed to explain the variation in total costs.[157]

74. The NRRI Study provides estimates for outside plant structure and cable costs using cost data derived from construction contracts supplied by the RUS for a sample of companies that operate under various soil, weather, and population density conditions.[158] In generating these estimates, Gabel and Kennedy used standard regression techniques to measure

---

[153] Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated Jan 29, 1999 (Sprint Jan. 29, 1999 *ex parte*).

[154] Sprint Jan. 29, 1999 *ex parte* at 8-9.

[155] *See infra* paras. 85-86.

[156] Sprint Jan. 29 *ex parte*, attachment at 5.

[157] Sprint Jan. 29 *ex parte*, attachment at 7.

[158] To develop these estimates, Gabel and Kennedy first developed from the raw data reflected on these contracts a data base that contains outside plant structure and cable costs. The outside plant structure and cable cost data in this data base are derived from 171 contracts for 57 companies in 27 states, adjusted to 1997 dollars. NRRI Study at 2.

the effect of geological and density conditions on cable and structure costs.[159] In general, the econometric formulations that Gable and Kennedy developed to estimate cable costs measure the effect on these costs of cable size and the placement of two or more cables on the same route.

75. We tentatively conclude that one substantive change should be made to Gabel and Kennedy's analysis. Gabel and Kennedy used the ordinary least squares statistical technique to estimate the cost of structure and cables. The ordinary least squares technique fits a straight line to the data by minimizing the sum of squared prediction errors. The ordinary least squares technique is efficacious, however, only for a data set lacking statistical outliers.[160] Such outliers have an undue influence on regression results, since the residual associated with each outlier is squared in calculating the regression. In order to mitigate the influence of such outlier values, statisticians have developed so-called robust regression techniques for estimating regression equations. We tentatively conclude that a robust regression technique should be used for analyzing the RUS data. We seek comment on this tentative conclusion.

76. Specifically, we tentatively conclude that the robust regression technique proposed by Huber should be applied to the RUS data. Essentially, this algorithm uses a standard statistical criterion to determine the most extreme outliers, and excludes them. Thereafter, as suggested by Huber, it iteratively performs a regression, then for each observation calculates an observation weight based on the absolute value of the observation residual. Finally, the procedure performs a weighted least squares regression using the calculated weights. This process is repeated until the values of the weights effectively stop changing. We have used the robust regression parameter estimates for cable, conduit, and buried structure. The use of robust estimation did not improve the statistical properties of the estimators for pole costs, so we tentatively conclude that the ordinary least squares technique is appropriate for pole costs.[161] We seek comment on these tentative conclusions and analysis.

77. 24-Gauge Aerial Copper Cable. We tentatively conclude that we should use the regression equation in the NRRI Study, as modified by the Huber methodology described above,

---

[159] In these regression analyses, Gabel and Kennedy used data from the HAI model on line counts and rock, soil, and water conditions for the geographic region in which each company in the data base operates. NRRI Study at 34-36. Regression analysis is a standard method used to study the dependence of one variable, the dependent variable, on one or more other variables, the explanatory variables. It is used to predict or forecast the mean value of the dependent variable on the basis of known or expected values of the explanatory variables. For a discussion of regression analysis, *see* William H. Greene (1990), *Econometric Analysis*, New York: MacMillan Publishing Company.

[160] Statistical outliers are values that are much higher or lower than other data in the data set.

[161] For the robust regression of the pole cost equation, the value of the F-statistic was not statistically significant at the five percent level.

to estimate the cost of 24-gauge aerial copper cable, with three adjustments.[162]

78. First, we propose to adjust the equation to reflect the superior buying power that non-rural LECs may have in comparison to the LECs represented in the RUS data. We seek comment on whether an adjustment for superior bargaining power is necessary, and, if so, how such an adjustment should be made.

79. Based on data entered into the record in a proceeding before the Maine Public Utilities Commission, Gabel and Kennedy determined that Bell Atlantic's material costs for aerial copper cable are approximately 15.2 percent less than these costs for the RUS companies.[163] We tentatively conclude that this figure represents a reasonable estimate of the difference in the material costs that non-rural LECs pay in comparison to those that the RUS companies pay. To reflect this degree of buying power in the cable cost estimates that we derive for non-rural LECs, we propose to reduce the regression coefficient for the number of copper pairs by 15.2 percent for aerial copper cable. This coefficient measures the incremental or additional cable cost associated with one additional copper pair and therefore largely reflects the material cost of the cable. We seek comment on this proposed adjustment. We also invite parties to suggest alternative methods for capturing the impact of superior buying power.

80. Second, we propose to adjust the equation in the NRRI Study to account for LEC engineering costs, which were not included in the RUS cable data. The BCM2 default values include a loading of five percent for engineering. The HAI sponsors claim that engineering constitutes approximately 15 percent of the cost of installing outside plant cables. This percentage includes both contractor engineering and LEC engineering. The cost of contractor engineering already is reflected in the RUS cable cost data. Based on the record, we tentatively conclude that we should add a loading of 10 percent to the material and labor cost of the cable (net of LEC engineering and splicing costs) to approximate the cost of LEC engineering. We seek comment on this tentative conclusion and invite commenters to justify an alternative loading factor for LEC engineering.

81. Third, we propose to adjust the equation to account for splicing costs, which also were not included in the RUS data. In the NRRI Study, Gabel and Kennedy determined that the ratio of splicing costs to copper cable costs (excluding splicing and LEC engineering costs) is 9.4 percent for RUS companies.[164] We tentatively conclude that we should adopt a loading of 9.4 percent for splicing costs. We seek comment on this tentative conclusion.

---

[162] This modified regression equation is set forth in Appendix D, section I.A. The appendix also includes an example of how we propose to use this equation to estimate the cost of 24-gauge aerial copper cable.

[163] NRRI Study at 47.

[164] NRRI Study at 29.

82. 24-Gauge Underground Copper Cable. We tentatively conclude that we should use the regression equation in the NRRI Study, as modified by the Huber methodology described above, to estimate the cost of 24-gauge underground copper cable. We also tentatively conclude that we should use the same three adjustments proposed for 24-gauge aerial copper cable, with one exception.[165] We tentatively conclude that we should reduce the regression coefficient for the number of copper pairs by 16.3 percent, to reflect superior buying power, based on the analysis in the NRRI study.[166] We seek comment on the use of this equation and the proposed adjustments.

83. 24-Gauge Buried Copper Cable. We tentatively conclude that it is necessary to modify the regression equation in the NRRI Study, as modified by the Huber methodology described above, to estimate the cost of a 24-gauge buried copper cable, because the equation in the study includes labor and material costs for both buried cable and structure. Appendix D provides further detail on this proposed equation.[167] We seek comment on this tentative conclusion and proposed equation.

84. We propose to make the same three adjustments to this equation as we proposed for 24-gauge aerial and underground cables, with the exception of the adjustment for superior buying power. Because the NRRI Study does not include a recommendation for such an adjustment for buried cable, we tentatively conclude we should use 15.2 percent, which is the lower of the reductions used for aerial and underground cable. We seek comment on the use of these adjustments for 24-gauge buried cable.

85. 26-Gauge Copper Cable. Because the NRRI Study did not provide estimates for 26-gauge copper cable, we must either use another data source or find a method to derive these estimates from those for 24-gauge. The HAI sponsors support the proposal presented by Commission staff at the workshop to use the relative weight of copper to adjust the 24-gauge copper costs to derive 26-gauge copper costs, although they would make further adjustments to reflect the cost of 26-gauge copper for cable sizes of 400 pairs and larger.[168] The BCPM sponsors challenge the assumption that the cost of copper cable is closely tied to the relative weight of the copper in the cable.[169] Both the HAI sponsors and the BCPM sponsors argue that

---

[165] *See* Appendix D, section I.B.

[166] Based on data entered into the record in the aforementioned proceeding before the Maine Commission, Gabel and Kennedy determined that Bell Atlantic's material costs for underground copper cable are approximately 16.3 percent less than these costs for the RUS companies. *See* NRRI Study at 47.

[167] *See* Appendix D, section I.C.

[168] MCI Feb. 9, 1999 *ex parte*.

[169] Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated Feb. 26, 1999 (Sprint Feb. 26, 1999 *ex parte*).

the cost of splicing is not directly a function of investment, but rather is primarily a function of the number of pairs to be spliced, and the distance between splices.[170] Although they agree that splicing costs should be estimated using the average cost per pair-foot, they disagree over what those costs should be.

86. We tentatively conclude that we should derive cost estimates for 26-gauge cable by adjusting our estimates for 24-gauge cable. We agree with the BCPM sponsors that the cost of copper cable should not be estimated based solely on the relative weight of the cable. Instead, we propose to use the ordinary least squares regression technique to estimate the ratio of the cost of 26-gauge to 24-gauge cable for each plant type (*i.e.*, aerial, underground, buried). We propose to estimate these ratios using data on 26-gauge and 24-gauge cable costs submitted by Aliant and Sprint and the BCPM default values for these costs.[171] While we would prefer to develop these ratios based on data from more than these three sources, we tentatively conclude that these are the best data available on the record for this purpose. We seek comment on these tentative conclusions and proposed analysis, including the regression techniques described in Appendix D.[172] We invite parties to propose alternative methods of deriving cost estimates for 26-gauge cable.

c. Cost of Fiber Cable

87. In selecting input values for fiber cable costs, we must determine values for the cost per foot of fiber for various strand sizes for aerial, underground, and buried cable. Both the HAI and BCPM sponsors provide default input values for fiber cable costs that are based upon the opinions of their respective experts, without data enabling us to substantiate those opinions. In addition, the Commission received cable cost data from a number of LECs, including data received in response to the structure and cable cost survey, which staff is continuing to analyze, as noted above.

88. At the December 11, 1998 workshop, Commission staff described how they had computed the preliminary fiber cable costs, by pair size and by plant type (aerial, buried, or underground) that had been posted on the Commission's Web site prior to the workshop. Using a methodology similar to the one used for copper cable, staff estimated the cost of the smallest size fiber cable based on an analysis of proposed values and used the analysis in the NRRI Study to derive costs for larger sizes.

---

[170] MCI Feb. 9, 1999 *ex parte* at 6-7; Sprint Feb. 26, 1999 *ex parte*, attachment at 6.

[171] We are not able to use the HAI default values in addition to these data to estimate these ratios because the HAI defaults do not have separate values for 26-gauge and 24-gauge cable costs for each different cable size.

[172] *See* Appendix D, sections I.D, E, F.

89. We tentatively conclude that we should use the RUS data and the analysis in the NRRI Study, with certain adjustments, to estimate fiber cable costs. For the reasons discussed above for copper cable, we also tentatively conclude that the cost of fiber cable will vary for aerial, underground, and buried plant. We tentatively select the input values for the per foot cost of aerial, underground, and fiber cable in various strand sizes, as shown in Appendix A. We seek comment on these tentative conclusions and proposed values.

90. Aerial Fiber Cable. We tentatively conclude that we should use the regression equation in the NRRI Study, as modified by the Huber methodology described above, to estimate the cost of aerial fiber cable, with three adjustments similar to those made for copper cable.[173] We seek comment on this tentative conclusion.

91. As noted, we propose three adjustments to the equation used in the NRRI Study to estimate the cost of aerial fiber cable. First, based on the NRRI Study, we propose to reduce by 33.8 percent the regression coefficient for the number of fiber strands, to reflect the superior buying power of non-rural LECs.[174] Second, for the reasons described earlier,[175] we tentatively conclude that we should add a loading of 10 percent to the material and labor cost of the cable (net of LEC engineering and splicing costs) to approximate the cost of LEC engineering. Finally, we tentatively conclude that we should add a loading for splicing costs of 4.7 percent to the material and labor cost of the cable (net of LEC engineering and splicing costs), based on the estimates in the NRRI Study.[176] We seek comment on these tentative conclusions and proposed adjustments.

92. Underground Fiber Cable. We tentatively conclude that we should use the regression equation in the NRRI Study, as modified by the Huber methodology described above, to estimate the cost of underground fiber cable, with three adjustments similar to those made for aerial fiber cable.[177] We seek comment on this tentative conclusion.

93. As noted, we propose three adjustments to the NRRI equation for the cost of underground fiber cable. First, based on the NRRI Study, we propose to adjust downward by

---

[173] This modified regression equation is set forth in Appendix D, section II.A. The appendix also includes an example of how we propose to use this equation to estimate the cost of aerial fiber cable.

[174] Based on data entered into the record in the aforementioned proceeding before the Maine Commission, Gabel and Kennedy determined that Bell Atlantic's material costs for fiber cable are approximately 33.8 percent less than these costs for the RUS companies. *See* NRRI Study at 47.

[175] *See supra* para. 80.

[176] NRRI Study at 29.

[177] *See* Appendix D, section II.B.

27.8 percent the regression coefficient for the number of fiber strands, to reflect the superior buying power of non-rural LECs.[178] Second, for the reasons described earlier,[179] we tentatively conclude that we should add a loading of 10 percent to the material and labor cost of the cable (net of LEC engineering and splicing costs) to approximate the cost of LEC engineering. Finally, we tentatively conclude that we should add a loading for splicing costs of 4.7 percent to the material and labor cost of the cable (net of LEC engineering and splicing costs), based on the estimates in the NRRI Study.[180] We seek comment on these tentative conclusions and proposed adjustments.

94. Buried Fiber Cable. We tentatively conclude that it is necessary to modify the regression equation in the NRRI Study, as modified by the Huber methodology described above, to estimate the cost of a buried fiber cable, because the equation in the study includes labor and material costs for both buried fiber cable and structure. Appendix D provides further detail on the proposed modifications to the equation used in the NRRI Study.[181] We seek comment on this tentative conclusion and proposed equation.

95. We also propose three adjustments to the proposed equation. First, based on the NRRI Study, we propose to reduce by 27.8 percent the regression coefficient for the number of fiber strands, to reflect the superior bargaining power of non-rural LECs.[182] Second, for the reasons described earlier,[183] we tentatively conclude that we should add a loading of 10 percent to the material and labor cost of the cable (net of LEC engineering and splicing costs) to approximate the cost of LEC engineering. Finally, we tentatively conclude that we should add a loading for splicing costs of 4.7 percent to the material and labor cost of the cable (net of LEC engineering and splicing costs), based on the estimates in the NRRI Study.[184] We seek comment on these tentative conclusions and proposed adjustments.

---

[178] *See* NRRI Study at 47.

[179] *See supra* para. 80.

[180] NRRI Study at 29.

[181] *See* Appendix D, section II.C.

[182] Based on data entered into the record in the aforementioned proceeding before the Maine Commission, Gabel and Kennedy determined that Bell Atlantic's material costs for underground and aerial fiber cable are approximately 33.8 and 27.8 percent lower than the RUS values. *See* NRRI Study at 47. No data are available for buried fiber. We tentatively conclude that we should use the lower of these two numbers -- 27.8 percent -- for buried fiber cable.

[183] *See supra* para. 80.

[184] NRRI Study at 29.

c. Cable Fill Factors

96. In determining appropriate cable sizes, network engineers include a certain amount of spare capacity to accommodate administrative functions, such as testing and repair, and some expected amount of growth. The percentage of the total usable capacity of cable that is expected to be used to meet anticipated demand is referred to as the cable fill factor.[185] If cable fill factors are set too high, the cable will have insufficient capacity to accommodate small increases in demand or service outages. In contrast, if cable fill factors are set too low, the network could have considerable excess capacity for many years. While carriers may choose to build excess capacity for a variety of reasons, we must determine the appropriate cable fill factors to use in the federal mechanism. If the fill factors are too low, the resulting excess capacity will increase the model's cost estimates to levels higher than an efficient firm's costs, potentially resulting in excessive universal service support payments.

97. Variance Among Density Zones. In general, both the HAI and BCPM sponsors provide default fill factors for copper cable that vary by density zone, and they agree that fill factors should be lower in the lowest density zones.[186] HAI sponsors claim that an outside plant engineer is more interested in providing a sufficient number of spares than in the ratio of working pairs to spares, so the appropriate fill factor will vary with cable size.[187] For example, 75 percent fill in a 2400 pair cable provides 600 spares, whereas a 50 percent fill in a six pair cable provides only three spares. Because smaller cables are used in lower density zones, HAI recommends that lower fill factors be used in the lowest density zones to ensure there will be enough spares available. The BCPM sponsors claim that less dense areas require lower fill ratios because the predominant plant type is buried and it is costly to add additional capacity after installation.[188] We tentatively agree with the HAI and BCPM sponsors that fill factors for copper cable should be lower in the lowest density zones, which is reflected in the fill factors that we propose in this Notice. We seek comment of this tentative finding.

---

[185] We note that the actual fill factor may be lower than the fill factor used to design the network (sometimes referred to as administrative fill), because cable and fiber are available only in certain sizes. For example, assume a neighborhood with 100 households has a current demand of 120 telephones. Dividing the 120 pair demand by an 80 percent administrative fill factor establishes a need for 150 pairs. However, cable is not sold in 150 pair units. The company will purchase the smallest cable that is sufficient to provide 150 pairs, which is a 200 pair cable. The fill factor that occurs and is measurable, known as the effective fill, will be the number of pairs needed to meet demand, 120 pairs, divided by the number of pairs installed, 200 pair, or 60 percent.

[186] As explained below, default values in BCPM 3.1 for distribution cable do not vary by density zone.

[187] HAI Dec. 11, 1997 submission, Inputs Portfolio at 39, 63.

[188] BCPM 3.1 May 26, 1998 (Preliminary Edition) Loop Inputs Documentation at 51.

98. Distribution Fill Factors. The fill factors proposed by the HAI sponsors for distribution cable are somewhat lower than for copper feeder cable.[189] The BCPM default fill factors for distribution cable, on the other hand, currently are set at 100 percent for all density zones.[190] This difference is related to the differences between certain assumptions that were made in the HAI and BCPM models. The HAI proponents claim that the level of spare capacity provided by their default values is sufficient to meet current demand plus some amount of growth.[191] This is consistent with the HAI model's approach of designing plant to meet current demand, which on average is 1.2 lines per household. BCPM, on the other hand, designs outside plant with the assumption that every residential location has two lines, which is more than current demand. Because it is costly to add distribution plant at a later point in time, incumbent LECs typically build enough distribution plant to meet not only current demand, but also anticipated future demand.[192] BCPM adopts this convention. Setting the fill factor at 100 percent in BCPM offsets BCPM's assumption that every household has two lines and the resulting estimation of appropriate cable sizes is sufficient to meet current demand, rather than long term growth.[193]

99. In a meeting with Commission staff, Ameritech raised the issue of whether industry practice is the appropriate guideline for determining fill factors to use in estimating the forward-looking economic cost of providing the services supported by the federal mechanism. Ameritech claims that forward-looking fill factors should reflect enough capacity to provide service for new customers for a few years until new facilities are built, and should account for the

[189] HAI 5.0 default values range from 50 percent in the lowest density zone to 75 percent in the highest density zone for distribution cable sizing fill factors, and range from 65 percent in the lowest density zone to 75 percent in the highest density zone for copper feeder cable sizing fill factors. HAI Dec. 11, 1997 submission, Inputs Portfolio at 39, 63.

[190] BCPM Dec. 11, 1997 submission. Earlier versions of BCPM, however, had lower fill factors for distribution than for feeder. *See, e.g., Further Notice* at para. 118. Default values in BCPM 3.1 range from 75 to 85 percent for feeder cable.

[191] HAI Dec. 11, 1997 submission, Inputs Portfolio at 39, 63.

[192] For example, in an *ex parte* meeting on March 24, 1999, Ameritech representatives said that Ameritech designs distribution plant to meet "ultimate" demand and designs feeder plant that is "growable." *See* Letter from Celia Nogales, Ameritech, to Magalie Roman Salas, FCC, dated March 25, 1999 (Ameritech March 25 *ex parte*).

[193] Commission staff requested that the BCPM sponsors make this change from earlier versions of BCPM to avoid double counting. That is, cable sizing in BCPM is a function of both the number of lines per customer location and the fill factor. In HAI, cable sizing is a function of the number of customer locations and current demand of 1.2 telephones per household.

excess capacity required for maintenance and testing, defective copper pairs, and churn.[194]

100. We tentatively conclude that the fill factors selected for use in the federal mechanism generally should reflect current demand,[195] and not reflect the industry practice of building distribution plant to meet "ultimate" demand. The fact that industry may build distribution plant sufficient to meet demand for ten or twenty years does not necessarily suggest that these costs should be supported by universal service support mechanisms. This also appears to reflect the assumptions underlying the HAI and BCPM default fill factors. Because the synthesis model designs outside plant to meet current demand in the same manner as the HAI model, we believe the fill factors should be set at less than 100 percent. We tentatively select the HAI defaults for distribution fill factors and tentatively conclude that they reflect the appropriate fill needed to meet current demand. We seek comment on these tentative conclusions.

101. Feeder Fill Factors. In contrast to distribution plant, feeder plant typically is designed to meet only current and short term capacity needs.[196] The BCPM copper feeder default fill factors are slightly higher than HAI's, but both the HAI and BCPM default values appear to reflect current industry practice of sizing feeder cable to meet current, rather than long term, demand. Because both the HAI and BCPM default values assume that copper feeder fill reflects current demand, we tentatively select copper feeder fill factors that are the average of the HAI and BCPM default values. We seek comment on these tentative selections.

102. Fiber Fill Factors. Because of differences in technology, fiber fill factors typically are higher than copper feeder fill factors. Standard fiber optic multiplexers operate on four fiber strands: primary optical transmit, primary optical receive, redundant optical transmit, and redundant optical receive. In determining appropriate fiber cable sizes, network engineers take into account this 100 percent redundancy in determining whether excess capacity is needed that would warrant application of a fill factor.[197] Both the HAI and BCPM models use the standard practice of providing 100 percent redundancy for fiber and set the default fiber fill factors at 100 percent. We tentatively conclude that the input value for fiber fill in the federal mechanism should be 100 percent. We seek comment on this tentative conclusion.

---

[194] Ameritech filed data, subject to the protective order in this proceeding, showing how these considerations are used to calculate the actual and forward-looking fill factors in Ameritech's territory. *See* Ameritech March 25 *ex parte*.

[195] We define "current demand" to include a reasonable amount of excess capacity to accommodate short term growth.

[196] *See, e.g.,* Ameritech March 25 *ex parte*.

[197] That is, fiber plant with a 100 percent fill factor has an actual utilization of 50 percent; whereas copper plant with a 50 percent fill factor has an actual utilization of 50 percent.

C. Structure Costs

1. Background

103. In the *1997 Further Notice*, the Commission sought comment and adopted tentative findings and conclusions on issues relating to the cost of outside plant. The Commission directed the HAI and BCPM proponents to justify fully their default values for their mix of aerial, underground, and buried structure (*i.e.*, plant mix) and sought comment on the input values that will accurately reflect the impact of varying terrain conditions on costs.[198] The Commission noted that "recent installations of outside structure may more closely meet forward-looking design criteria than do historical installations."[199] The Commission found that an efficient carrier will vary its plant mix according to the population density of an area and tentatively concluded that the assignment of plant mix defined by the model should reflect both terrain factors and line density zones.[200] Because burying cable in very rocky areas is costly, for example, the Commission tentatively concluded that relatively more feeder and distribution cable should be assigned to aerial installation for all density zones in wire centers characterized as "hard rock" conditions than in those wire centers with other terrain conditions.[201]

104. Outside plant structure refers to the set of facilities that support, house, guide, or otherwise protect distribution and feeder cable and varies by plant mix. Aerial structure consists of telephone poles, and associated hardware, such as anchors and guys. Buried structure consists of trenches.[202] Underground structure consists of trenches and conduit, and for feeder plant, manholes and pullboxes. As noted, underground cable is placed underground within conduits for added support and protection. Structure costs include the initial capital outlay for physical material associated with outside plant structure, including manholes; conduit, trenches, poles, anchors and guys, and other facilities; the capitalized cost for supplies, delivery, provisioning, right of way fees, taxes, and any other capitalized costs directly attributable to these assets; and the capitalized cost for the labor, engineering, and materials required to install these assets. For example, buried and underground structure costs include capitalized labor, engineering, and material costs for such activities as plowing or trenching, backfilling, boring cable, and cutting and restoring asphalt, concrete, or sod, or any combination of such activities.

---

[198] *1997 Further Notice*, 12 FCC Rcd at 18541.

[199] *1997 Further Notice*, 12 FCC Rcd at 18541.

[200] *1997 Further Notice*, 12 FCC Rcd at 18541.

[201] *1997 Further Notice*, 12 FCC Rcd at 18541.

[202] When a plow is used to place buried cable, a separate trench is not required.

105. Both the HAI and BCPM sponsors provide default input values for structure costs that are based upon the opinions of their respective experts, without backup data that allows us to substantiate these values. Although BCPM provides one nationwide set of default values for structure costs, the BCPM sponsors have argued that we should use company-specific inputs and have proposed alternative values for company-specific structure costs in some study areas.[203] In addition, the Commission received other structure cost data from a number of LECs, including data received in response to the structure and cable cost survey developed by staff, which staff is continuing to analyze, as noted above.

2. Issues for Comment

106. The synthesis model uses structure cost tables that identify the per foot cost of structure by type (aerial, buried, or underground), loop segment (distribution or feeder), and terrain conditions (normal, soft rock, or hard rock), for each of the nine density zones. For aerial structure, the cost per foot that is entered in the model is calculated by dividing the total installed cost per telephone pole by the distance between poles. As described below, we tentatively conclude that we should use, with certain modifications, the estimates in the NRRI Study for the per foot cost of aerial, underground, and buried structure. In general, these estimates are derived from regression equations that measure the effect on these costs of density, water, soil, and rock conditions.

a. Cost of Aerial Structure

107. We tentatively conclude that we should use the regression equation for aerial structure in the NRRI Study as a starting point.[204] We propose to use this equation to develop proposed input values for the labor and material cost for a 40-foot, class four telephone pole. We develop separate pole cost estimates for normal bedrock, soft bedrock, and hard bedrock.[205] The regression coefficients estimate the combined cost of material and supplies. The NRRI Study reports that the average material price for a 40-foot, class four pole is $213.94.[206] We note that this estimate is very close to results obtained from the data submitted in response to the *1997 Data Request*. According to the Commission staff's analysis of these data, the unweighted

---

[203] *See* Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated June 11, 1998, attachment; BellSouth reply comments dated June 12, 1998, at 2 (arguing only state specific input values are appropriate); Letter from William W. Jordan, BellSouth, to Magalie Roman Salas, FCC, dated August 7, 1998, attachment, Responses to FCC Staff Questions of June 25, 1998, Question 4.

[204] *See* NRRI Study at 52, Table 2-12. This regression equation is set forth in Appendix D, section III.A.

[205] *See* Appendix D, section III.A.

[206] NRRI Study at 51, Table 2-11.

average material cost of a 40-foot, class four pole is $213.97, and the weighted average, by line count, is $228.22.[207] We seek comment on this tentative conclusion and analysis.

108. We tentatively conclude that we should add to these estimates the cost of anchors, guys, and other materials that support the poles, because the RUS data from which this regression equation was derived do not include these costs. In the NRRI Study, Gabel and Kennedy used the RUS data to develop the following cost estimates for anchors, guys and other pole-related items: $32.98 in rural areas, $49.96 in suburban areas, and $60.47 in urban areas.[208] We tentatively conclude that these are reasonable estimates for the cost of anchors, guys, and other pole-related items. We seek comment on these tentative conclusions and proposed values.

109. We also tentatively add an estimate for the cost of LEC engineering, which is not reflected in the data from which Gabel and Kennedy derived cost estimates for poles and anchors, guys, and pole-related materials. For the reasons described above for copper and fiber cable, we tentatively conclude that we should add a loading of 10 percent to the material and labor cost (net of LEC engineering) for poles, anchors, guys, and other pole-related items. We seek comment on these tentative conclusions and invite proposals justifying an alternative loading factor for LEC engineering.

110. In order to obtain proposed input values that can be used in the model, we must convert the estimated pole costs into per foot costs for each of the nine density zones. For purposes of this computation, we propose to use for density zones 1 and 2 the per pole cost that we have estimated for rural areas, based on the NRRI Study; for density zones 3 through 7 the per pole cost for suburban areas; and for density zones 8 and 9 the per pole cost for urban areas. We then divide the estimated cost of a pole by the estimated distance between poles. We propose to use the following values for the distance between poles: 250 feet for density zones 1 and 2; 200 feet for zones 3 and 4; 175 feet for zones 5 and 6; and 150 feet for zones 7, 8, and 9. For the most part, these values are consistent with both the HAI and BCPM defaults. We seek comment on these proposals.

b. Cost of Underground Structure

111. We tentatively conclude that we should adopt a similar methodology to estimate the cost of underground structure, as we proposed for the cost of aerial structure. We tentatively conclude that we should use the equation set forth in the appendix as a starting point for this

[207] This is slightly higher than the HAI default value of $201.00 for the same height and class pole, and considerably less than the BCPM default value of $368.17

[208] *See* NRRI Study at 55, Table 2-14.

estimate.[209] We propose to use this equation to develop proposed input values for the labor and material cost for underground cable structure. We develop separate cost estimates for underground structure in normal bedrock, soft bedrock, and hard bedrock for density zones 1 and 2.[210] As we did for aerial structure, we tentatively conclude that we should add a loading factor of 10 percent for LEC engineering. We seek comment on these tentative conclusions.

112. We are able to develop directly from the regression equation cost estimates for underground structure only in density zones 1 and 2, because the RUS data is from companies that operate only in those density zones. We tentatively conclude that we should derive cost estimates for density zones 3 through 9 by extrapolating from the estimates for density zone 2. We further tentatively conclude that we should perform such extrapolation based on the growth rate between density zones in the BCPM and HAI default values for underground and buried structure.[211] Although we would prefer to rely on data specific to the density zone, rather than extrapolated, we tentatively conclude that, based on our current analysis, this is the best data currently available for this purpose.[212] We seek comment on these tentative conclusions. In Appendix D, we describe the proposed method of extrapolation.[213] We seek comment on this proposed method and invite parties to suggest alternative methods for estimating costs in density zones 3 through 9.

c. Cost of Buried Structure

113. We tentatively conclude that we should use the modified equation for estimating the cost of 24-gauge buried copper cable and structure to estimate the cost of buried structure.[214] It is necessary to modify this equation because estimates derived from it include labor and material costs for both buried cable and structure. Appendix D provides further detail on the modified

[209] *See* Appendix D, section III.B. This regression equation is based on the RUS data, but was developed after the publication of that report. The NRRI Study does not set forth a regression equation for estimating the cost of underground structure.

[210] This regression equation was developed using underground cost data for density zones 1 and 2. The variable in this equation that represents the density zone of the geographic area in which the underground costs are incurred is not statistically significant at any standard level of significance.

[211] We propose to use this same extrapolation method for both underground and buried structure.

[212] As noted, staff is continuing to analyze the data received in response to the survey on cable costs and structure.

[213] *See* Appendix D, section III.B.

[214] This equation is set forth in Appendix D, section III.C.

equation.[215] We seek comment on this tentative conclusion.

114. For the reasons described above, we tentatively conclude that we should add a loading of 10 percent for LEC engineering to the estimates generated by the modified equation. We seek comment on this tentative conclusion.

115. We are able to develop directly from the regression equation cost estimates for buried structure only in density zones 1 and 2, because the RUS data is from companies that operate only in those density zones. We tentatively conclude that we should derive cost estimates for density zones 3 through 9 by extrapolating from the estimates for density zone 2. We further tentatively conclude that we should perform such extrapolation based on the same method proposed for estimating the cost of underground structure. We seek comment on these tentative conclusions.[216]

d. Plant Mix

116. As discussed above, we have tentatively selected input values for the costs of cable and outside plant structure that differ for aerial, buried, and underground cable and structure. Because these cost differences can be significant, the relative amount of plant type in any given area, *i.e.*, the plant mix, plays a significant part in determining total outside plant investment. The synthesis model provides three separate plant mix tables, for distribution, copper feeder, and fiber feeder, which can accept different percentages for each of the nine density zones. Although we tentatively propose using nationwide input values for plant mix, as we have for other input values, we seek comment on an alternative to nationwide plant mix input values, as discussed below.

117. The BCPM sponsors claim that in low densities there generally is a greater percentage of buried plant than underground plant, and conversely, in higher densities there is more underground than buried plant.[217] The BCPM default plant mix values reflect these assumptions. Although the HAI default plant mix values for feeder plant also reflect these assumptions, HAI's assumptions with respect to distribution plant mix are quite different than BCPM's, as discussed below. The HAI sponsors suggest that aerial plant is still the most prevalent plant type, but claim that their default plant mix values reflect an increasing trend toward the use of buried cable in new subdivisions.[218] The HAI default values generally assume

---

[215] *See* Appendix D, section III.C.

[216] This extrapolation method is described in Appendix D, section III.B.

[217] BCPM, Loop Inputs Documentation at 49, 54.

[218] HAI Inputs Portfolio at 37. The HAI sponsors quote a 1994 edition of Bellcore's *BOC Notes on the LEC Networks*: "The most common cable structure is still the pole line. Buried cable is now used whenever feasible, but

that there is more aerial plant than the BCPM default values.[219] The BCPM defaults have separate values for plant mix in hard rock terrain, which generally assume there is slightly more aerial and less buried plant than the normal and soft rock terrain defaults.

118. Distribution Plant. The BCPM default values for distribution plant assume that there is no underground plant in the lowest density zone and the percentage increases with each density zone to 90 percent underground distribution plant in the highest density zone. In contrast, the HAI default values for distribution plant mix place no underground structure in the six lowest density zones and assume that only 10 percent of the structure in the highest density zone is underground.[220] The BCPM default values assume there is no aerial plant in the highest density zone in normal and soft rock terrain, and 10 percent aerial plant in hard rock terrain. In contrast, the HAI default values assume that there is significantly more aerial cable, 85 percent, in the highest density zone, but notes that this includes riser cable within multi-story buildings and "block cable" attached to buildings, rather than to poles.

119. We tentatively select input values for distribution plant mix that more closely reflect the assumptions underlying BCPM's default values than HAI's default values for several reasons. The synthesis model does not design outside plant that contains either riser cable or block cable, so we do not believe it would be appropriate to assume that there is as high a percentage of aerial plant in densely populated areas as the HAI default values assume. Although our proposed plant mix values assume somewhat less underground structure in the lower density zones than the BCPM default values, we disagree with HAI's assumption that there is very little underground distribution plant and none in the six lowest density zones. We tentatively select the distribution plant mix values set forth in Appendix A, and seek comment on our tentative conclusions. We tentatively propose input values, for the lowest to the highest density zones, that range from zero percent to 90 percent for underground plant; 60 to zero percent for buried plant; and 40 to ten percent for aerial plant.

120. Feeder Plant. The default plant mix percentages for feeder plant are generally similar in the BCPM and the HAI models. Although the BCPM default values vary between normal or soft rock terrain and hard rock terrain, as noted above, and the HAI default values

---

pole lines remain an important structure in today's environment."

[219] In the four lowest density zones, the HAI defaults assume slightly less aerial fiber feeder than the BCPM defaults, but in all other cases, assume more aerial plant than BCPM. In addition, the HAI model provides that a certain percentage of buried plant can be shifted to aerial (and vice versa) based on certain cost minimization routines.

[220] HAI Inputs Portfolio at 36.

differ between copper and fiber feeder, the plant mix ratios across density zones are similar.[221] For example, both the BCPM default values and the HAI default values assume that there is only five or ten percent of underground feeder plant in the lowest density zone.[222] The HAI defaults assume there is somewhat more aerial feeder cable than the BCPM defaults, except for fiber feeder cable in the four lowest density zones. The BCPM defaults assume there is no aerial feeder plant in the three highest density zones, except in hard rock terrain. Despite these differences, the relative amounts of aerial and buried plant across density zones are generally similar.[223]

121. We tentatively select input values for feeder plant mix, set forth in Appendix A, that generally reflect the assumptions underlying the BCPM and HAI default plant mix percentages, with certain modifications. We tentatively propose input values, for the lowest to the highest density zones, that range from five percent to 95 percent for underground plant; 50 to zero percent for buried plant; and 45 to five percent for aerial plant. Based on the Commission staff's preliminary review of the structure and cable survey data,[224] the proposed values, unlike the HAI and the BCPM (for normal and soft rock) default values, assume that there is no buried plant in the highest density zone. In contrast to the BCPM defaults, the proposed values assume there is some aerial plant in the three highest density zones. We tentatively find that it is reasonable to assume that there is some aerial feeder plant in all density zones, as HAI does, particularly in light of our assumption that there is no buried feeder in the highest density zone, where aerial placement would be the only alternative to underground plant. Although the HAI sponsors have proposed plant mix values that vary between copper feeder and fiber feeder, they have offered no convincing rationale for doing so. We tentatively conclude that, like the BCPM defaults, our proposed plant mix ratios should not vary between copper feeder and fiber feeder. We seek comment on our tentative conclusions.

122. Alternatives to Nationwide Plant Mix Values. In the *1997 Further Notice*, the Commission tentatively concluded that plant mix ratios should vary with terrain as well as density zones. Because the synthesis model does not provide separate plant mix tables for different

[221] The BCPM default values for copper and fiber feeder are the same.

[222] HAI default values assume five percent underground feeder plant in the lowest density zone for both copper feeder and fiber. BCPM default values assume ten percent underground copper and fiber feeder in normal and soft rock terrain and five percent in hard rock terrain.

[223] For aerial plant, in the lowest to the highest density zones, the BCPM defaults range from 40 to zero percent for normal and soft rock terrain, and from 50 to five percent for hard rock terrain; and the HAI defaults range from 50 to five percent for aerial copper feeder and 35 to five percent for fiber feeder. For buried plant, in the lowest to the highest density zones, the BCPM defaults range from 50 to zero percent for normal and soft rock terrain, and from 45 to zero percent for hard rock terrain; and the HAI defaults range from 45 to five percent for buried copper feeder and 60 to five percent for fiber feeder.

[224] The survey is described above. *See supra* para. 53; *see also* App. C.

terrain conditions, the proposed nationwide plant mix values do not vary by terrain. One method of varying plant mix by terrain would be to add separate plant mix tables, as there are in BCPM, to the synthesis model. We observe that, while the BCPM model provides separate plant mix tables, the BCPM default values reflect only slightly more aerial and less buried plant in hard rock terrain than in normal and soft rock terrain. Another method of varying plant mix would be to use company specific or state specific input values for plant mix as advocated by the BCPM sponsors and other LECs.[225]

123. We generally have chosen not to use study area specific input values in the federal mechanism, and recognize that historical plant mix ratios may not reflect an efficient carrier's plant type choice today. On the other hand, historical plant mix also may reflect terrain conditions that will not change over time. For example, because it is costly to bury cable in hard rock, a carrier serving a very rocky area would tend to use more aerial than buried plant. The Commission staff's analysis of current ARMIS data reveals a great deal of variability in plant mix ratios among the states. In certain state proceedings, U S West has proposed an algorithm for adjusting plant mix to reflect its actual sheath miles as reported in ARMIS. We seek comment on a modified version of this algorithm as an alternative method of determining plant mix percentages.

124. The proposed algorithm uses ARMIS 43-08 data on buried and aerial sheath distances and trench distances to allocate model determined structure distance between aerial, buried, and underground structures.[226] The first step is to set the underground structure distance equal to the ARMIS trench distance and to allocate that distance among the density zones on the basis of the nationwide plant mix defaults. Then an initial estimate of aerial plant is calculated as the sum of the synthesis model structure distances by density zone multiplied by the nationwide aerial plant mix defaults. A second estimate of aerial plant is calculated by multiplying structure distance less trench miles by the aerial percentage of total ARMIS sheath miles. Then an adjustment ratio is calculated by dividing the second estimate by the initial estimate. This adjustment ratio is then applied to each density zone to adjust the nationwide default so that the final synthesis model plant mix reflects the study area specific plant mix. The buried plant mix percentage is determined as a residual equal to one minus sum of the underground and aerial percentages. We seek comment on this alternative to nationwide plant mix values. We also invite parties to suggest other alternatives to determine plant mix in the synthesis model.

125. We also seek comment on whether we should allow the synthesis model to choose

[225] As noted above, although the BCPM sponsors have provided nationwide default values, they generally advocate company specific input values.

[226] Structure distance, also known as route distance, measures the distance of the pole line or the trench. Sheath distance measures cable distance. If there is only one cable along a particular route then structure distance and sheath distance are equal. When, however, there is more than one cable along a route, sheath distance will be a multiple of the structure distance.

the plant mix on the basis of minimum annual cost. We note that this optimization would be constrained to reflect the embedded underground plant percentage, because underground plant is typically deployed in relatively dense areas for reasons of public safety. Embedded percentages of aerial and buried plant, on the other hand, may reflect zoning ordinances but we note that these ordinances in turn may reflect purely aesthetic concerns rather than public safety. If we were to determine that we should use study area specific plant mix input values, we seek comment on whether the synthesis model should be permitted to use its optimization feature for percentages of aerial and buried plant.

D. Structure Sharing

1. Background

126. Outside plant structures are generally shared by LECs, cable operators, electric utilities, and others, including competitive access providers and interexchange carriers. To the extent that several utilities may place cables in common trenches, or on common poles, it is appropriate to share the costs of these structures among the various users and assign a portion of the cost of these structures to the LEC.

127. In the *1997 Further Notice*, the Commission tentatively concluded that 100 percent of the cost of cable buried with a cable plow should be assigned to the telephone company.[227] In addition, the Commission also tentatively concluded that Sprint's suggested value of 66 percent is an acceptable aggregate default input value for the percent of costs assigned to the LEC for all other shared facilities.[228] Several commenters disagreed with these tentative conclusions.[229] The Commission also sought comment on AT&T's contention that changes to the regulatory climate will increase the extent to which carriers are required or willing to share structures.[230]

128. Several comments relating to structure sharing values were filed in response to the *1997 Further Notice*.[231] Both the BCPM and HAI models vary the percentage of costs they assume will be shared depending on the type of structure (aerial, buried, or underground) and line

---

[227] *1997 Further Notice*, 12 FCC Rcd at 18547, para. 80.

[228] *1997 Further Notice*, 12 FCC Rcd at 18548, para. 81.

[229] *See* AT&T/MCI Sept. 24 comments at 12-13; Florida PSC Sept. 24 comments at 6-7; GTE Sept. 24 comments at 9.

[230] *1997 Further Notice*, 12 FCC Rcd at 18548, para. 82.

[231] *See, e.g.*, AT&T/MCI Sept. 24 comments; Bell Atlantic Sept. 24 comments; GTE Sept. 24 comments.

density. The model proponents differ significantly, however, on their assumptions as to the extent of sharing and, therefore, assignment of structure cost to the LEC.[232]

2. Issues for Comment

129. We tentatively adopt the following structure sharing percentages that represent the percentage of structure costs to be assigned to the LEC. For aerial structure, we tentatively assign 50 percent of structure cost in density zones 1-6 and 35 percent of the costs in density zones 7-9 to the LEC. For underground and buried structure, we tentatively assign 90 percent of the cost in density zones 1-2, 85 percent of the cost in density zone 3, 65 percent of the cost in density zones 4-6, and 55 percent of the cost in density zones 7-9 to the LEC.[233]

130. We believe that the structure sharing percentages that we tentatively adopt reflect a reasonable percentage of the structure costs that should be assigned to the LEC. We note that our tentative conclusions reflect the general consensus among commenters that structure sharing varies by structure type and density. While disagreeing on the extent of sharing, the majority of commenters agree that sharing occurs most frequently with aerial structure and in higher density zones.[234] For example, no commenter attributes more than 50 percent of the cost of aerial structure to the LEC. The sharing values that we tentatively adopt reflect these guidelines. In addition, we note that the Washington Utilities and Transportation Commission has adopted structure sharing values that are similar to those that we tentatively adopt.[235] We also note that the sharing values that we tentatively adopt fall within the range of values proposed by HAI and BCPM.

131. In addition, we agree with the Nebraska Public Service Commission that there are some opportunities for sharing even in the lowest density zones.[236] As noted by the Nebraska Commission, "[e]ven in these more remote regions of the state, there will be some opportunities

---

[232] *See* HAI Dec. 11, 1997 submission, App. B at 57; BCPM Jan. 31, 1997 submission, Att. 9. The BCPM sponsors assume that an efficient telephone company will benefit only marginally from sharing. The HAI sponsors assume that utilities will engage in substantial sharing with telephone companies, and generally assigns between 25% and 50% of the cost of shared facilities to the LEC.

[233] *See* Appendix A for a complete list of the input values that we tentatively adopt in this Further Notice.

[234] *See, e.g.,* HAI Dec. 11, 1997 submission, App. B at 57; BCPM Jan. 31, 1997 submission, Att. 9; Montana State Cost Study at 46-47.

[235] *See* Washington USF Proceeding, Docket No. UT-980311(a), App. D.

[236] Letter from Frank E. Landis, Nebraska Public Service Commission, to Magalie Roman Salas, FCC, dated May 22, 1998 (Nebraska State Cost Study) at 5.

for sharing as new homes and businesses are constructed."[237] We therefore do not assign 100 percent of the cost of buried or underground structure to the LEC in the lowest density areas, as suggested by the BCPM proponents.

132. We seek comment on the tentative conclusions set forth in this section. In addition, we seek comment on AT&T's contention that the structure sharing percentages should reflect the potential for sharing, rather than the LEC's embedded sharing practice.[238]

E. Serving Area Interfaces

1. Background

133. A serving area interface (SAI) is a centrally located piece of network equipment that acts as a physical interface between a copper feeder cable connecting a wire center and neighborhood distribution copper cables.[239] The model includes copper cable and SAI investment only when there are no DLC or T1 terminals.[240] The model input table lists prices for indoor and outdoor SAIs of various sizes.[241] An indoor SAI is generally used in multi-unit buildings housing business establishments or residential accommodations. The construction of an outdoor SAI involves the additional cost of metal cabinets for housing protection and connection materials. Thus, the cost of constructing an outdoor SAI tends to be somewhat higher than the cost of constructing an indoor SAI. Consequently, an outdoor SAI is generally used only when there is no place to house an indoor SAI.

134. Both the sponsors of BCPM and HAI have submitted default input values for indoor and outdoor SAI costs. In addition, Sprint submitted cost estimates for a 7200 pair indoor SAI.[242] Because the cost of a SAI depends on the cost of its components, we tentatively conclude

---

[237] Nebraska State Cost Study at 5.

[238] AT&T Sept. 24 comments at 12-13. For example, AT&T contends changes in the regulatory climate have increased the extent to which carriers are required or are willing to share structures.

[239] Generally, when a neighborhood is located near a wire center, copper feeder cable, using analog transmission, is deployed to connect the wire center to the SAI. From the SAI, copper cables of varying gauge extend to all of the customer premises in the neighborhood.

[240] Both indoor and outdoor SAI investments are a function of the total number of pairs, both feeder and distribution, that the SAI terminates.

[241] The current version of the model supports eighteen SAI sizes. SAI capacities currently supported are 7200, 5400, 4200, 3600, 3000, 2400, 2100, 1800, 1200, 900, 600, 400, 300, 200, 100, 50, 25 and 1 line facilities.

[242] *Indoor SAI Cost Analysis*, submitted by Sprint - Local Telecommunications Division, July 30, 1998.

that, in the absence of contract data between the LECs and suppliers, it is necessary to evaluate the cost of these components. Our analysis therefore begins with a review of the data and justifications submitted by the HAI sponsors and Sprint regarding the cost of the components that comprise a 7200 pair indoor SAI.[243]

135. On or around November 25, 1998, Commission staff posted preliminary ranges of SAI input values on the Commission's Web site to elicit comment and empirical data from interested parties on the cost of SAIs.[244] Commission staff also conducted a workshop on December 11, 1998, to discuss the posted preliminary inputs.[245]

2. Issues for Comment

a. Cost of a 7200 Pair SAI

136. Our proposed approach takes into account the cost of the following SAI components for a 7200 pair indoor SAI: building entrance splicing and distribution splicing; protectors; tie cables; placement of feeder blocks; placement of cross-connect jumpers/punch down; and placement of distribution blocks. Of these, we tentatively conclude that protector and splicing costs are the main drivers of SAI costs, and cross-connect costs and feeder block and distribution block installation costs greatly contribute to the difference in Sprint's and the HAI proponents' indoor SAI costs.[246] Based upon the following analysis of the record regarding these costs, we propose a total cost of $21,708 for the 7200 pair indoor SAI.[247] We seek comment on

---

[243] We note that the BCPM defaults do not specify estimates for the cost of SAI components.

[244] *Workshop Public Notice* at 2. Commission staff used BCPM default inputs as the low end of the ranges for both indoor and outdoor SAIs, and Sprint's cost estimates as the high end of the range for indoor SAIs. The high end of the range for outdoor SAIs represented staff's analysis of state-approved SAI parameters. Staff's preliminary ranges for SAI costs did not include HAI inputs because staff concluded that HAI had not included all of the materials and splicing required to install this equipment.

[245] *See Common Carrier Bureau Releases Preliminary Common Input Values to Facilitate Selection of Final Input Values for the Forward-Looking Cost Model for Universal Service*, Public Notice, CC Docket Nos. 96-45, 97-160, DA 99-295 (rel. Feb. 5, 1999) (*Preliminary Input Values Public Notice*); *Workshop Public Notice*. S*ee also*, Preliminary Input Values Handouts, dated December 11, 1998.

[246] *See* Appendix D, section IV for a breakdown of costs for each component calculated to derive the proposed cost of a 7200 pair DLC.

[247] The following is a break-down of costs for a 7200 SAI size:

Building Entrance Splicing	$1,014.00
Protectors	$12,520.00
Placement of Feeder Blocks	$930.00

this tentative analysis.

137. Protector Costs. The cost of the protector is the single greatest contributor to the difference in Sprint's and HAI's indoor SAI costs. HAI proposes a cost of $2.00 per pair for protector material, and Sprint initially proposed a $6.62 cost per pair for protector material. In its review of Sprint's proposed cost, staff concluded that all of the parts identified in Sprint's proposal may not be necessary for SAI construction. Staff also believed, however, that HAI's proposal was for less than a fully functional SAI, and found HAI's proposed cost to be too low. Having analyzed the *ex parte* submissions, staff proposed a cost of $4.00 per pair for protector material.[248] In its February 4, 1999, *ex parte* submission, Sprint agreed that $4.00 is a reasonable estimate of the cost. We tentatively adopt this proposed value and seek comment.[249]

138. Splicing and Labor Rates. HAI and Sprint propose different splicing rates, but do not dispute splice set-up time. The HAI sponsors propose a splicing rate of 300 pairs per hour, while Sprint argues for a splicing rate of 100 pairs per hour.[250] We believe that HAI's proposed rate is a reasonable splicing rate under optimal conditions, and therefore, we tentatively conclude that Sprint's proposed rate is too low. We note that the HAI sponsors have submitted a letter from AMP Corporation, a leading manufacturer of wire connectors, in support of the HAI rate.[251] We recognize, however, that splicing under average conditions does not always offer the same achievable level of productivity as suggested by the HAI sponsors. For example, splicing is not typically accomplished under controlled lighting or on a worktable. Having accounted for such variables, we propose to adjust the splicing rate to 250 pairs per hour. We also propose a $60.00

Placement of Cross Connects	$4,067.00
Placement of Distribution Blocks	$2,363.00
Placement of 41 each 100 Pair Distribution Tie Cables	$187.00
Distribution Splicing	$627.00
Total	$21,708.00

[248] Preliminary Input Values Handouts, dated December 11, 1998.

[249] Appendix D shows how we use this value to estimate the total cost of protectors in a 7200 pair indoor SAI. *See* Appendix D, section IV.

[250] *See* Letter from Chris Frentrup, MCI WorldCom, to Magalie Roman Salas, FCC, dated January 21, 1999. On January 20, 1999, the sponsors of HAI provided a demonstration of splicing, in support of their splicing rate. Letter from Kenneth Cartmell, U S West, dated February 8, 1999, to Magalie Roman Salas, FCC; Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated February 4, 1999.

[251] *See* attachment to letter from Chris Frentrup, Senior Economist, MCI WorldCom, to Magalie Roman Salas, FCC, dated January 21, 1999.

per hour labor rate for splicing, which is within the range of filings on the record.[252] We seek comment on these proposed values.[253]

139. Cross-Connect Costs. The cross-connect is the physical wire in the SAI that connects the feeder and distribution cable. Sprint asserts that the "jumper" method generally will be employed to cross-connect in a SAI. In contrast, HAI suggests that the "punch down" method is generally used to cross-connect. We tentatively conclude that neither the jumper method nor the punch down method is used exclusively in SAIs. In buildings with high churn rates, such as commercial buildings, carriers may be more likely to use the jumper method. On the other hand, in residential buildings, where changes in service are less likely, carriers may be more likely to use the less expensive punch down method. Based on the record, it appears that both methods are commonly used, and that neither is used substantially more than the other. Therefore, we tentatively conclude that we should assume that each method will be used half the time. We seek comment on this tentative conclusion.[254] In particular, we invite parties to justify a particular allocation between the jumper and punch down methods.

140. Feeder Block and Distribution Block Installation Rates. Sprint proposes an installation rate of 60 pairs per hour, while the HAI sponsors propose 400 pairs per hour. Because neither feeder block installation nor distribution block installation is a complicated procedure, we tentatively conclude that Sprint's rate of 60 pairs per hour is too low. We recognize, however, that installation conditions are not always ideal. Like splicing, feeder block and distribution block installations are not typically accomplished under controlled lighting or on a worktable. Having accounted for such variables, we propose a rate of 200 pairs per hour. We seek comment on this proposed value.[255]

b. Cost of Other SAI Sizes

141. Because we currently do not have similar component-by-component data for other SAI sizes, we propose to determine the costs of the other SAI sizes by extrapolating from the cost of the 7200 pair indoor SAI. We believe that this is a reasonable approach because there is a linear relationship between splicing and protection costs, which are the main drivers of cost, and the number of pairs in the SAI. We look to the HAI data to determine the relationship in cost

[252] The $60.00 per hour rate is the prevalent labor rate for mechanical apprentices.

[253] Appendix D, shows how the proposed splicing and labor rates are used in calculating the cost of a 7200 pair indoor SAI. *See* Appendix D, section IV.

[254] Appendix D shows how this tentative conclusion is used to determine proposed costs for a 7200 pair SAI. *See* Appendix D, section IV.

[255] Appendix D show how this proposed value is used in the calculation of a 7200 pair SAI.

among the various sizes of SAI. Specifically, we develop a ratio of our proposed cost for a 7200 pair indoor SAI to the cost proposed by HAI. We then propose to apply this ratio, 2.25, to the values submitted by the HAI sponsors for other sizes of indoor and outdoor SAIs. Applying this factor, we tentatively adopt the cost estimates for indoor and outdoor SAIs contained in Appendix A. We propose to use the HAI, rather than BCPM data, in this manner because BCPM has not submitted estimates for all of the SAI sizes used in the model. We note that using the BCPM data in this way would result in roughly the same estimates. We seek comment on these tentative conclusions and proposed values.

F. Digital Loop Carriers

1. Background

142. A digital loop carrier (DLC) is a piece of network equipment that converts a digital signal carried on optical fiber cable to an analog, electrical signal that is carried on copper cable and is compatible with customers' telephones.[256] Because of the high cost of DLCs, a single DLC is shared among a number of customers. The model uses fiber cable and DLCs whenever it calculates that this configuration is cheaper than using copper cable or when the distance exceeds the maximum copper loop length. When using DLCs, the model determines the size and number of DLCs that should be installed at a location, based on cost minimization and engineering constraints. In designing outside plant, the model uses five different sizes of DLCs.[257] In order to run the model, a user must input the fixed and per-line cost for each of these DLC sizes. The total cost of a particular DLC is determined by multiplying the number of lines connected to the DLC times the per-line cost of the DLCs, and then adding the fixed cost of the DLC.

2. Issues for Comment

143. Both the sponsors of BCPM and HAI have submitted default values for DLC costs. Because these values are based on the opinions of experts without data to enable us to substantiate these opinions, however, we tentatively conclude that we should not rely on these data. We also tentatively conclude that the most reliable data on DLC costs available to the Commission at this time are the contract data submitted to the Commission in response to the

[256] Optical fiber cable carries a digital signal that is incompatible with most customers' telephone equipment, but the quality of the signal degrades less with distance compared to a signal carried on copper wire. Generally, when a neighborhood is located too far from the wire center to be served by copper cables alone, an optical fiber cable will be deployed to a point within the neighborhood, where a DLC will be placed to convert incoming digital signals to analog signals and outgoing analog signals to digital. From the DLC, copper cables of varying gauge extend to all of the customer premises in the neighborhood.

[257] The current version of the model supports a fifth DLC size in addition to those already supported. DLC capacities currently supported are 2016, 1344, 672, 96, and 24 line facilities.

1997 Data Request, and in *ex parte* submissions following the December 11, 1998 workshop. We seek comment on these tentative conclusions.

144. Following their submission of DLC data to the Commission in response to the *1997 Data Request*, US West, Bell South, and ATU resubmitted their data on the record in this proceeding.[258] At the December 11, 1998 workshop, staff of the Common Carrier Bureau discussed the DLC costs data on the record in this proceeding.[259] In an effort to elicit further discussion of DLC input values, staff presented a template of the components of a typical DLC. The HAI sponsors, GTE, and Aliant submitted data using the template of DLC costs.[260] Staff found the data submitted by the HAI sponsors to be significantly lower than the contract data on the record, and staff concluded that it would be inappropriate to use it, especially as no support was provided in justification. Because the data submitted by the companies are based on actual costs incurred in purchasing DLCs, we tentatively conclude that they are more reliable than the opinions proffered, and, therefore, should be used to estimate the cost of DLCs. Although we would prefer to have a larger sampling of data, we note that the data represent the costs incurred by several of the largest non-rural carriers, as well as two of the smallest non-rural carriers. We also note that, throughout this proceeding, the Commission has repeatedly requested cost data on DLCs.[261] We believe that we are using the best data available on the record to determine the cost of DLCs.[262]

---

[258] In response to the *1997 Data Request*, Ameritech, Bell Atlantic (including NYNEX), Bell South, SBC, US West, GTE, Sprint, ATU, and PRTC originally submitted data to the Commission on DLC costs in 1997. Bell South and US West resubmitted their data on the record of this proceeding subject to the *Protective Order*. Letter from William W. Jordan, Bell South, to Magalie Roman Salas, FCC, dated March 15, 1999; Letter from Robert B. McKenna, US West, to Magalie Roman Salas, FCC, dated March 8, 1999. Letter from Alane C. Weixel, counsel for ATU, to Magalie Roman Salas, FCC, dated May 6, 1999 (ATU May 6, 1999 *ex parte*).

[259] *See Material Cost Workshop - Digital Loop Carrier Equipment "Template for Determining DLC Cost"* handout.

[260] Letter from W. Scott Randolph, GTE, to Magalie Roman Salas, FCC, dated February 11, 1998; Letter from Robert A. Mazer & Albert Shuldiner, Counsel for Aliant, to Magalie Roman Salas, FCC, dated February 8, 1998. The HAI sponsors filed an *ex parte* letter with DLC cost information using a different template. Letter from Chris Frentrup, MCI WorldCom, to Magalie Roman Salas, FCC, Docket No. 96-45, 97-160, dated January 21, 1999 (following their January 20, 1999 presentation). US West and Sprint filed responses to the HAI presentation on February 8, 1999 and February 4, 1999, respectively.

[261] In addition to the data submitted in response to the *1997 Data Request*, and following the December 11, 1998 workshop, the Bureau requested further data on DLC costs in the *1997 Further Notice* and in the *Inputs Public Notice*. *See also Preliminary Input Values Public Notice*.

[262] Only US West, Bell South, and ATU presented their contract data from the *1997 Data Request* in a format that staff could use. Some of the data and comments that were submitted in response to the *1997 Data Request*, but not re-filed on the record under the *Protective Order*, could not be used because the data were either inadequate or presented in a format from which staff could not extract relevant information.

145. We note that ATU asserts that material handling and shipping costs should be added to the DLC prices reflected in the contract it submitted. ATU suggests that these costs could represent up to 10 percent of the material cost of a DLC.[263] It is unclear whether the DLC data submitted by other parties include these costs. We seek comment on the extent, if any, to which we should increase our proposed estimates for DLCs to reflect material handling and shipping costs.

146. We recognize that the cost of purchasing and installing a DLC changes over time. Such changes occur because of improvements in the methods and components used to produce DLCs, changes in both capital and labor costs, and changes in the functionality requirements of DLCs. Thus, we believe it is appropriate to adjust the contract data to reflect 1999 prices. In order to capture changes in the cost of purchasing and installing DLCs over time, we propose a 2.6 percent annual reduction in both fixed DLC cost and per line DLC cost. This proposed rate is based on the change in cost calculated for electronic digital switches over a four year period. We believe that the change in the cost of these switches over time is a reasonable proxy for changes in DLC cost, because they are both types of digital telecommunications equipment. We also note that the 2.6 percent figure is a conservative estimate, based on the change in cost of remote switches. Our analysis suggests that the change in cost of host switches over the past four years is much higher. Finally, we note that use of the current consumer price index results in a similar figure over four years.[264] The indexed amount is based on the effective date of the contracts. Based upon an average of the contract data submitted on the record, adjusted for cost changes over time, we tentatively adopt the cost estimates for DLCs contained in Appendix A. We seek comment on this proposed analysis and the proposed values.

VI. SWITCHING AND INTEROFFICE FACILITIES

A. Background

147. The central office switch provides the connection between a subscriber's local loop and the outside world. Modern digital switches provide voice, data, and video signals connecting telephones, fax machines, and computers on the public switched network.[265] In order to accomplish this, a telephone network must connect customer premises to a switching facility,

---

[263] ATU May 6, 1999 *ex parte*. ATU also suggests that costs for placement, installation, and testing should be added to the DLC material costs it submitted. We note that these site preparation costs are already separately accounted for in the model.

[264] *See infra* para. 226.

[265] The functions performed by the switch for local service include: line termination; line monitoring; usage call processing, routing, and completion; interconnection to other carriers; billing and maintenance; and vertical services and features. We note that not all of these functions are supported by universal service.

ensure that adequate capacity exists in that switching facility to process all calls, and interconnect the switching facility with other switching facilities to route calls to their destination. A wire center is the location of the switching facility.[266] The infrastructure to interconnect the wire centers is known as the "interoffice" network, and the carriage of traffic among wire centers is known as "transport."

148. In the *Universal Service Order*, the Commission stated that "[a]ny network function or element, such as . . . switching, transport or signaling, necessary to provide supported services must have an associated cost."[267] In the *1997 Further Notice*, the Commission sought comment on issues that affect the input values relating to the forward-looking economic cost of switching and interoffice transport.[268] The *Switching and Transport Public Notice* established several guidelines relating to switching, the design of the interoffice network, and interoffice cost attributable to providing supported services.[269] In the *Platform Order*, the Commission concluded that the federal mechanism should incorporate, with certain modifications, the HAI 5.0a switching and interoffice facilities module.[270]

149. Both HAI and BCPM have provided default input values for estimating the forward-looking economic cost of switching and interoffice network.[271] On November 25, 1998, the Bureau announced the release of preliminary input values on its Web site.[272] On December 1, 1998, the Bureau held a public workshop designed to elicit comment on the switching inputs

[266] The wire center boundaries define the area in which all customers are connected to a given wire center.

[267] *Universal Service Order*, 12 FCC Rcd at 8913, para. 250 (criterion two).

[268] *1997 Further Notice*, 12 FCC Rcd at 18560-66, paras. 121-38.

[269] *Switching and Transport Public Notice* at 2-6. The Bureau guidelines established that: (1) the models permit individual switches to be identified as host, remote, or stand-alone; (2) switching investment costs should be separately estimated for host, remote, and stand-alone switches; (3) models should include switch capacity constraints; (4) all of the line-side port costs and a percentage of usage costs should be assigned to the cost of providing the supported service; and (5) models should accommodate an interoffice network that is capable of connecting switches designated as hosts and remotes in a way that is compatible with capabilities of equipment and technology that are available today and current engineering practices. *Id.*

[270] *Platform Order*, 13 FCC Rcd at 21354, para. 75.

[271] *See* Letter from Richard N. Clarke, AT&T, to Magalie Roman Salas, FCC, dated February 3, 1998 (HAI Feb. 3 submission) App. B; BCPM April 30, 1998 submission, Switch Model Inputs.

[272] *See Workshop Public Notice* at 2.

values to be used in the federal mechanism.[273] On February 5, 1999, the Bureau released a set of revised preliminary input values that included switching and interoffice transport values to facilitate the review and selection of final input values.[274]

150. In this section, we tentatively adopt and seek comment on the inputs associated with the installation and purchase of new switches, the use of the LERG to identify host-remote switch relationships, and other switching and interoffice input issues that have been raised by commenters. The remaining switching and interoffice-related input values that we tentatively adopt in this Further Notice are provided in Appendix A.[275]

B. Issues for Comment

1. Switch Costs

151. We now examine the inputs associated with the purchase and installation of new switches. Specifically, we must select values for the fixed and per-line cost of host and remote switches, respectively.

152. Switch Cost Data. Both the sponsors of BCPM and HAI have submitted default values for switch costs. To a large extent, however, these values are based on non-public information or opinions of their experts, but without data that enable us adequately to substantiate those opinions. Consistent with the recommendation of the Joint Board and criterion eight in the *Universal Service Order*, we tentatively conclude that we should not rely on these submissions because the underlying data are not sufficiently open and available to the public. We also tentatively conclude that it is not necessary to rely on this information, because the Commission, in conjunction with the work of Gabel and Kennedy,[276] the Bureau of Economic Analysis (BEA) of the Department of Commerce, and the U.S. Department of Agriculture Rural Utility Service (RUS), has compiled publicly available data on the cost of purchasing and installing switches. This information was gathered from depreciation reports filed by LECs at the Commission and from reports made by LECs to RUS.

153. The depreciation data contains, for each switch reported: the model designation of

---

[273] *See Workshop Public Notice*. The December 1, 1998 workshop addressed issues relating to switching and expenses.

[274] *Preliminary Input Values Public Notice*.

[275] These inputs values are generally agreed upon by the parties or have not been disputed.

[276] David Gabel and Scott Kennedy, *Estimating the Cost of Switching and Cables Based on Publicly Available Data*, The National Regulatory Research Institute, NRRI 98-09, April 1998 (NRRI Study).

the switch; the year the switch was first installed; and the lines of capacity and book-value cost of purchasing and installing each switch at the time the depreciation report was filed with the Commission.[277] The RUS data contains, for each switch reported: the switch type (i.e., host or remote); the number of equipped lines; cost at installation; and year of installation.[278]

154. The sample that we propose to use to estimate switch costs includes 1,060 observations. The sample contains 921 observations selected from the depreciation data, which provide information on the costs of purchasing and installing switches gathered from 20 states. The sample also contains 139 observations selected from the RUS data, which provide information from across the nation on the costs of small switches purchased and installed by rural carriers. The combined sample represents purchases of both host and remote switches, with information on 468 host switches and 592 remote switches, and covers switches installed between 1989 and 1996. This set of data represents the most complete public information available to the Commission on the costs of purchasing and installing new switches.

155. In response to the *1997 Data Request*, the Commission received a second set of information pertaining to 1,486 switches. Upon analysis, however, Commission staff identified one or more problems with most of the data submitted: missing switch costs; zero or negative installation costs; zero or blank line counts; unidentifiable switches; or missing or inconsistent Common Language Local Identification (CLLI) codes. After excluding these corrupted observations, 302 observations remained. The remaining observations represented switches purchased by only four companies. We tentatively conclude that the data set we propose to use is superior to the data set obtained in response to the *1997 Data Request*, both in terms of the number of usable observations and the number of companies represented in the data set. We seek comment on this tentative conclusion.

156. Following the December 1, 1999 workshop, three companies voluntarily submitted further data regarding the cost of purchasing and installing switches.[279] Because these submissions were received late in the process, Commission staff has not had sufficient time to analyze the quality and content of the information. We seek comment on the use of this data set as a substitute or complement to the data set we propose.

---

[277] Until 1996 large incumbent LECs were required to file depreciation rate reports with the Commission pursuant to 47 C.F.R. § 43.43. Prior to filing these reports, companies generally submit depreciation rate studies that include data for each digital switch in operation. See Appendix E of this Further Notice for a description of the data set and an explanation of adjustments made to the data.

[278] Many small telephone companies receive financial assistance from RUS, which requires these companies to report the payments made for new switches. See Appendix E for a description of the RUS data and an explanation of adjustments made to the data.

[279] BellSouth January 29, 1999 *ex parte*, Sprint February 5, 1999 *ex parte*, and GTE February 22, 1999 *ex parte*.

157. Adjustments to the Data. The cost figures reported in the depreciation information reflect the costs of purchasing and installing new switches. While the RUS cost data also contain information on purchasing and installing new switches, they do not include: (1) the cost associated with purchasing and installing the main distribution frame (MDF); (2) the cost associated with purchasing and installing power equipment; (3) the cost of connecting each remote switch to its respective host switch; and (4) LEC engineering costs.[280] In order to make the depreciation and RUS information comparable, we propose to add estimates of these four components to the switch costs reported in the RUS information. These additions are discussed below. We seek comment on this proposed approach.

158. In order to account for the cost of MDF equipment omitted from the RUS information, AT&T recommends using the HAI 5.0a default value of $12 per line for MDF. We tentatively conclude that $12 per line is a reasonable cost for purchasing and installing MDF equipment.[281] No party contests this value. We seek comment on this tentative conclusion and invite commenters to submit alternative values.

159. In order to account for the cost of central office power equipment omitted from the RUS information, AT&T recommends using the HAI 5.0a default values for these inputs. We tentatively use the following input values for power equipment: $12,000 for switches with 0-999 lines; $40,000 for switches with 1,000-4,999 lines; and $74,500 for switches with 5,000-25,000 lines. These values are derived from a range of values on the record in this proceeding, including state cost studies.[282] We seek comment on the values we tentatively adopt and invite commenters to submit alternative values.

160. Gabel and Kennedy estimate that the average cost of terminating a remote on a host switch is $27,598.[283] Relying on this estimate, we tentatively conclude that $27,598 should be added to the cost of each remote switch reported in the RUS data. We seek comment on this tentative conclusion and invite commenters to submit alternative values.

161. Gabel and Kennedy also recommend, based on a data analysis undertaken by RUS,

---

[280] Letter from W. Scott Randolph, GTE, to Magalie Roman Salas, FCC dated December 18, 1998 (GTE Dec. 18 *ex parte*) at 5 and 6; NRRI Study at 97 and 102; Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated December 22, 1998 (Sprint Dec. 22 *ex parte*) at 13-21; Letter from Richard Clarke, AT&T, to Magalie Roman Salas, FCC, dated January 7, 1999 (AT&T Jan. 7 *ex parte*) at 1.

[281] AT&T Jan. 7 *ex parte* at 1.

[282] *See, e.g.*, Commonwealth of Kentucky, *An Inquiry Into Universal Service Funding Issues*, Administrative Case No. 360 (1998) App. F at 14 (Kentucky Cost Study); *Compliance Proceeding for Implementation of the Texas High Cost Universal Service Plan*, Order No. 30, Project No. 18515 (August 24, 1998).

[283] NRRI Study at 102-104.

that the cost of switches reported in the RUS data should be increased by 8 percent in order to account for the cost of LEC engineering.[284] Relying on those estimates, we tentatively conclude that 8 percent should be added to the total cost, including MDF, power, and remote connection costs, of each switch reported in the RUS data. We note that the proposed value is based on the only information on the record on this issue. We seek comment on this tentative conclusion and invite commenters to submit alternative values.

162. We tentatively conclude that switch costs should be estimated based on a sample of public data that includes both RUS and depreciation data. As noted, this information represents the broadest range of data publicly available for both small and large switches. We seek comment on the appropriateness of merging the two data sets.

163. Methodology. In order to determine the reasonable forward-looking cost of switches, based on the selected data set, we propose to employ regression analysis. In the process of estimation, we propose, where appropriate, to make adjustments to the information compiled by the above parties. These proposed modifications to the data and estimation techniques used by the Commission are discussed below.

164. We tentatively conclude that the cost of a switch should be estimated as a linear function of the number of lines connected to the switch, the type of switch installed (i.e., host or remote), and the date of installation. We adopt a linear function based on examination of the data and statistical evidence. Sprint recommends using a non-linear function, such as the log-log function, to take into account the declining marginal cost of a switch as the number of lines connected to it increases.[285] We tentatively conclude that the linear function we adopt provides a better fit with the data than the log-log function. A discussion of the effect of time and type of

---

[284] *Id*.

[285] Sprint Dec. 22 *ex parte* at 12. Sprint criticized the Commission's preliminary switch regression presented in the December 1998 workshop based on the "R-squared" statistical goodness of fit criterion. However, after adjusting for data transformations associated with moving to a log-log specification, the R-squared of a log-log regression (0.54) suggested by Sprint is lower than the R-squared in the linear regression (0.78). Specifically, we note that the R-squared measure resulting from a regression employing a log-log functional form is not directly comparable to the R-squared measure from a linear regression. In order for the two measures to be comparable, the R-squared measure computed from the log-log regression must be computed using observed and predicted cost measures, not the logs of these measures. We also note that the log-log regression we employed is of the form:

$$Ln(Cost) = a_1 + a_2*Ln(Lines) + a_3*Host + a_4*Ln(Time) + a_5*Ln(Lines)*Ln(Time) + a_6*Host*Ln(Time) + e$$

where Ln(x) denotes the natural log of x. Because Sprint did not make these necessary adjustments, we believe that their criticism of the use of a linear function is misplaced. For a discussion of the "R-squared" statistical goodness of fit criterion and a discussion of log-log specifications, see William H. Greene, *Econometric Analysis*, 192-193 and 251 (1990).

switch on switch cost is presented below. We seek comment on these tentative conclusions.

165. Based upon an analysis of the data and the record, we tentatively conclude that the fixed cost (i.e., the base getting started cost of a switch, excluding costs associated with connecting lines to the switch) of host switches and remote switches differ, but the per-line variable cost (i.e., the costs associated with connecting additional lines to the switch) of host and remote switches are approximately the same. This is consistent with statistical evidence[286] and the comments of the HAI sponsors.[287] We seek comment on this tentative conclusion.

166. Accounting for Changes in Cost Over Time. We recognize that the cost of purchasing and installing switching equipment changes over time. Such changes result, for example, from improvements in the methods used to produce switching equipment, changes in both capital and labor costs, and changes in the functional requirements that switches must meet for basic dial tone service. In order to capture changes in the cost of purchasing and installing switching equipment over time, we propose to modify the data to adjust for the effects of inflation, and explicitly incorporate variables in the regression analysis that capture cost changes unique to the purchase and installation of digital switches. We describe this process below.

167. To the extent that the general level of prices in the economy change over time, the purchasing power of a dollar, in terms of the volume of goods and services it can purchase, will change. In order to account for such economy-wide inflationary effects, we propose to multiply the cost of purchasing and installing each switch in the data set by the gross-domestic-product chain-type price index[288] for 1997 and then divide by the gross-domestic-product chain-type price

[286] *See* General Wald Test for omitted variables in Ramu Ramanathan, *Introductory Econometrics with Applications* 170 (1989).

[287] Letter from Richard Clarke, AT&T, to Magalie Roman Salas, FCC, dated January 7, 1999 (AT&T Jan. 7 *ex parte*) at 1. "The primary difference between a host switch and remote switch is in the extent and complexity of the `getting started equipment,' associated with each type of switch (e.g., switch central processor functions, SS7 non-scaleable equipment, maintenance and testing, call recording for billing purposes, etc.). Because most of these functions for lines terminating a remote switch are performed at that switch's host, very little of this type of `getting started' equipment is required at the remote. In contrast, the scaleable equipment used to terminate lines and trunks and to perform basic call processing is essentially the same at the host and remote. In fact, the line units used by Lucent 5E Remote Switching Modules are identical to those used by 5E host or stand-alone switches. Similarly, the line cards used in Nortel DMS 100 host or stand-alone switches are the same as those used in DMS 100 remotes, or in DMS 10 host or remote switches." *Id.*

[288] The gross-domestic-product chain-type price index, which tracks economy-wide inflation, is published monthly by the Bureau of Economic Analysis of the U.S. Department of Commerce in the Survey of Current Business.

index for the year in which the switch was installed, thereby converting all costs to 1997 values.[289]

168. In order to account for cost changes unique to switching equipment, we propose to enter time terms directly into the regression equation.[290] GTE expresses concern that, under certain specifications of time, the regression equation produces investments for remote switch "getting started" costs that are negative and that such specifications overstate the decline in switch costs.[291] The HAI sponsors also caution that the historical large percentage price declines seen in recent years may not continue.[292] We tentatively conclude that the reciprocal form of time in the regression equation proposed would satisfy these concerns by yielding projections of switch purchase and installation costs that are positive yet declining over time.

169. Ameritech and GTE advocate the use of the Turner Price Index,[293] which is an index designed to measure the changing cost of telecommunications plant, to convert the embedded cost information contained in the depreciation data to costs measured in current dollars.[294] We note, however, that this index and the data underlying it are not on the public record. We prefer to rely on public data when available. Moreover, we tentatively conclude it is not necessary to rely on this index to convert switch costs to current dollars. As described in the preceding paragraph, the Commission has proposed to account for costs explicitly in the estimation process, rather than adopt a surrogate such as the Turner Price Index. We seek comment on this proposed approach. In addition, we seek comment on the potential impact of increased use of packet switches, including the possibility that manufacturers will reduce the price of circuit switches to maintain market share.

170. Treatment of Switch Upgrades. The book-value costs recorded in the depreciation data include both the cost of purchasing and installing new equipment and the cost associated with installing and purchasing subsequent upgrades to the equipment over time. Upgrades costs

---

[289] Figures are adjusted after estimation for both realized and expected inflation between 1997 and 1999. *See* Appendix E for an explanation of these adjustments.

[290] Time was added to the regression in reciprocal form as an independent variable to measure fixed cost changes unique to remote switches. Then, a time term was added in conjunction with the host identifier variable to measure the fixed cost changes unique to host switches. A time term was also added in conjunction with the line variable, in order to measure cost changes unique to line additions on switches.

[291] GTE Dec. 18 *ex parte* at 4.

[292] AT&T Jan. 7 *ex parte* at 4.

[293] The index is published semi-annually by AUS consultants.

[294] See Ameritech Dec. 16, 1998 comments at 5; GTE Dec. 18, 1998 *ex parte* at 4.

will be a larger fraction of reported book-value costs in instances where the book-value costs of purchasing and installing switching equipment are reported well after the initial installation date of the switch. In order to estimate the costs associated with the purchase and installation of new switches, and exclude the costs associated with upgrading switches, we propose to remove from the data set those switches installed more than three years prior to the reporting of their associated book-value costs. We believe that this restriction would eliminate switches whose book values contain a significant amount of upgrade costs, and recognizes that, when ordering new switches, carriers typically order equipment designed to meet short-run demand.

171. We tentatively conclude that we should reject the suggestion of Ameritech, GTE, and Sprint that the costs associated with purchasing and installing switching equipment upgrades should be included in our cost estimates.[295] The model platform we adopted is intended to use the most cost-effective forward-looking technology available at a particular period of time. The installation costs of switches, as configured by us above, reflect the most cost-effective forward-looking technology for meeting industry performance requirements. Switches, augmented by upgrades, may provide carriers the ability to meet performance requirements, but do so at greater costs. Therefore, such augmented switches do not constitute cost-effective forward-looking technology. In addition, as industry performance requirements change over time, so will the costs of purchasing and installing new switches. The historical cost data employed in this proposed analysis reflect such changes over time, as do the time-trended cost estimates. We seek comment on this tentative conclusion.

172. Additional Variables. Several parties contend that additional independent variables should be included in our regression equation. Some of the recommended variables include minutes of use, calls, digital line connections, vertical features, and regional, state, and vendor-specific identifiers.[296] For the purposes of this analysis, our proposed model specification is limited to include information that is in both the RUS and depreciation data sets. Neither data set includes information on minutes of use, calls, digital line connections, vertical features, or differences between host and stand-alone switches. Nor do they contain detail sufficient to allow us to obtain such information from other sources. State and regional identifiers are not included in the proposed regression because we only have depreciation data on switches from 20 states. Thus, we could not accurately estimate region-wide or state-wide differences in the cost of switching. Our proposed model specification also does not include vendor-specific variables or variables distinguishing host switches from stand-alone switches because the model platform does not distinguish between different types of switches.

---

[295] Ameritech Dec. 16, 1998 comments at 4-5; GTE Dec. 18, 1998 *ex parte* at 4-5; Sprint Dec. 22, 1998 *ex parte* at 5-7.

[296] GTE Dec. 18, 1998 *ex parte* at 5; Sprint Dec. 22, 1998 *ex parte* at 13; Ameritech Dec. 16, 1998 comments at 6.

173. Switch Cost Estimates. Using the regression analysis discussed above, we tentatively adopt the fixed cost (in 1999 dollars) of a remote switch as $186,400 and the fixed cost (in 1999 dollars) of both host and stand-alone switches as $447,000. We tentatively adopt the additional cost per line (in 1999 dollars) for remote, host, and stand-alone switches as $83.[297] We seek comment on these tentative conclusions.

2. Use of the Local Exchange Routing Guide (LERG)

174. We tentatively conclude that the Local Exchange Routing Guide (LERG) database should be used to determine host-remote switch relationships in the federal universal service mechanism.[298] In the *1997 Further Notice*, the Commission requested "engineering and cost data to demonstrate the most cost-effective deployment of switches in general and host-remote switching arrangements in particular."[299] In the *Switching and Transport Public Notice*, the Bureau concluded that the model should permit individual switches to be identified as host, remote, or stand-alone switches.[300] The Bureau noted that, although stand-alone switches are a standard component of networks in many areas, current deployment patterns suggest that host-remote arrangements are more cost-effective than stand-alone switches in certain cases.[301] No party has placed on the record in this proceeding an algorithm that will determine whether a wire center should house a stand-alone, host, or remote switch.[302]

175. In the *Platform Order*, we concluded that the federal mechanism should incorporate, with certain modifications, the HAI 5.0a switching and interoffice facilities module.[303] In its default mode, HAI assumes a blended configuration of switch technologies to develop

---

[297] See Appendix E for regression results, and an explanation of how cost estimates are derived from these results.

[298] The LERG is a database of switching information maintained by Bellcore that includes the existing host-remote relationships. The HAI proponents have placed on the record the portion of the LERG that identifies the host-remote relationships. Letter from Chris Frentrup, MCI, to Magalie Roman Salas, FCC, dated September 14, 1998 (MCI Sept. 14 *ex parte*).

[299] *1997 Further Notice*, 12 FCC Rcd at 18560-61, para. 122.

[300] *Switching and Transport Public Notice* at 2. Switches can be designated as either host, remote, or stand-alone switches. Both a host and a stand-alone switch can provide a full complement of switching services without relying on another switch. A remote switch relies on a host switch to supply a complete array of switching functions and to interconnect with other switches.

[301] *Switching and Transport Public Notice* at 2-3.

[302] *Platform Order*, 13 FCC Rcd at 21355, para. 76.

[303] *Platform Order*, 13 FCC Rcd at 21354-55, para. 75.

switching cost curves.[304] HAI also allows the user the option of designating, in an input table, specific wire center locations that house host, remote, and stand-alone switches. When the host-remote option is selected, switching curves that correspond to host, remote, and stand-alone switches are used to determine the appropriate switching investment. The LERG database could be used as a source to identify the host-remote switch relationships. In the *Platform Order*, we stated that "[i]n the inputs stage of this proceeding we will weigh the benefits and costs of using the LERG database to determine switch type and will consider alternative approaches by which the selected model can incorporate the efficiencies gained through the deployment of host-remote configurations."[305]

176. The majority of commenters support the use of the LERG database as a means of determining the deployment of host and remote switches.[306] These commenters contend that the use of the LERG to determine host-remote relationships will incorporate the accumulated knowledge and efficiencies of many LECs and engineering experts in deploying the existing switch configurations.[307] Commenters also contend that an algorithm that realistically predicts this deployment pattern is not feasible using publicly available data and would be "massive and complex."[308] The HAI proponents argue, however, that use of the LERG to identify host-remote relationships may reflect the use of embedded technology, pricing, and engineering practices.[309] Although the HAI proponents oppose the use of the LERG, they have taken steps to ensure that the LERG database is compatible with use in the switching module in the synthesis model.[310]

177. We tentatively conclude that the LERG database is the best source currently available to determine host-remote switch relationships in the federal universal service mechanism.

---

[304] HAI Feb. 3, 1998 submission, Model Description at 58.

[305] *Platform Order*, 13 FCC Rcd at 21355, para. 76.

[306] *See, e.g.*, Aliant *Switching and Transport Public Notice* comments at 2; BellSouth et al. *Switching and Transport Public Notice* comments, att. 1 at 1-2; GTE *Switching and Transport Public Notice* comments at 11; Bell Atlantic *Switching and Transport Public Notice* reply comments at 2.

[307] Bell Atlantic *Switching and Transport Public Notice* reply comments, att. 1 at 2; BellSouth et al. *Switching and Transport Public Notice* reply comments, att. 1 at 2-3.

[308] *See, e.g.*, AT&T/MCI *Switching and Transport Public Notice* comments at 6; BellSouth et al. *Switching and Transport Public Notice* reply comments, att. 1 at 2.

[309] Letter from Richard N. Clarke, AT&T, to Magalie Roman Salas, FCC, dated January 6, 1998 at 11 (AT&T Jan. 6 *ex parte*). For example, the HAI sponsors contend that factors influencing the placement of switches, such as line demand, switch prices, and life cycle costs, may have changed over time.

[310] *See* MCI Sept. 14 *ex parte*; Letter from Richard N. Clarke, AT&T, to Magalie Roman Salas, FCC, dated September 16, 1998 (AT&T Sept. 16 *ex parte*).

As noted above, no algorithm has been placed on the record to determine whether a wire center should house a stand-alone, host, or remote switch. In addition, a majority of commenters agree that development of such an algorithm would be difficult using publicly available data.[311] We tentatively conclude that the use of the LERG to identify the host-remote switch relationships is superior to HAI's averaging methodology which may not, for example, accurately reflect the fact that remote switches are more likely to be located in rural rather than urban areas. We therefore tentatively agree with the BCPM proponents and other commenters that use of the LERG is the most feasible alternative currently available to incorporate the efficiencies of host-remote relationships in the federal universal service mechanism. We seek comment on these tentative conclusions. In particular, we encourage parties to comment on any alternative source or methodology that will identify host-remote switch relationships on a forward-looking basis.

3. Other Switching and Interoffice Transport Inputs

178. General. Several commenters assert that the depreciation studies on which the Commission relied to develop switch costs include all investments necessary to make a switch operational.[312] These investments include telephone company engineering and installation, the main distribution frame (MDF), the protector frame (often included in the MDF), and power costs.[313] To avoid double counting these investments, both as part of the switch and as separate input values, the model proponents agree that the MDF/Protector investment per line and power input values should be set at zero.[314] In addition, commenters agree that the Switch Installation Multiplier should be set at 1.0.[315] We agree that including these investments both as part of the switch cost and as separate investments would lead to double counting of these costs. We therefore tentatively conclude that the MDF/Protector investment per line and power input values should be set at zero. We further tentatively conclude that the Switch Installation Multiplier should be set at 1.0. We seek comment on these tentative conclusions.

179. Analog Line Offset. We tentatively conclude that the "Analog Line Circuit Offset for Digital Lines" input should be set at zero. The HAI proponents contend that the switch investment in the model should be adjusted downward to reflect the cost savings associated with

---

[311] *See, e.g.*, Ameritech *Switching and Transport Public Notice* comments at 3; AT&T/MCI *Switching and Transport Public Notice* comments at 6; BellSouth et al. *Switching and Transport Public Notice* comments att. 1 at 1-2; GTE *Switching and Transport Public Notice* at 11-12.

[312] AT&T Jan. 7 *ex parte*; GTE Dec. 18 *ex parte* at 5-7; Sprint Dec. 22 *ex parte* at 9.

[313] AT&T Jan. 7 *ex parte*; Sprint Dec. 22 *ex parte* at 9.

[314] AT&T Jan. 7 *ex parte*; GTE Dec. 18 *ex parte* at 5-6; Sprint Dec. 22 *ex parte* at 9.

[315] *See, e.g.*, AT&T Jan. 7 *ex parte*; GTE Dec. 18 *ex parte* at 6.

terminating digital, rather than analog, lines.[316] The HAI proponents assert that this cost savings is due primarily to: (1) the elimination of a MDF and protector frame termination; and (2) the economic efficiencies of terminating multiple lines on a DS-1 trunk termination instead of individual analog line terminations. Further, HAI contends that the depreciation data on which the Commission relied in developing switch investments do not reflect adequately the cost savings that would be realized if "60+% of lines are terminated on DLC - as occurs in the TELRIC models."[317] HAI contends that the depreciation data used to determine costs reflect the use of only approximately 15 percent digital lines.[318]

180. The HAI proponents suggest that the analog line offset input should be set to $15.00 per line to reflect additional savings in switch investment for terminating digital lines in the model.[319] The BCPM proponents and GTE recommend setting the analog line offset to zero.[320] Sprint contends that the analog line offset is inherent in the switching curve in the model, thus making this input unnecessary.[321] Sprint argues that an unknown mixture of analog and digital lines are taken into consideration in developing the switch curve.[322] GTE asserts that the analog offset must be set to zero to "track with the switching inputs."[323]

181. We note that the record contains no basis on which to quantify savings beyond those taken into consideration in developing the switch cost. We also note that the depreciation data used to determine the switch costs reflect the use of digital lines. The switch investment

---

[316] AT&T Jan. 7 *ex parte*. The HAI proponents contend that the cost of terminating digital lines is significantly less expensive than terminating analog lines.

[317] AT&T Jan. 7 *ex parte*.

[318] AT&T Jan. 7 *ex parte*.

[319] AT&T Jan. 7 *ex parte*. The HAI proponents reach this value by first concluding that the total switch cost savings for digital lines should be approximately $20.00 per line. HAI calculates this cost savings as follows: (1) $12.00 for the MDF/Protectors that are not needed in the switch for incoming lines terminated on DLC; and (2) $8.00 per-line "efficiencies" (e.g., greater usage concentration, eliminated line cards, and lower cost to terminate trunks carrying DLC lines). Next, HAI concludes that the average fraction of digital lines included in the "historical" data is roughly 15% (or one quarter of the 60% digital line usage engineered in the model). The HAI proponents then deduct from the $20.00 value, one quarter of the digital line usage savings that is already taken into consideration in the historical data, to arrive at the analog line offset value of $15.00 per line.

[320] GTE Dec. 18 *ex parte* at 6; Sprint Dec. 22 *ex parte* at 12; Sprint Jan. 8 *ex parte* at 15.

[321] Sprint Dec. 22 *ex parte* at 12.

[322] Sprint Dec. 22 *ex parte* at 12.

[323] GTE Dec. 18 *ex parte* at 6.

value will therefore reflect savings associated with digital lines. We also note that HAI's proposed analog line offset of $15.00 per line is based on assumptions that are neither supported by the record nor easily verified. For example, it is not possible to determine from the depreciation data the percentage of lines that are served by digital connections. It is therefore not possible to verify HAI's estimate of the digital line usage in the "historical" data. In addition, HAI provides little support for its conclusion that there is a $20.00 per line cost savings using digital lines. HAI merely attributes a portion of this estimate to certain "efficiencies" realized from terminating digital rather than analog lines. In the absence of more explicit support of HAI's position, we tentatively conclude that the Analog Line Circuit Offset for Digital Lines should be set at zero. We seek comment on this tentative conclusion.

182. Switch Capacity Constraints. We tentatively adopt the HAI default switch capacity constraint inputs as proposed in the HAI 5.0a model documentation.[324] The forward-looking cost mechanism contains switch capacity constraints based on the maximum line and traffic capabilities of the switch. The HAI proponents now recommend increasing the switch line and traffic capacity constraints above the HAI input default values for those inputs.[325] HAI contends that the default input values no longer reflect the use of the most current technology.[326] For example, HAI contends that the maximum equipped line size per switch should be increased from 80,000 to 100,000 lines.[327]

183. We tentatively conclude that the original HAI switch capacity constraint default values are reasonable for use in the federal mechanism. We note that commenters have reviewed these values and are in general agreement with the HAI default values.[328] For example, we note that the HAI and BCPM default values for maximum equipped lines per switch are identical at 80,000 lines per switch.[329] We also note that the HAI model documentation indicates that the 80,000 line assumption was based on a conservative estimate "recognizing that planners will not typically assume the full capacity of the switch can be used."[330] The HAI proponents therefore

[324] HAI Feb. 3, 1998 submission, App. B at 38-39.

[325] AT&T Jan. 7 *ex parte*. The HAI proponents included the updated switch capacity constraints in a table attached to the Jan. 7 *ex parte*.

[326] AT&T Jan. 7 *ex parte*.

[327] AT&T Jan. 7 *ex parte*.

[328] *See, e.g.,* BellSouth *Inputs Public Notice* reply comments at Exhibit 2-13; BCPM Inputs Portfolio at 34-36.

[329] *See* HAI Dec. 11 submission, Model Inputs at 80; BCPM April 30, 1998 submission, Switching Model Inputs at 34.

[330] *See* HAI Dec. 11 submission, Model Inputs at 80.

selected the 80,000 line limitation as the maximum equipped line size value with the knowledge that the full capacity of the switch may be higher.[331] We seek comment on our tentative conclusion.

184. Switch Port Administrative Fill. We tentatively adopt a switch port administrative fill factor of 94 percent. HAI defines the switch port administrative fill as "the percent of lines in a switch that are assigned to subscribers compared to the total equipped lines in a switch."[332] HAI assigns a switch port administrative fill factor of 98 percent in its default input values.[333] The BCPM default value for the switch percent line fill is 88 percent.[334]

185. The BCPM proponents contend that switches have significant unassigned capacity due to the fact that equipment is installed at intervals to handle one to three years' growth.[335] BCPM most recently contends that U S WEST and BellSouth have company-wide average fills in the range of 76 percent.[336] Sprint, on behalf of the BCPM proponents, now recommends an average fill factor of 80 percent.[337]

186. We note that the switch port administrative fill factor of 94 percent has been adopted in several state universal service proceedings and is supported by the Georgetown Consulting Group, a consultant of BellSouth.[338] We also note that this value falls within the range established by the HAI and BCPM default input values. The BCPM model documentation

---

[331] In addition, we note that a decision to adopt the revised HAI values for maximum equipped lines per switch would have only a minimal impact on the overall forward-looking cost estimation because less than 2 percent of wire centers have more than 80,000 lines. A review of the data indicates that, of the 12,506 wire centers served by non-rural LECs, only 189 (1.5 percent) have more than 80,000 lines and 57 (0.5 percent) have more than 100,000 lines. *See* HAI Feb. 3, 1998 model submission.

[332] HAI Dec. 11, 1997 submission, Inputs Portfolio at 80.

[333] HAI Dec. 11, 1997 submission, Inputs Portfolio at 80.

[334] BCPM April 30, 1998 submission, Switch Model Inputs at 20-21. BCPM defines Switch Percent Line Fill as the ratio between the number of working lines on the switch and the total number of lines for which the switch is engineered.

[335] Sprint Dec. 22 *ex parte* at 17.

[336] Sprint Dec. 22 *ex parte* at 18.

[337] Sprint Dec. 22 *ex parte* at 18.

[338] BellSouth *Inputs Public Notice* reply comments at Exhibit 2-13; Kentucky Cost Study App. F at 13; Louisiana Public Service Commission, *State Forward-Looking Cost Studies for Federal Universal Service Support* (May 19, 1998) (Louisiana Cost Study).

established a switch line fill default value of 88 percent that included "allowances for growth over an engineering time horizon of several years."[339] BCPM has provided no additional evidence to support its revised value of 80 percent. We therefore tentatively adopt a switch port administrative fill factor of 94 percent. We seek comment on this tentative value.

187. Trunking. We tentatively conclude that the switch module should be modified to disable the computation that reduces the end office investment by the difference in the interoffice trunks and the 6:1 line to trunk ratio. In addition, we tentatively adopt the HAI suggested input value of $100.00 for the trunk port investment, per end.

188. The HAI switching and interoffice module developed switching cost curves using the Northern Business Information (NBI) publication, "U.S. Central Office Equipment Market: 1995 Database."[340] These investment figures were then reduced per line to remove trunk port investment based on NBI's implicit line to trunk ratio of 6:1.[341] The actual number of trunks per wire center is calculated in the transport calculation, and port investment for these trunks is then added back into the switching investments.

189. The BCPM proponents contend that, under the HAI trunk investment approach, raising the per-trunk investment leads to a decrease in the switch investment per line under the HAI approach, "despite a reasonable and expected increase" in the investment per line.[342] The BCPM proponents argue that the trunk port input value should be set at zero to avoid producing "contradictory" results.[343] GTE also notes that the selection of the trunk port input value creates a dilemma in that it is used to reduce the end office investment, as noted above, and to develop a tandem switch investment.[344] GTE recommends that the switch module be modified by disabling the computation that reduces the end office investment by the difference in the computed interoffice trunks and the 6:1 line to trunk ratio.[345] The HAI sponsors agree that the trunk port

[339] BCPM April 30, 1998 submission, Switch Model Inputs at 20-21.

[340] HAI Dec. 11, 1997 submission, Model Description at 52.

[341] HAI Dec. 11, 1997 submission, Model Description at 53.

[342] Sprint Dec. 22 *ex parte* at 10.

[343] Sprint Dec. 22 *ex parte* at 10.

[344] GTE Dec. 18 *ex parte* at 6.

[345] GTE Dec. 18 *ex parte* at 6.

calculation should be deactivated in the switching module.[346]

190. We agree with commenters that the trunk port input creates inconsistencies in reducing the end office investment. We do not, however, agree with the suggestion of the BCPM sponsors to simply set this input value at zero. As noted by GTE, this input value is also used to calculate the tandem switch investment.[347] Consistent with the suggestions by GTE and the HAI sponsors, we tentatively conclude that the switch module should be modified to disable the computation that reduces the end office investment by the difference in the computed interoffice trunks and the 6:1 line to trunk ratio.

191. Because the trunk port input value is also used to determine the tandem switch investment, we must determine the trunk port, per end investment.[348] The HAI input value for trunk port investment per end is $100.00.[349] GTE and Sprint contend that this value should be much higher -- ranging from $200.00 to $500.00.[350] BellSouth notes that four states have issued orders addressing the cost of the trunk port for universal service.[351] These states estimate the cost of the trunk port ranging from $62.73 to $110.77.[352] We tentatively conclude that the record supports the adoption of a trunk port investment per end of $100.00, as suggested by the HAI sponsors. As noted above, this value is consistent with the findings of several states and BellSouth. In addition, GTE and Sprint provide no data to support their proposed trunk port investment value. We therefore tentatively adopt the HAI suggested input value of $100.00 for the trunk port investment, per end. We seek comment on our tentative conclusions.

VII. EXPENSES

192. In this section, we address the inputs in the model related to expenses, including

---

[346] Letter from Chris Frentrup, MCI, to Magalie Roman Salas, FCC, dated Feb. 9, 1999 (MCI Feb. 9 *ex parte*) at 24.

[347] GTE Dec. 18 *ex parte* at 6.

[348] HAI defines this input as the "per trunk equivalent investment in switch trunk port at each end of a trunk." HAI Dec. 11, 1997 submission, Appendix B (HM 5.0 Inputs, Assumptions, and Default Values) at 46.

[349] HAI Dec. 11, 1997 submission, Inputs Portfolio at 102.

[350] GTE Dec. 18 *ex parte* at 6; Sprint Dec. 22 *ex parte* at 10.

[351] Letter from William W. Jordan, BellSouth, to Magalie Roman Salas, FCC, dated August 7, 1998 (BellSouth Aug. 7 *ex parte*) Attachment to Question 1 at 5, 9, 13, 17 (dated July 15, 1998). The four states are Kentucky, Louisiana, North Carolina, and South Carolina.

[352] *Id*.

general support facilities (GSF) expenses. In light of the criteria identified in the *Universal Service Order*, the Commission intends to select inputs that will result in a reasonable allocation of joint and common costs for non-networked related costs such as GSF, plant specific and non-specific expenses, and corporate and customer operations. The Commission seeks to develop an appropriate methodology for estimating these types of expenses to "ensure that the forward-looking economic cost [calculated by the federal mechanism] does not include an unreasonable share of the joint and common costs for non-supported services."[353]

A. Background

193. GSF costs and expenses include the investment and expenses related to vehicles, land, buildings, and general purpose computers. Other expenses (that are not associated with GSF) include: plant specific expenses,[354] plant non-specific expenses,[355] corporate operations expenses,[356] and customer services expenses.[357] For purposes of this *Further Notice*, costs associated with common support services (often called overhead expenses) refer to plant non-specific expenses, corporate operations expenses, and customer service expenses.

194. In the *1997 Further Notice*, the Commission sought comment on how to remove costs for nonregulated activities from costs for regulated activities in order to incorporate the appropriate amount of GSF investment and expenses in estimating the costs of providing the supported services.[358] The Commission tentatively concluded that GSF expenses should vary by state with respect to land values because a large share of GSF expenses is attributable to the cost of land.

195. In the *Further Notice*, the Commission also sought comment on how to establish forward-looking expenses in the selected federal mechanism.[359] The Commission specifically sought comment on which expenses should be calculated on a per-line basis and which should be calculated as a percentage of investment. The Commission also sought comment on whether

---

[353] *Platform Order*, 13 FCC Rcd at 21357, para. 81.

[354] Plant specific expenses include the cost of maintaining telecommunications plant and equipment.

[355] Plant non-specific expenses include the cost of engineering, network operations, and power expenses.

[356] Corporate operations expenses include the cost of administration, human resources, legal, and accounting expenses.

[357] Customer service expenses include the cost of marketing, billing, and directory listing expenses.

[358] *1997 Further Notice*, 12 FCC Rcd at 18569, para. 148.

[359] *1997 Further Notice*, 12 FCC Rcd at 18572-73, para. 157.

there are measures other than lines and investment to which specific expenses should be tied.[360] With respect to plant specific expenses, the Commission sought comment on whether maintenance expense estimates should depend upon plant mix and, in particular, whether an increase in the use of aerial cable also increases maintenance expenses, and whether plant specific expenses should vary with such characteristics as climate or soil type.[361] In addition, the Commission asked commenters to identify the complete set of forward-looking expenses for which universal service support should be available.[362]

196. In the *Platform Order*, we adopted HAI's algorithm for calculating expenses and GSF costs, as modified to provide some additional flexibility in calculating expenses offered by the BCPM sponsors.[363] With this added flexibility, the model allows the user to estimate expenses as either a per-line amount or as a percentage of investment. We noted that many of the questions regarding how best to calculate expenses will be resolved in the input selection phase of this proceeding.[364]

B. Issues for Comment

1. Plant Specific Operations Expenses

197. We first address the inputs related to plant specific operations.[365] Plant specific operations expenses are the expense costs related to the maintenance of specific kinds of telecommunications plant.[366]

---

[360] *1997 Further Notice*, 12 FCC Rcd at 18572, 18574-77, paras. 157, 162, 165, 168, 171.

[361] *1997 Further Notice*, 12 FCC Rcd at 18574, para. 162.

[362] *1997 Further Notice*, 12 FCC Rcd at 18574-77, paras. 162, 165, 168, 171.

[363] *Platform Order*, 13 FCC Rcd at 21357, para. 81.

[364] *Platform Order*, 13 FCC Rcd at 21360, para. 87.

[365] Note that plant-specific operations expenses include general support facilities (GSF) expenses.

[366] Plant specific operations expenses correspond to the following ARMIS 43-03 report accounts:

6110 - Network Support Expense
6120 - General Support Expense
6210 - COE Switch
    6212 - COE Digital Electronic Switch only
6220 - Operator Systems
6230 - COE Transmission
    6231 - Radio Systems

198. Nationwide Estimates. We tentatively conclude that we should adopt input values that reflect the average expenses that will be incurred by non-rural carriers, rather than a set of company-specific maintenance expense estimates. We make this tentative conclusion for a number of reasons. First, we note that this tentative conclusion is consistent with a recommendation of the state Joint Board members.[367] Second, we have not been able to obtain current cost-to-book cost ratios for each ARMIS reporting firm, which would be necessary to calculate company or study area specific expense-to-investment ratios in the proposed methodology described below. Further, we tentatively conclude that the use of national or regional averages for input factors is more consistent with the forward-looking nature of the high cost model because it mitigates the rewards to less efficient companies. We seek comment on these tentative conclusions. Parties advocating the use of company-specific values or other alternatives to nationwide or regional estimates should identify the method and data readily available to firms that would be used to estimate plant-specific expenses. Commenters should also indicate how their proposal is consistent with the goal of estimating forward-looking costs. We note that the proposed expense estimates in Appendix A are nationwide averages.

199. In support of the use of company-specific factors, a number of commenters and workshop participants argue that maintenance expenses vary widely by geographic area and the type of plant installed. Others contend that plant-specific expenses are highly dependent on regional wage rate differentials. At this time, we have been unable to verify significant regional differences among study areas or between companies based solely on labor rate variations using the publicly available ARMIS expense account data for plant-specific maintenance costs. Nonetheless, we believe that expenses vary by the type of plant installed. The synthesis model takes this variance into account because, as investment in a particular type of plant varies, the

---

6232 - COE Circuit - DDS
6232 - COE Circuit - Other than DDS
6310 - Information Origination/Termination
6311 - Station Apparatus (only)
6341 - Large PBX
6351 - Public Telephone
6362 - Other Terminal Equipment
6411 - Poles
6421.1 - Aerial Cable - Metallic (Copper)
6421.2 - Aerial Cable - Fiber
6422.1 - Underground Cable - Metallic (Copper)
6422.2 - Underground Cable - Fiber
6423.1 - Buried Cable - Metallic (Copper)
6423.2 - Buried Cable - Fiber
6441 - Conduit Systems

[367] *See* State High Cost Report at 21; *1997 Further Notice*, 12 FCC Rcd at 18574, para. 161.

associated expense cost also varies. We seek comment on the degree to which regional wage rate differentials exist and are significant. We ask parties to suggest independent data sources on variations of wage rates between regions. We seek comment on a methodology that permits such distinctions without resorting to self-reported information from companies.

200. One possible approach would be to use indexes calculated by the President's Pay Agent for calculating locality pay differentials for Federal employees.[368] Under this methodology, we would first calculate a baseline expense factor for the labor-related portion of each plant-specific expense account according to a formula which is based on the sum of an expense factor for that category by study area, a weight representing the total investment in a study area, and the regional wage differential deflator calculated in the Pay Agent's report applicable to the study area.[369] The baseline expense would then be disaggregated to each wire center or study area using the deflator. We seek comment both on the validity of this approach as well as on the specific implementation.

201. We also tentatively conclude that we should not adopt different expense estimates for small, medium, and large non-rural companies on a per line basis. In order to determine if economies of scale should be a factor in plant-specific expenses, Commission staff tested whether significant differences in maintenance expenses per line could be discerned from segmenting companies into small carriers with less than 500,000 access lines, medium carriers with between 500,000 and 5,000,000 access lines, and those large carriers with over 5,000,000 access lines.[370] We have found no significant differences in the expense factor per-line or per-investment estimates based on these criteria. Therefore, to estimate costs associated with an efficient network as determined by the forward-looking mechanism, we tentatively conclude that plant-specific maintenance factors should be estimated on a national basis. We seek comment on these tentative conclusions.

202. Methodology. Commenters advocate two methods of estimating plant specific operations expenses. The BCPM sponsors contend that all expenses should be calculated on a per-line basis. The BCPM default estimates for these accounts are based on a survey of companies. The HAI sponsors argue that expenses should be calculated as a percentage of investment. Specifically, the HAI sponsors assert that plant specific operations expenses should

---

[368] *Report on Locality-based Comparability Payments for the General Schedule,* Annual Report of the President's Pay Agent, Appendix II, 1995.

[369] The baseline expense factor is calculated according to the formula $E_i = \sum_j e_{ij} w_j r_j$ where E_i is the baseline expense factor for category i, e_{ij} is the expense factor for category i and for study area j, w_j is a weight based on the number of switched lines in study area j, and r_j is the regional deflator from the Pay Agent's report for the region most applicable to study area j.

[370] We note that the data used for this analysis is available on the Commission's Web site at http://www.fcc.gov.

be calculated as a fixed percentage of investment.

.

203. Although we agree with the HAI sponsors that plant specific operations expenses should be estimated as a percentage of investment, we tentatively decline to adopt the flat percentages they advocate. By using ARMIS investment values that are not converted to current levels, the flat-rate method proposed by the HAI sponsors does not attempt to use forward-looking estimates. We also tentatively decline to adopt the per-line BCPM default estimates. Based on a private survey of companies, the BCPM values fail to comply with criterion eight identified in the *Universal Service Order*, because the underlying data for these values are not open to and verifiable by the public nor made available under the *Protective Order*.[371] In contrast to the BCPM proposal, the methodology that we tentatively adopt here is primarily based on readily identifiable and publicly available ARMIS data. Although ARMIS data reflect the embedded costs incurred by incumbent LECs, we take steps in our proposed methodology to convert these costs to forward-looking estimates, as described below. We note that this methodology was proposed by Commission staff in the public workshop on maintenance expenses on December 10, 1998.

204. In order to estimate forward-looking plant specific operations expenses, we have considered the requirements set forth in the *Platform Order*, and information provided in workshops, comments and *ex-partes.* We tentatively conclude that the input values for each plant specific operations expense account should be calculated as the ratio of booked expense to current investment. These expense-to-investment ratios would then be multiplied in the model by the model-derived investment for each investment account or group of accounts, to produce an estimate of the plant specific operations expenses.

205. Our proposed methodology for estimating expense to investment ratios consists of four steps. First, staff obtained from some of the ARMIS-filing companies, account-specific current cost to book cost (current-to-book) ratios for the related investment accounts. The current-to-book ratio is a tool that is used to restate the historic, financial account balance on a company's books, which reflects investment decisions made over many years, to present day replacement cost.[372] For each account or sub-account, a current-to-book ratio is developed by first revaluing each type of equipment at its current replacement cost. The sum of these current costs are then divided by the total, embedded cost account balance. The resulting current-to-book ratio will be greater than one if current costs are rising relative to the historic costs and less than one if current costs are declining. Current-to-book ratios for the years ending 1995 and 1996 were provided by the following five holding companies: Ameritech, Bell Atlantic, Bell

[371] Protective Order, 13 FCC Rcd at 13910.

[372] An example of a current-to-book ratio for a facility would be defined as the ratio of the current cost of a facility divided by its embedded cost. Therefore, if a pole cost $200 to install in 1980, and $400 today, the current-to-book ratio is $400/$200 = 2.0.

South, GTE, and Southwestern Bell.[373] Although we would prefer to have data from more companies, the other ARMIS-filing carriers informed us that, they either no longer maintain this type of information, or never used current-to-book ratios for accounting purposes.[374]

206. Second, staff calculated composite current-to-book ratios for each account. For each study area of the five holding companies that provided current-to-book ratios, we obtained year-end 1995 and 1996 investment balances from ARMIS for the plant accounts consistent with the aforementioned plant-specific expense accounts.[375] Study area-specific current-to-book ratios for the two periods were multiplied by the 1995 and 1996 ARMIS investments in each account to derive the forward-looking, "current," year-end 1995 and 1996 investment levels by account and by study area. The ARMIS and current investments were then summed separately, by year and by account, for all study areas of the five holding companies. The resulting total current investment (by year and by account for the sum of all study areas) was then divided by the total ARMIS investment (by year and by account for the sum of all study areas) producing two sets of

[373] The current-to-book ratios submitted by these companies are proprietary information subject to provisions in the *Protective Order* and therefore are not re-produced here.

[374] We note that the five carriers that provided current-to-book ratios account for 66 percent of plant specific expenses and 70 percent of the investment reflected in ARMIS.

[375] Investment balances were obtained from the following plant accounts:

2112 - 2116 - Network Support Investment
2121 - 2124 - General Support Investment
2210 - COE Switch
    2212 - COE Digital Electronic Switch only
2230 - COE Transmission
    2231 - Radio Systems
    2232 - COE Circuit - DDS
    2232 - COE Circuit - Other than DDS
2310 - Information Origination/Termination
    2311 - Station Apparatus
    2341 - Large PBX
    2351 - Public Telephone
    362 - Other Terminal Equipment
2410 - Cable and Wire Facilities
    2411 - Poles
    2421.1 - Aerial Cable - Metallic (Copper)
    2421.2 - Aerial Cable - Fiber
    2422.1 - Underground Cable - Metallic (Copper)
    2422.2 - Underground Cable - Fiber
    2423.1 - Buried Cable - Metallic (Copper)
    2423.2 - Buried Cable - Fiber
    2241 - Conduit Systems

composite current-to-book ratios (year end 1995 and 1996).

207. Third, to calculate the expense-to-investment ratios for the plant-specific operations expense accounts, staff obtained total, year-end 1995 and 1996 investment account balances from the ARMIS 43-03 reports for all ARMIS-filing companies. To make these embedded account balances forward-looking, staff next multiplied each investment account balance for each year by the current-to-book ratios for the same year developed earlier. The 1995 and 1996 "current" balances for each account were then averaged by adding the two years together and dividing by two.

208. Finally, from the 1996 ARMIS 43-03 report, staff obtained the 1996 balances for each plant-specific operations expense account for all ARMIS-filing companies. The expense account balances were divided by their respective average "current" investment to obtain expense-to-investment ratios. We tentatively conclude that these expense-to-investment ratios should be applied in the mechanism to the model-derived investment balances to obtain forward-looking plant-specific operations expense estimates. The industry-wide expense-to-investment ratios are listed in Appendix A. We seek comment on these proposed input values, tentative conclusions, and the proposed methodology outlined above.

209. Converting Expense Estimates to Current Values. We recognize that plant specific expenses will change over time. Because we initially used data from 1996 in the methodology described above, we tentatively conclude that it is appropriate to adjust this data to account for inflation and changes in productivity by obtaining revised 1997 current-to-book ratios from those companies providing data. In addition, we tentatively conclude that we should use the most current ARMIS data available necessary for the maintenance factor methodology. Because expense and investment balances for 1998 are not available from ARMIS at this time, we have also not been able to include them in calculating the plant-specific maintenance factors. We tentatively conclude that we should use these data in the final computation of expense estimates. We seek comment on these tentative conclusions.

210. GSF Investment. GSF investment includes buildings, motor vehicles, and general purpose computers. The synthesis model uses a three-step algorithm to estimate GSF for each study area. First, the model calculates a GSF investment ratio for each GSF account by dividing the ARMIS investment for the account by the ARMIS total plant in service (TPIS). Second, the model calculates a preliminary estimate GSF investment for each account by multiplying the GSF investment ratio for that account times the model's estimate of TPIS.[376] Finally, the model reduces each of the preliminary GSF investment estimates by multiplying by one of two factors,

[376] As calculated by the model, TPIS excludes GSF investment, while ARMIS TPIS includes GSF investment. HAI Dec. 11, 1997 submission.

which are the same as those used in the HAI model.[377]

211. We tentatively conclude that the model's preliminary estimate of GSF investment should be reduced, because only a portion of GSF investment is related to the cost of providing the services supported by the federal mechanism. We also tentatively conclude that the synthesis model should not use the same factors as those used in the HAI model. The HAI sponsors, who developed the expense module in the synthesis model, have not shown why these particular factors should be used for this purpose. Instead, we tentatively conclude that total GSF investment should be reduced by factors that reflect the percentage of customer operations, network operations, and corporate operations used to provide the supported services.[378] We seek comment on these tentative conclusions.

2. Common Support Service Expenses

212. We next address common support service expenses, which are comprised of corporate operations, customer service expenses, and plant non-specific expenses. Corporate operations expenses are those costs associated with general administrative, executive planning, human resources, legal, and accounting expenses for total company operations. Customer service expenses include marketing, billing, operator services, directory listing, and directory assistance costs.[379] Plant non-specific expenses are common network operations and maintenance type of

---

[377] These two factors are one minus either the Total Operations General Support Allocator (Total Operations Allocator) or the Office Worker General Support Allocator (Office Worker Allocator). The Total Operations Allocator is applied to the Motor Vehicles, Garage Work Equipment, and Other Work Equipment accounts, while the Office Worker Allocator is applied to the Furniture, Office Equipment, Buildings and General Purpose Computer accounts. *See* HAI Dec. 11, 1997 submission. Each of these allocators is a fraction. The Total Operations Allocator is the ratio of the sum of customer operations expenses and corporate operations expenses to total operating expenses. The Office Worker Allocator is the ratio of the sum of corporate operations expenses and network operations expenses to the sum of customer operations expenses, corporate operations expenses and network operations expenses.

[378] We tentatively conclude that the Office Worker Allocator should equal the ratio of the sum of customer operations expenses, network operations expenses, and corporate operations expenses assigned to supported services, to the sum of those expenses calculated on a total regulated basis. In principle the Total Operations Allocator should equal the Office Worker Allocator. Due to equations embedded in the HAI expense module, however, the total operations general support allocator is set equal to one minus the office worker general support allocator. We tentatively conclude that GSF investment should be calculated as the product of the Office Worker Allocator, calculated on a nationwide basis, and the preliminary GSF investment, which is calculated on a study area specific basis.

[379] Corporate operations and customer services include the following ARMIS accounts and their subaccounts:

6610 - Marketing Total
- 6611 - Product Management
- 6612 - Sales

expenses, including engineering, network operations, power and testing expenses, that are considered general or administrative overhead to plant operations.[380] Commission staff held public workshops where they sought comment on various paradigms and econometric estimation techniques used to calculate these factors. Commission staff also discussed possible methods for subtracting non-recurring costs from expense estimates and for adjusting estimates for inflation and potential wage differentials.[381]

213. Per-Line Basis. Common support services are costs that cannot readily be associated with any particular maintenance expense or investment account. As a result, we tentatively conclude that these expenses (unlike plant-specific expenses) should be estimated on a per-line basis, as advocated by the BCPM sponsors.[382] We tentatively conclude that the HAI

6613 - Product Advertising
6620 - Service Expense Total
6621 - Call Completion (Operator Service Expense)
6622 - Number Services (Directory Publishing Expense)
6623 - Customer Services
6710 - Executive and Planning Total
6711 - Executive
6712 - Planning
6720 - General and Administrative
6721 - Accounting and Finance
6722 - External Relations
6723 - Human Resources
6724 - Information Management
6725 - Legal
6726 - Procurement
6727 - Research and Development
6728 - Other General and Administrative

[380] Non-specific plant expenses include the following ARMIS expense accounts:

6510 - Other Property Plant and Equipment Expense
6530 - Network Operations
6531 - Power
6532 - Testing

[381] See *1997 Further Notice*, 12 FCC Rcd at 18578, para 173.

[382] BCPM model default values on a per-line per-month basis are the following:

Aggregate USOA Account	BCPM Default Values
Other PP & E (6510)	$ 0.03
Network Operations (6530)	1.33
Marketing (6610)	0.35

sponsors have failed to justify their proposal that expense estimates for certain accounts be based on a percentage of ARMIS-reported expenses or a percentage of total capital costs and operations expenses.[383] We seek comment on these tentative conclusions.

214. Nationwide Estimates. Commenters such as Aliant, Sprint, GTE, and Bell South have argued for the inclusion of all accounts, and have argued further that these types of corporations and customer service expenses are inherently company specific in nature and should be evaluated in this manner. We tentatively conclude that inputs for corporate operations, customer services, and plant non-specific expenses should also be estimated on a nationwide basis rather than a more disaggregated basis. We seek comment on this tentative conclusion.

215. Costs associated with plant non-specific expenses used to supply and run network operations by definition cannot be directly allocated to individual maintenance or investment accounts. Commenters have suggested that these types of expenses may vary among carriers and between study areas. They argue that these differences may be a result of company specific plant configurations, geographic and labor demographic variables, one-time exogenous costs, and non-recurring adjustments such as re-engineering expenses. They further argue that administrative support expense differences are also a function of regional wage differentials and plant specifications. As stated earlier, we cannot at this time distinguish significant differences in regional wage differentials for administrative services based solely on ARMIS expense data for these accounts. Further, costs associated with corporate overhead and customer services accounts are not directly linked to specific company investment levels. We tentatively conclude that, for forward-looking cost estimates, these types of administrative and service expenses are less dependent on carrier physical plant or geographic differentials than those that also correlate to company size (number of lines) and demand (minutes of use), which were used as estimation variables to develop the model inputs. We seek further comment on this analysis.

216. We also tentatively conclude that we should not adopt different estimates for small, medium, and large high cost non-rural companies for common support service expenses. As with plant specific expenses, Commission staff tested whether statistically significant differences in common support service expenses per line could be determined from segmenting companies into small carriers with less than 500,000 access lines, medium carriers with between

Service Exp./Customer Operations (6620)	2.42
xec., Planning, G&A (6700)	2.29
Total Per-Line Per-Month Expenses	$ 6.42

[383] For example, the HAI sponsors propose that network operations expense be estimated at 50 percent of ARMIS-reported network operations expense. Corporate overhead expense was estimated to be 10.4 percent of the total of capital costs and operations expenses as a default value. *See 1997 Further Notice*, 12 FCC Rcd at 18572, 18577, paras. 164, 170.

500,000 and 5,000,000 access lines, and those large carriers with over 5,000,000 access lines. We have further reviewed whether expense estimates varied due to the total number of Dial Equipment Minutes (DEMs) reported by companies in addition to the number of lines. As with the plant-specific accounts, we could find no significant differences in the expense factor per-line based on these criteria. Therefore, consistent with the forward-looking costs associated with an efficient network as determined by the federal mechanism, we tentatively conclude that we should estimate these non-specific network operations expenses on a nationwide, per-line basis. We seek comment on this tentative conclusion.

217. Data Source. Following standard economic analysis and forecasting methods, we propose to use publicly available 1996 ARMIS expense data[384] and minutes of use information from NECA,[385] by study area, to estimate the portion of these company-wide expenses to be covered by universal service support. We believe that consolidation of this data produces a sufficient number of observations by study area for each of these accounts.[386] Public data for 1996 was used in this analysis in order to compare the estimates obtained with proprietary information received from a previous data request. We note that this methodology was proposed by Commission staff in a public workshop on December 1, 1998. We seek comment on this proposal.

218. Regression Methodology. Using standard multi-variate regression analysis, we developed two different specifications to determine the portion of corporate and customer operations and plant non-specific expenses subject to universal service support. Each equation estimates total expenses per total lines as a function of switched lines per total lines, special lines per total lines, and toll minutes per total lines, either in combination (Specification 1) or separated between intrastate toll and interstate toll minutes per total lines (Specification 2).[387]

---

[384] Data was taken from 1996 ARMIS 43-01, Subject to Separations (Column F) for Accounts 6610, 6620, 6710 and 6720. Data was taken from 1996 ARMIS 43-03, Subject to Separations (Column M) for Accounts 6510 and 6530. Line counts were taken from 1996 ARMIS 43-08, Table III, Total Switched Lines (Column DJ) and Total Access Lines (Column DM).

[385] Dial Equipment Minutes of Use (DEMS) for 1996 were taken from NECA, available on the Commission's Web site at http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/neca.html.

[386] See Appendix F for further explanation of the data sources used and the method for consolidating study areas between data sets to reconcile the number of observations for the variables used in the regression equations.

[387] Specification 1 used the following regression equation: Expense/Total Lines = $_1$ (Switched Lines/Total Lines)+ $_2$ (Special Lines/Total Lines)+ $_3$ (Toll Minutes/Total Lines). Specification 2 used the following equation: Expense/Total Lines = $_1$ (Switched Lines/Total Lines)+ $_2$ (Special Lines/Total Lines)+ $_3$ (State Toll Minutes/Total Lines)+ $_4$ (Interstate Toll Minutes/Total Lines)

219. Each specification has been chosen to separate the portion of expenses that could be estimated as attributable to special access lines and toll usage, which are not supported by the high cost mechanism, rather than switched lines and local usage. Commission staff found from an earlier formulation that, when the model included both a switched line component and a local usage component, the number of switched lines and local DEMs were so highly correlated that it did not increase the explanatory power of the model to include both variables. As a result, we tentatively conclude that we should not include local dial equipment minutes per total lines as an explanatory variable, despite suggestions by a number of workshop participants and commenters. Because both regression equations produce reasonable estimates, and in order to prevent any potential advantage to firms which might have a different mix of toll minutes, we propose to use the average of the estimates from the two specifications. We seek further comment on this proposed regression methodology.

220. Removal of One-Time and Non-Supported Expenses. In order to eliminate the impact of one-time non-recurring expenses on forward-looking estimates, we have sought verifiable public information on exogenous costs and those that are recovered through non-recurring charges and tariffs. These include specific one time charges for the cost of mergers, acquisitions, and process re-engineering. We also sought to estimate the cost of providing permanent number portability, network and interexchange carrier connection, disconnection, and re-connection (i.e., churn) costs. Other recurring functions that we have attempted to identify include vertical features expenses, billing and collection expense not related to supported services, operational support systems and other expenses associated with providing unbundled network elements and wholesale services to competitive local exchange carriers, collocation expenses, and costs associated with SS7 services.

221. Without obtaining proprietary information from carriers, we have been unable to find an objective public data source or discern a systematic method for excluding many of these costs from the expense data used to calculate the input factors. AT&T and MCI WorldCom presented an analysis to Commission staff on January 14, 1999, proposing a method to estimate, non-supported, non-recurring, or one-time expenses for customer, network, and corporate operations expenses. Averaging data for five years (1993-1997) of corporate Security and Exchange Commission (SEC) 10-K and 10-Q filings, a percentage of corporate and network operations identified as one-time charges were estimated for the BOCs and all Tier One companies. Because the SEC reports do not specifically indicate whether the one-time expenses were actually made during the year(s) indicated, we tentatively conclude that we should not use these figures to adjust the 1996 ARMIS data used in estimating the expense input values. The analysis does indicate, however, that one-time expenses for corporate operations can be significant and should be estimated, if possible.[388] Because this type of data detail is not publicly

[388] According to the analysis, on average, approximately 20 percent of yearly corporate operations expenses consisted of non-recurring charges for costs relating to merger and acquisitions and workforce restructuring over

available from ARMIS or easily reconcilable from other public company financial reports to individual account expenses for a specific year, we invite comment on how to identify and estimate these expenses.

222. We tentatively conclude that, if it is determined that expense estimates to be used as inputs in the high-cost mechanism are to be revised annually, as suggested by various parties,[389] one-time non-recurring costs should be systematically excluded. We further recommend that, to the extent possible, efforts be made to use current information supplied and verified by the companies, if none can be found independently, to more accurately reflect forward-looking expenses. We seek comment on this tentative conclusion and recommendation.

223. Removal of Non-Supported Expenses. Cost reductions were made for continuous non-supportable services which could be identified and estimated from publicly available (ARMIS) expense data. Expense adjustments were made to calculated input values for marketing expenses. Though the HAI sponsors and state Joint Board members suggested that marketing expenses be excluded entirely,[390] commenters and workshop participants noted that Section 214 of the Communications Act requires eligible telecommunications carriers to advertise the availability of residential local exchange and universal service supported services.[391]

224. We tentatively conclude that an analysis made by Economics and Technology, Inc., regarding the disaggregation of marketing and advertising expenses made by companies for basic telephone service, is the most accurate method on the record for apportioning marketing expenses between supported and non-supported services. This analysis attributes an average of 95.6 percent of company marketing costs to non-supported customers or activities, such as vertical and new services.[392] We seek comment on this proposed analysis for estimating marketing expenses.

---

the five year period. Network Operations one-time charges for things such as process re-engineering were also calculated using the same methodology. On average, 2.6 percent of yearly Network Operations expenses were attributed to non-recurring charges.

[389] See *1997 Further Notice*, 12 FCC Rcd at 18578, para. 173.

[390] Both the HAI sponsors as well as the State Joint Board indicated that all marketing expenses be excluded. *See 1997 Further Notice*, 12 FCC Rcd at 18576, paras. 166, 167. *See also*, Letter from Chris Fentrup, MCI-Worldcom to Magalie Roman Salas, FCC, dated January 15, 1999.

[391] Section 214 (e)(1)(B) of the Communications Act states that eligible telecommunications carriers shall, throughout the service area for which the designation of universal service support is received, "advertise the availability of such services and the charges therefor using media of general distribution." 47 USC § 214(e)(1)(B).

[392] *See* Further Comments of the National Cable Television Association Inc., CC Docket 96-45, Appendix 3A. The adjustment for supported local loop Marketing Expenses was made by deducting 95.6 percent of estimated expenses, maintaining 4.4 percent of Account 6610. See further discussion in Appendix F for calculations of expense reductions.

225. We also propose adjustments for non-supported service costs related to coin operations and collection, published directory, access billing, interexchange carrier office operation, and service order processing,[393] which are associated with specific expense accounts used in the regression analysis. Under this methodology, percentage reductions would be made to the estimated coefficients for those accounts using calculations based on a time trend analysis of average ARMIS 43-04 expense data[394] for five years (1993-1997). We seek comment on this proposed methodology.

226. Converting Expenses to 1999 Values. In order to bring forward the 1996 data relied upon for estimating common support service expenses, we propose to use a 6.0 percent productivity factor for each year (1997 and 1998) to reduce the estimated input values for each account. The 6.0 percent productivity factor is based on the 6.5 percent "X-factor" used in the Commission's price cap methodology.[395] We note that the D.C. Circuit Court of Appeals recently reversed and remanded for further explanation the Commission's decision to select 6.0 percent as the first component of the X-factor.[396] In light of that remand, we seek comment on whether we should continue to adjust our expense input values to reflect productivity gains. If we determine that such adjustment is appropriate, we may want to use an alternative method of estimating productivity. We seek comment on what other measures we could use to adjust our expense data for gains in productivity. We further propose to add an inflation factor for each year based on the fixed weighted Gross Domestic Product Price Index (GDP-PI) for 1997 (2.1120 percent) and for 1998 (2.1429 percent).[397] Thus, we propose a net reduction of 3.888 percent for 1997 and 3.8571 percent for 1998 when using the 6.0 percent productivity factor. We seek comment on this method for converting expenses to 1999 values.

---

[393] A deduction was made for average expenses relating to Coin Collection and Administration, Carrier Access Billing, and Other Customer Services Total at -12.46 percent from the Customer Services Subaccount 6623, maintaining 87.54 percent of the costs associated with this account. See discussion in Appendix F for the calculations and methodology of expense reductions.

[394] ARMIS 43-04 Accounts Subject to Separations, Basic Local Loop and Other Related Services for Total Customer Operations Expense.

[395] Under price cap regulation, the productivity (X) factor includes a .50 percent (.005) Consumer Productivity Dividend (CPD), which is used as a supplement to calculated productivity measures to assure that consumers additionally benefit from price cap rules through lower access charge rates. Thus, for universal service calculations, this dividend was subtracted from expected productivity increases or cost savings that can be experienced each year (1997 and 1998) by firms that may provide universal service.

[396] *United States Telephone Association v. FCC*, No. 97-1469 (D.C. Cir. May 21, 1999).

[397] These inflation factors provided by the Department of Commerce were used by price cap companies in their annual tariff filings to the Commission to allow an increase in revenues for the years 1997 and 1998 under the price cap regulatory mechanism and access reform rules.

227. Estimates of Corporate Operations, Customer Operations, and Plant Non-Specific Expenses. Appendix A contains a summary of the proposed per-line, per-month input figures for both plant non-specific expenses, corporate operations, and customer operations adjusted expenses as calculated using the aforementioned methodology. We seek comment on these proposed values.[398]

VIII. CAPITAL COSTS

228. In this section, we address the inputs in the model related to capital costs: depreciation, cost of capital, and annual charge factors.

A. Depreciation

1. Background

229. We now consider the inputs related to the calculation of depreciation expenses. The model uses "adjusted projected lives" to recover the current costs of the assets.[399] Under this approach, the annual depreciation charges associated with an asset are computed by dividing the asset's current cost by its adjusted projected life.[400] A shorter life will increase the annual

[398] Input values for common support service expenses are reproduced here:

Aggregate USOA Account		Adjusted Expense Inputs
Other PP & E (6510)	$	0.07
Network Operations (6530)		1.35
Marketing (6610)		0.02
Service Exp./Customer Operations (6620)		1.07
Exec., Planning, G&A (6700)		2.60
Totals Per-Line Per-Month	$	5.11

[399] *1997 Further Notice*, 12 FCC Rcd at 18570, para. 149. The projected life of an asset is the asset's expected service life at installation, reflecting not only the physical life of the equipment, but also the obsolescence associated with the replacement of older equipment with equipment that uses new technologies and forecasts of future replacements. The adjusted projected life of an asset is its projected life adjusted by its future net salvage value. Future net salvage is the percentage of the asset's value that the owner expects to obtain when selling the asset at the end of its useful life. *Id.*

[400] Depreciation charges are computed in this manner for the first year. In subsequent years, depreciation charges are computed using reserve.

depreciation expense.

230. In the *Universal Service Order*, the Commission concluded that "economic lives and future net salvage percentages used in calculating depreciation expense should be within the FCC-authorized range" and use currently authorized depreciation lives.[401] In the *1997 Further Notice*, the Commission tentatively concluded that it should adopt depreciation expenses that reflect a weighted average of the rates authorized for carriers that are required to submit their rates to us.[402] The Commission also sought comment on whether adjusted projected asset lives should reflect the lives of facilities and equipment dedicated to providing only the services supported by universal service or whether the asset lives should reflect a decision to replace existing plant with plant that can provide broadband services.[403] The *May 4 Public Notice* requested further information on these issues.[404]

2. Issues for Comment

a. Method of Depreciation

231. Before selecting values for projected life and future net salvage value, we first tentatively adopt the method of depreciation that should be used in the model, that is, how depreciation allowances should be allocated over the life of an asset. The Commission's depreciation accounting rules require carriers to use straight-line equal-life group depreciation.[405] Both the HAI and BCPM proponents advocate the use of straight-line depreciation in calculating depreciation expenses.[406] Ameritech suggests that the depreciation method used for a specific geographic area should be consistent with any studies that underlie the development of economic lives or net salvage values for that same area.[407] GTE proposes that incumbent LECs be allowed

---

[401] *Universal Service Order*, 12 FCC Rcd at 8913-14, para. 250 (criterion 5).

[402] *1997 Further Notice*, 12 FCC Rcd at 18571, para. 152.

[403] *Id.*

[404] *See Inputs Public Notice*.

[405] 47 C.F.R. § 32.2000(g). Straight-line depreciation is an accounting technique in which an asset's value is divided into equal parts over its useful life. The equal-life group procedure subdivides assets according to age. *See Amendment of Part 31 (Uniform System of Accounts for Class A and B Companies) so as to Permit Depreciable Property to be Placed in Groups Comprised of Units with Expected Equal Life for Depreciation Under the Straight-Line Method*, Report and Order, 83 FCC2d 267 (1980), recon., 87 FCC2d 916 (1981), supplemental opinion, 87 FCC2d 1112 (1981).

[406] HAI June 1, 1998 comments at 14; BCPM June 1, 1998 comments at 8.

[407] Ameritech June 12, 1998 reply comments at 2-3.

to use depreciation lives based on the expected economic life of the asset.[408] Because the Commission's rules require the use of straight-line depreciation, rather than a more accelerated depreciation method, we tentatively conclude that this method, which is used for all Commission-proposed depreciation, is also appropriate for use in the high cost support mechanism. We seek comment on this tentative conclusion.

b. Depreciation Lives and Future Net Salvage Percentages

232. In estimating depreciation expenses, the model uses the projected lives and future net salvage percentages for the asset accounts in Part 32 of the Commission's rules.[409] Traditionally, the projected lives and future net salvage values used in setting a carrier's rates have been determined in a triennial review process involving the state commission, the Commission, and the carrier. In order to simplify this process, the Commission has prescribed ranges of acceptable values for projected lives and future net salvage percentages.[410] The Commission's prescribed ranges reflect the weighted average asset life for regulated telecommunications providers. These ranges are treated as safe harbors, such that carriers that incorporate values within the ranges into their depreciation filings will not be challenged by the Commission. Carriers that submit life and salvage values outside of the prescribed range must justify their submissions with additional documentation and support.[411] Commission authorized depreciation lives are not only estimates of the physical lives of assets, but also reflect the impact of technological obsolescence and forecasts of equipment replacement. We believe that this process of combining statistical analysis of historical information with forecasts of equipment replacement generates forward-looking projected lives that are reasonable estimates of economic lives and, therefore, are appropriate measures of depreciation.

233. In the *1997 Further Notice*, the Commission tentatively concluded that it should adopt depreciation expenses that reflect a weighted average of the rates authorized for carriers

---

[408] GTE June 12, 1998 reply comments at 19. GTE urges the Commission to allow incumbent LECs to use the same depreciation rates and salvage values as they use for financial reporting or, in the alternative, to establish a range based on the depreciation rates and salvage values used by interexchange carriers and competitive LECs for their financial reporting.

[409] *See* 47 C.F.R. § 32.2000(j)

[410] *See* 47 C.F.R. § 32.2000(g)(iii).

[411] The Commission has proposed streamlining the depreciation prescription process by, *inter alia*, expanding the prescribed range for the digital switching plant account and eliminating salvage from the depreciation process. *See 1998 Biennial Regulatory Review -- Review of Depreciation Requirements for Incumbent Local Exchange Carriers*, Notice of Proposed Rulemaking, CC Docket No. 98-137, 13 FCC Rcd 20542 (1998).

that are required to submit their rates to us.[412] The values submitted by the HAI sponsors essentially reflect such a weighted average. The HAI values represent the weighted average depreciation lives and net salvage percentages from 76 study areas.[413] According to the HAI sponsors, these depreciation lives and salvage values reflect the experience of the incumbent LEC in each of these study areas in retiring plant, and its projected plans for future retirements.[414]

234. We tentatively conclude that HAI's values represent the best forward-looking estimates of depreciation lives and net salvage percentages.[415] We seek comment on this tentative conclusion. Generally, these values fall within the ranges prescribed by the Commission for projected lives and net salvage percentages. Although the HAI values for four account categories fall outside of the Commission's prescribed ranges,[416] these values still reflect the weighted average of projected lives and net salvage percentages that were approved by the Commission and therefore are consistent with the approach proposed in the *1997 Further Notice*. As noted above, the fact that an approved value falls outside of the prescribed range simply means that the carrier that proposed the value was required to provide additional justification to the Commission for this value. We are satisfied that HAI calculated its proposed rates using the proper underlying depreciation factors and that HAI's documentation supports the selection of these values.

235. We disagree with the BCPM sponsors and other incumbent LECs that the Commission's prescribed ranges are not appropriate for determining depreciation rates in a competitive environment.[417] These parties argue that rapid changes in technology and the opening of local telecommunications markets to competition shorten asset lives significantly beyond what the Commission has prescribed.[418] The BCPM sponsors claim that these factors cause existing equipment to become obsolete at a faster pace, thus reducing the overall economic value of the assets more quickly.[419] We agree with the HAI sponsors that there is no evidence to support the

---

[412] *1997 Further Notice*, 12 FCC Rcd at 18571, para. 152.

[413] HAI June 1, 1998 comments at 10.

[414] *Id.*

[415] The proposed values for these inputs are listed in Appendix A.

[416] HAI's lives and salvage values fall within the Commission's prescribed ranges with the exception of values for four accounts: Digital Circuit Equipment; Garage Work Equipment; Operator Systems; and Poles.

[417] Aliant June 1, 1998 comments at 3-4; Ameritech June 1, 1998 comments at 4; BCPM June 1, 1998 comments at 11-13; GTE June 1, 1998 comments at 15-16; Southwestern June 1, 1998 comments at 9-10.

[418] BCPM June 1, 1998 comments at 12; Southwestern June 1, 1998 comments at 17; GTE June 1, 1998 comments at 16; Ameritech June 1, 1998 comments at 4.

[419] BCPM June 1, 1998 comments at 9-10.

claim that increased competition or advances in technology require the use of shorter depreciation lives in the model than are currently prescribed by the Commission.[420] The Commission's prescribed lives are not based solely on the engineered life of an asset, but also consider the impacts of technological change and obsolescence. We note that the depreciation values we tentatively adopt are generally at the lower end of the prescribed range. We further note that although the average depreciation rate for an incumbent LEC's Total Plant in Service is approximately seven percent, incumbent LECs are retiring plant at a four percent rate. This difference has allowed depreciation reserves to increase so that the depreciation reserve-ratio is greater than 50 percent. We tentatively conclude that the existence of this difference implies that the prescribed lives are shorter than the engineered lives of these assets. In addition, this difference provides a buffer against technological change and competitive risk for the immediate future. We therefore tentatively conclude that the Commission's prescribed ranges are appropriate to determine depreciation rates for the model. We seek comment on these tentative conclusions.

236. We tentatively decline to adopt the values for projected lives and net salvage percentages submitted by the BCPM proponents. The BCPM proponents based their default values for projected lives and salvage on a LEC industry data survey requesting forward-looking values.[421] With regard to projected lives, the BCPM values generally fall outside of the Commission's prescribed ranges.[422] Because the BCPM sponsors fail to introduce sufficient evidence supporting their values, we tentatively decline to accept their approach. The BCPM proponents submitted values for projected life that are significantly shorter than the already shortened Commission's prescribed life ranges.[423] This is significant because BCPM's values that fall outside of the prescribed ranges represent accounts that reflect the overwhelming majority of plant investment, thus potentially triggering a dramatic increase in support. We seek comment on this assessment.

B. Cost of Capital

[420] HAI June 1, 1998 comments at 13.

[421] BCPM Dec. 11 submission at 80.

[422] The eight categories in which BCPM's values fall outside required ranges for projected lives were: Digital Circuit Equipment; Digital Switching; Aerial Cable-Metallic; Aerial Cable-Non-Metallic; Underground Cable-Metallic; Underground Cable-Non-Metallic; Buried Cable-Metallic; and Buried Cable-Non-Metallic. The two categories in which BCPM's values fall outside required ranges for net salvage percentage were Digital Circuit Equipment and Poles.

[423] BCPM Dec. 11 submission at 80.

237. The cost of capital represents the annual percentage rate of return[424] that a company's debtholders and equity holders require as compensation for providing the debt and equity capital that a company uses to finance its assets.[425] In the *Universal Service Order*, the Commission concluded that the current federal rate of return of 11.25 percent is a reasonable rate of return by which to determine forward-looking costs.[426]

238. The HAI proponents have submitted data indicating that the incumbent LEC's cost of capital is 10.01 percent, not the current 11.25 percent federal rate of return.[427] The HAI proponents also contend that certain state commissions have determined that even lower costs of capital are appropriate.[428] The BCPM proponents advocate a cost of capital rate of 11.36 percent.[429]

239. We find that both BCPM and HAI proponents have failed to make an adequate showing to justify rates that differ from the current 11.25 percent federal rate of return. We tentatively conclude, therefore, that the current rate is reasonable for determining the cost of universal service. If the Commission, in a rate represcription order, adopts a different rate of return, we tentatively conclude the model should use the more recently determined rate of return. We seek comment on these tentative conclusions.

C. Annual Charge Factors

240. Incumbent LECs develop cost factors, called "annual charge factors," to determine the dollar amount of recurring costs associated with acquiring and using particular pieces of investment for a period of one year. Incumbent LECs develop these annual charge factors for each category of investment required. The annual charge factor is the sum of depreciation, cost of capital, adjustments to include taxes on equity, and maintenance costs.

241. To develop annual charge factors, the BCPM proponents propose a model with

---

[424] Rate of return is the percentage which a telephone carrier is authorized to earn on its rate base. For example, if the rate of return is 11.25% and the rate base is $1 million, the carrier is authorized to earn $112,500.

[425] *See Local Exchange Carriers' Rates, Terms, and Conditions for Expanded Interconnection Through Physical Collocation for Special Access and Switched Transport*, Second Report and Order, CC Docket No. 93-316212 FCC Rcd 18370, 18765 (1997).

[426] *Universal Service Order*, 12 FCC Rcd at 8913, para. 250.

[427] HAI June 1, 1998 comments at 13.

[428] *Id.* at 13.

[429] BCPM Dec. 11 submission.

user-adjustable inputs to calculate the depreciation and cost of capital rates for each account.[430] The BCPM proponents state that this account-by-account process was designed to recognize that all of the major accounts have, *inter alia*, differing economic lives and salvage values that lead to distinct capital costs.[431] HAI's model is also user adjustable and reflects the sum for the three inputs: depreciation, cost of capital, and maintenance costs.[432]

242. Because the synthesis model uses HAI's expense module, with modifications, we tentatively conclude that HAI's annual charge factor should be used.[433] We believe that HAI's annual charge factor is consistent with other inputs used in the model adopted by the Commission, and therefore easier to implement. We seek comment on this analysis and our tentative decision to use HAI's annual charge factor.

IX. OTHER ISSUES RELATED TO THE HIGH COST MECHANISM

A. Alternatives to the Forward-Looking Cost Model

243. It is our expectation that the model outputs will be fully verified in time for implementation on January 1, 2000, and we remain firmly committed to the idea that support based on forward-looking costs will provide the best assurance of predictable, specific, and sufficient support as competition develops. In the unlikely event that the model is not ready for timely implementation, however, we seek comment on how the Commission might determine support levels without resort to a forward-looking cost model. Commenters addressing this issue should specifically describe how their proposal will generate sufficient support to meet the goals of section 254, even as competition develops in the local exchange.

B. Proposed Modification to Procedures for Distinguishing Rural and Non-Rural Companies

1. Background

244. In the *Universal Service Order*, the Commission determined that rural and non-

[430] BCPM Dec. 11 submission at 80.

[431] *Id.* BCPM's model includes all of the methodologies that are in practice today, including: Deferred taxes; Mid-year, Beginning Year, and End Year placing conventions; Gompertz-Makeham Survival Curves; Future Net Salvage Values; Equal Life Group Methods; and others. The model also incorporates separate Cost of Debt and Equity rates, along with the Debt to Equity ratio. *Id.*

[432] HAI Dec. 11 submission at 41.

[433] The expense module contains the expense values including, plant specific maintenance ratios, and the algorithms that determine monthly cost per-line given the results of all other modules.

rural carriers will receive federal universal service support determined by separate mechanisms, at least until January 1, 2001.[434] The Commission stated that it would define rural carriers as those carriers that meet the statutory definition of a rural telephone company in section 153(37) of the Communications Act.[435] Under this definition, a "local exchange carrier operating entity" is deemed a "rural telephone company" to the extent that such entity--

> (A) provides common carrier service to any local exchange carrier study area that does not include either--
>
> (i) any incorporated place of 10,000 inhabitants or more, or any part thereof, based on the most recently available population statistics of the Bureau of the Census; or
>
> (ii) any territory, incorporated or unincorporated, included in an urbanized area, as defined by the Bureau of the Census as of August 10, 1993;
>
> (B) provides telephone exchange service, including exchange access, to fewer than 50,000 access lines;
>
> (C) provides telephone exchange service to any local exchange carrier study area with fewer than 100,000 access lines; or
>
> (D) has less than 15 percent of its access lines in communities of more than 50,000 on the date of enactment of the Telecommunications Act of 1996.

245. In addition, the Commission determined that LECs should self-certify their status as a rural company each year to the Commission and their state commission.[436] On September 23, 1997, the Common Carrier Bureau (Bureau) released a Public Notice requiring carriers seeking to be classified as rural telephone companies to file a letter with the Commission by April 30 of each year certifying that they meet the statutory definition.[437] The *Self-Certification Public Notice* requires a LEC certifying as a rural carrier to explain how it meets at least one of the four criteria set forth in the statutory definition.[438] On March 16, 1999, the Bureau released a Public Notice revising the annual deadline for LECs seeking to be classified as rural carriers to July 1 of each year.

---

[434] *Universal Service Order*, 12 FCC Rcd at 8927, para. 273.

[435] *See* 47 U.S.C. § 153(37); *Universal Service Order*, 12 FCC Rcd at 8944, para. 310.

[436] *Universal Service Order*, 12 FCC Rcd at 8943-44, para. 310.

[437] Self-Certification as a Rural Telephone Company, *Public Notice*, DA 97-1748 (rel. Sept. 23, 1997) (*Self-Certification Public Notice*).

[438] *See* 47 U.S.C. § 153(37).

2. Issues for Comment

246. On June 22, 1998, the Accounting Policy Division released a Public Notice with a list of the approximately 1,400 carriers that had certified as rural carriers as of April 30, 1998.[439] Because a vast majority of the carriers certifying as rural serve under 100,000 access lines, we tentatively conclude that we should adopt new filing requirements for carriers filing rural self-certification letters. We propose that carriers who serve under 100,000 access lines should not have to file the annual rural certification letter unless their status has changed since their last filing.[440] We believe that this is a better approach because the overwhelming majority of the companies that filed rural certification letters qualified as rural telephone companies because they provide service to fewer access lines than either the 50,000 or 100,000 line thresholds identified in the statute. Access line counts can be verified easily with publicly-available data. Further, this relaxation in filing requirements would lessen the burden on many rural carriers and Commission staff. We estimate that this change will eliminate the filing requirement for approximately 1,380 of the carriers that filed this year. We seek comment on this proposal.

247. As noted above, the Commission can easily determine whether a carrier satisfies criteria (B) or (C) of the rural telephone company definition,[441] because these criteria are based on information that can be verified easily with publicly available data -- the number of access lines served by a carrier. In contrast, criteria (A) and (D) require additional information and analysis to verify a carrier's self-certification as a rural company. Specifically, under criterion (A) a carrier is rural if its study area does not include "any incorporated place of 10,000 inhabitants or more" or "any territory ... in an urbanized area," based upon Census Bureau statistics and definitions.[442] Under criterion (D) a carrier is rural if it had "less than 15 percent of its access lines in communities of more than 50,000 on the date of enactment of the [1996 Act]."[443]

248. We tentatively conclude that, once we have clarified the meaning of "local exchange operating entity" and "communities of more than 50,000" in section 153(37), we should

---

[439] Commission Acknowledges Receipt of Letters Self-Certifying LECs as Rural Telephone Companies, *Public Notice*, DA 98-1205 (rel. June 22, 1998). Under current procedures, each of these carriers would have to submit another rural certification by July 1, 1999.

[440] The National Exchange Carrier Association, Inc. (NECA) has requested that the Commission eliminate the annual rural certification process. NECA states that the majority of carriers that meet the rural definition are small LECs with limited resources, and whose status is not likely to change. Letter from Richard A. Askoff, NECA to Irene Flannery, Chief, Accounting Policy Division, FCC, dated April 9, 1999.

[441] 47 U.S.C. § 153(37)(B), (C).

[442] 47 U.S.C. § 153(37)(A).

[443] 47 U.S.C. § 153(37)(D).

require carriers with more than 100,000 access lines that seek rural status to file certifications for the period beginning January 1, 2000, consistent with the Commission's interpretation of the rural telephone company definition. We seek comment on this tentative conclusion. We also seek comment on whether we should require these carriers to re-certify each year (after the filing for January 1, 2000) or, in the alternative, whether they should be required to re-certify only if their status has changed.

249. Most of the carriers asserting rural status under criterion (A) or (D) also claim rural status under the access line thresholds in criterion (B) or (C).[444] In these cases, the Commission does not need additional information to verify the carrier's rural status. If a carrier serves a local exchange study area with more than 100,000 access lines, however, the Commission needs additional information about the study area to determine whether criterion (A) or (D) is met. Based on the certifications we have received, we believe that carriers have adopted differing interpretations of criterion D. We tentatively conclude that criterion A, on the other hand, by referencing Census Bureau sources, can be applied consistently without further interpretation by the Commission. We seek comment on this tentative conclusion.

250. We have identified at least two issues in the rural telephone company definition for which carriers have adopted different interpretations that affect the determination of whether a carrier satisfies the requirements of criterion D. Specifically, carriers differ on whether criterion (D) should be applied on a holding company or study area-by-study area basis. For example, while most carriers have asserted that they meet the 15 percent/50,000 test in criterion (D) for a particular study area because less than 15 percent of its access lines within that study area are in communities of more than 50,000, at least one carrier claims it meets this criterion for all of its study areas, because less than 15 percent of its access lines nationwide are in such communities. In order to resolve these differences, we must interpret the phrase "local exchange operating entity" in the introductory text of section 153(37).

251. We therefore seek comment on how we should interpret the phrase "local exchange operating entity" in section 153(37) of the Communications Act. Specifically, we seek comment on whether that term refers to an entity operating at the study area level or at the holding company level. Although most of the carriers certifying under subparagraph (D) have construed the term to refer to an entity at the study area level, we note that at least one state commission, in denying a carrier's request for an exemption under section 251(f)(1) of the Communications Act, viewed the exemption claim from the perspective of the national operating entity.[445] We also request information on how states have construed the rural telephone company

[444] Many carriers claim they meet three or four of the criteria. We also note that many carriers that only cite one criterion may qualify under several criteria.

[445] *See* 47 U.S.C. § 251(f)(1); Order Denying Motion, Docket No. M-263, Iowa, Department of Commerce Utilities Board (Dec. 11, 1996).

definition in exercising their authority under section 251(f)(1) and section 214(e)(2) of the Act.[446]

252. Carriers also have used different interpretations of the phrase "communities of more than 50,000" in criteria (D) of the rural telephone company definition.[447] Some carriers have used Census Bureau statistics for legally incorporated localities, consolidated cities, and census-designated places, to identify communities of more than 50,000. Other carriers have provided lists of communities without identifying the source of the designation or the population information. Some carriers have attempted to distinguish between rural communities and communities that may be characterized as urban or suburban. One carrier, for example, based its analysis of its service territories on the Commission's definition of "rural area" in section 54.5 of the Commission's rules.[448] The carrier calculated its percentage of rural/non-rural lines by determining whether each of its wire centers is associated with a metropolitan statistical area (MSA). If so, these lines were considered to be urban, unless the wire center has rural pockets, as defined by the most recent Goldsmith Modification.[449]

253. We seek comment on how we should interpret the phrase "communities of more than 50,000" in section 153(37) of the Act. We seek comment on whether we should define communities of more than 50,000 by using Census Bureau statistics for legally incorporated localities, consolidated cities, and census-designated places. In the alternative, we seek comment on whether we should distinguish between rural and non-rural communities in applying criterion D of section 153(37). Specifically, we seek comment on whether we should use the methodology in section 54.5 of the Commission's rules to determine whether a community is in a rural area. We also seek comment on other methods of defining communities with populations greater than 50,000 for purposes of applying criterion D.

254. As noted above, states apply the definition of rural telephone company in

---

[446] 47 U.S.C. §§ 214(e)(2), 251(f)(1).

[447] 47 U.S.C. § 153(37)(D).

[448] Section 54.5 provides the following definition of rural area:

> A "rural area" is a non-metropolitan county or county equivalent, as defined in the Office of Management and Budget's (OMB) Revised Standards for Defining Metropolitan Areas in the 1990s and identifiable from the most recent Metropolitan Statistical Area (MSA) list released by OMB, or any contiguous non-urban Census Tract or Block Numbered Area within an MSA-listed metropolitan county identified in the most recent Goldsmith Modification published by the Office of Rural Health Policy of the U.S. Department of Health and Human Services."

47 C.F.R. § 54.5.

[449] *See* 47 C.F.R. § 54.5.

determining whether a rural telephone company is entitled to an exemption under section 251(f)(1) of the Act and in determining, under section 214(e)(2) of the Act, whether to designate more than one carrier as an eligible telecommunications carrier in an area served by a rural telephone company.[450] Although the Commission used the rural telephone company definition to distinguish between rural and non-rural carriers for purposes of calculating universal service support, there is no statutory requirement that it do so. The Commission adopted the Joint Board's recommendation to allow rural carriers to receive support based on embedded cost for at least three years, because, as compared to large LECs, rural carriers generally serve fewer subscribers, serve more sparsely populated areas, and do not generally benefit as much from economies of scale and scope.[451] The Commission also noted that for many rural carriers, universal service support provides a large share of the carriers' revenues, and thus, any sudden change in the support mechanisms may disproportionately affect rural carriers' operations.[452] We seek comment on whether the Commission should reconsider its decision to use the rural telephone company definition to distinguish between rural and non-rural carriers for purposes of calculating universal service support. That is, we seek comment on whether there are differences between our universal service policies and the competitive policies underlying sections 251(f)(1) and 214(e)(2) that would justify definitions of "rural telephone company" and "rural carrier" that differ.

255. Finally, we address a necessary procedural matter. Currently, carriers are required to file rural certifications by July 1, 1999 to be classified as rural for January 1, 2000. Given our tentative conclusions above that we should modify the current filing requirements for rural certification, including eliminating the filing requirement for most carriers that have filed previously, we move the July 1, 1999 filing deadline to October 15, 1999.

X. PROCEDURAL MATTERS AND ORDERING CLAUSE

A. *Ex Parte* Presentations

256. This is a permit-but-disclose notice-and-comment rulemaking proceeding. *Ex parte* presentations are permitted, except during the Sunshine Agenda period, provided that they are disclosed as provided in Commission's rules.[453]

B. Initial Regulatory Flexibility Act

[450] 47 U.S.C. §§ 214(e)(2), 251(f)(1).

[451] *Universal Service Order*, 12 FCC Rcd at 8936, para. 294.

[452] *Universal Service Order*, 12 FCC Rcd at 8936, para. 294.

[453] *See generally* 47 C.F.R. §§ 1.1202, 1.1203, 1.1206.

257. As required by the Regulatory Flexibility Act (RFA),[454] the Commission has prepared this Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the proposals in this Further Notice. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines as comments on the rest of this Further Notice, and should have a separate and distinct heading designating them as responses to the IRFA. The Commission will send a copy of this Further Notice, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA) in accordance with the RFA.[455] In addition, the Further Notice and IRFA (or summaries thereof) will be published in the Federal Register.

258. *Need for and Objectives of Proposed Rules*. In the *Universal Service Order*, the Commission adopted a plan for universal service support for rural, insular, and high cost areas to replace longstanding federal subsidies to incumbent local telephone companies with explicit, competitively neutral federal universal service mechanisms. In doing so, the Commission adopted the recommendation of the Joint Board that an eligible carrier's support should be based upon the forward-looking economic cost of constructing and operating the networks facilities and functions used to provide the services supported by the federal universal service mechanism.

259. Our plan to adopt a mechanism to estimate forward-looking cost has proceeded in two stages. On October 28, 1998, the Commission completed the first stage of this proceeding: the selection of the model platform. The platform encompasses the aspects of the model that are essentially fixed, primarily assumptions about the design of the network and network engineering. In this Further Notice we move toward completion of the second stage of this proceeding, by proposing input values for the cost model, such as the cost of cables, switches and other network components, in addition to various capital cost parameters. In addition, we propose adoption of a road surrogate algorithm to determine the location of customers and a data set of customer locations. This Further Notice also seeks comment on other issues related to the federal high cost mechanism, including alternatives to the forward-looking cost model and modifications to the procedures for distinguishing rural and non-rural companies.

260. *Legal Basis*: The proposed action is supported by sections 4(i), 4(j), 201-205, 254, and 403 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 154(j), 201-205, 254, and 403.

261. *Description and Estimate of the Number of Small Entities to which the Further Notice will Apply*.

---

[454] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et seq*., has been amended by the Contract with America Advancement Act of 1996, Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

[455] *See* 5 U.S.C. § 603(a).

262. The RFA generally defines "small entity" as having the same meaning as the term "small business," "small organization," and "small government jurisdiction."[456] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act, unless the Commission has developed one or more definitions that are appropriate to its activities.[457] Under the Small Business Act, a "small business concern" is one that: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) meets any additional criteria established by the SBA.[458] The SBA has defined a small business for Standard Industrial Classification (SIC) category 4813 (Telephone Communications Except Radiotelephone) to be small entities when they have no more than 1,500 employees.[459]

263. The most reliable source of information regarding the total number of certain common carriers appears to be data the Commission publishes annually in its *Carrier Locator* report, derived from filings made in connection with the Telecommunications Relay Service (TRS).[460]

264. Although some affected incumbent LECs may have 1,500 or fewer employees, we do not believe that such entities should be considered small entities within the meaning of the RFA because they are either dominant in their field of operations or are not independently owned and operated, and therefore by definition not "small entities" or "small business concerns" under the RFA. Accordingly, our use of the terms, "small entities" and "small businesses" does not encompass incumbent LECs. Out of an abundance of caution, however, for regulatory flexibility analysis purposes, we will separately consider small incumbent LECs within this analysis and use the term "small incumbent LECs" to refer to any incumbent LEC that arguably might be defined by the SBA as "small business concerns."[461]

---

[456] 5 U.S.C. § 601(6).

[457] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in 5 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition in the Federal Register."

[458] 15 U.S.C. § 632. *See, e.g., Brown Transport Truckload, Inc. v. Southern Wipers, Inc.*, 176 B.R. 82 (N.D. Ga. 1994).

[459] 13 C.F.R. § 121.201.

[460] *Carrier Locator: Interstate Service Providers*, Figure 1 (Jan. 1999) (*Carrier Locator*). *See also* 47 C.F.R. § 64.601 *et seq*.

[461] *See* 13 C.F.R. § 121.201, Standard Industrial Classification (SIC) 4813. Since the time of the Commission's 1996 decision, *Implementation of the Local Competition Provisions in the Telecommunications Act of 1996*, First Report and Order, 11 FCC Rcd 15499, 16144-45 (1996), the Commission has consistently addressed in its

265. Local Exchange Carriers. Neither the Commission nor SBA has developed a definition of small local exchange carriers. The closest applicable definition for these carrier-types under SBA rules is for telephone communications companies other than radiotelephone (wireless) companies.[462] The most reliable source of information regarding the number of these carriers nationwide of which we are aware appears to be data that we collect annually in connection with the TRS.[463] According to our most recent data, there are 1,410 LECs.[464] Although it seems certain that some of these carriers are not independently owned and operated, or have more than 1,500 employees, we are unable at this time to estimate with greater precision the number of these carriers that would qualify as small business concerns under SBA's definition. Consequently, we estimate that there are fewer than 1,410 small entity LECs that may be affected by the proposals adopted in this Further Notice. We also note that, with the exception of a modification in reporting requirements, the proposals in this Further Notice apply only to larger "non-rural" LECs.[465]

266. *Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements.*

267. On June 22, 1998, the Accounting Policy Division released a Public Notice with a list of the approximately 1,400 carriers that had certified as rural carriers as of April 30, 1998.[466] Because a vast majority of the carriers certifying as rural serve under 100,000 access lines, we tentatively conclude that we should adopt new filing requirements for carriers filing rural self-certification letters. We propose that carriers who serve under 100,000 access lines should not have to file the annual rural certification letter unless their status has changed since their last filing.[467] We believe that this is a better approach because the overwhelming majority of the companies that filed rural certification letters qualified as rural telephone companies because they

---

regulatory flexibility analyses the impact of its rules on such incumbent LECs.

[462] 13 C.F.R. § 121.210, SIC Code 4813.

[463] *Carrier Locator* at Fig. 1.

[464] *Carrier Locator* at Fig. 1.

[465] *See supra* para. 3.

[466] Commission Acknowledges Receipt of Letters Self-Certifying LECs as Rural Telephone Companies, *Public Notice*, DA 98-1205 (rel. June 22, 1998). Under current procedures, each of these carriers would have to submit another rural certification by July 1, 1999.

[467] The National Exchange Carrier Association, Inc. (NECA) has requested that the Commission eliminate the annual rural certification process. NECA states that the majority of carriers that meet the rural definition are small LECs with limited resources, and whose status is not likely to change. Letter from Richard A. Askoff, NECA to Irene Flannery, Chief, Accounting Policy Division, FCC, dated April 9, 1999.

provide service to fewer access lines than either the 50,000 or 100,000 line thresholds identified in the statute. Access line counts can be verified easily with publicly-available data. Further, this relaxation in filing requirements would lessen the burden on many rural carriers and Commission staff. We estimate that this change will eliminate the filing requirement for approximately 1,380 of the carriers that filed this year.

268. We tentatively conclude that, once we have clarified the meaning of "local exchange operating entity" and "communities of more than 50,000" in section 153(37), we should require carriers with more than 100,000 access lines that seek rural status to file certifications for the period beginning January 1, 2000, consistent with the Commission's interpretation of the rural telephone company definition. We also seek comment on whether we should require these carriers to re-certify each year (after the filing for January 1, 2000) or, in the alternative, whether they should be required to re-certify only if their status has changed.

269. In addition, we address a necessary procedural matter. Currently, carriers are required to file rural certifications by July 1, 1999 to be classified as rural for January 1, 2000. Given our tentative conclusions above that we should modify the current filing requirements for rural certification, including eliminating the filing requirement for most carriers that have filed previously, we propose moving the July 1, 1999 filing deadline to October 15, 1999.

270. *Steps Taken to Minimize Significant Economic Impact on Small Entities and Significant Alternatives Considered*. Throughout the Further Notice, we seek comment on the tentative conclusions that we propose. In addition, we believe that the reporting modifications that are proposed above will reduce the burden on rural LECs. As noted, we propose that carriers serving fewer access lines than either the 50,000 or 100,000 line thresholds should not be required to file annual rural certification letters unless their status has changed since their last filing.

271. *Federal Rules That May Overlap, Duplicate or Conflict with the Proposed Rule*. None.

C. Initial Paperwork Reduction Act Analysis

272. This Further Notice contains a proposed information collection. As part of its continuing effort to reduce paperwork burdens, we invite the general public and the Office of Management and Budget (OMB) to take this opportunity to comment on the information collections contained in this Further Notice, as required by the Paperwork Reduction Act of 1995, Pub. L. No. 104-13.[468] Public and agency comments are due at the same time as other comments

[468] A supporting statement, prepared in accordance with the Paperwork Reduction Act, that details the Commission's estimates with respect to the burdens imposed by the proposals in this Further Notice is available

on this Further Notice; OMB comments are due 60 days from date of publication of this Further Notice in the Federal Register. Comments should address: (a) whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility; (b) the accuracy of the Commission's burden estimates; (c) ways to enhance the quality, utility, and clarity of the information collected; and (d) ways to minimize the burden of the collection of information on the respondents, including the use of automated collection techniques or other form of information technology.

D. Deadlines and Instructions for Filing Comments

273. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, interested parties may file comments on or before July 2, 1999 and reply comments on or before July 16, 1999. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies. See Electronic Filing of Documents in Rulemaking Proceedings, 63 Fed. Reg. 24,121 (1998).

274. Comments filed through the ECFS can be sent as an electronic file via the Internet to <http://www.fcc.gov/e-file/ecfs.html>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form <your e-mail address." A sample form and directions will be sent in reply. Parties who choose to file by paper must file an original and four copies of each filing. If more than one docket or rulemaking number appear in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number. All filings must be sent to the Commission's Secretary, Magalie Roman Salas, Office of the Secretary, Federal Communications Commission, 445 Twelfth Street, S.W., TW-A325, Washington, D.C. 20554.

275. Parties must also send three paper copies of their filing to Sheryl Todd, Accounting Policy Division, 445 Twelfth Street S.W., 5-A523, Washington, D.C. 20554. In addition, commenters must send diskette copies to the Commission's copy contractor, International Transcription Service, Inc., 1231 20th Street, N.W., Washington, D.C. 20037.

E. Ordering Clauses

---

from the Commission or from the Office of Management and Budget.

276. IT IS ORDERED, pursuant to Sections 1, 4(i) and (j), 201-209, 218-222, 254, and 403 of the Communications Act, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 201-209, 218-222, 254, and 403 that this Further Notice of Proposed Rulemaking IS HEREBY ADOPTED and comments ARE REQUESTED as described above.

277. IT IS FURTHER ORDERED that the Commission's Office of Public Affairs, Reference Operations Division, SHALL SEND a copy of this Further Notice of Proposed Rulemaking, including the Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas
Secretary

Appendix A (Proposed Input Values)

Appendix B (Description of PNR's Methodology to Estimate the Number of Customer Locations)

Appendix C (Outside Plant Structure and Cable Costs Survey)

Appendix D (Description of Proposed Methodology for Estimating Outside Plant Costs)

Appendix E (Description of Switching Costs)

Appendix F (Description of Proposed Methodology for Estimating Expenses)