intrastate access and toll revenues, and decide how the remaining portion of the actual determined operating costs will be met.

In addition to the type of regulation that the smaller LECs are regulated under, the Small LECs point out nine other distinctions between the large and mid-size LECs, and the smaller LECs: (1) smaller LECs receive interstate USF monies under rules that do not provide funding for Pacific; (2) the smaller LECs receive support in the form of interstate dial equipment minutes (DEM) weighting; (3) the smaller LECs have been classified as rural telecommunications carriers by the Telco Act, and are subject to different policies on universal service funding and competition; (4) the smaller LECs have accounting records to show their actual costs on a geographically specific basis, whereas the large LECs do not have such records; (5) the smaller LECs already have geographic specific local rates; (6) the smaller LECs do not have extensive toll networks like the larger LECs; (7) the smaller LECs will not be competing with the CLCs on the same scale as GTEC and Pacific; (8) given the size and budgets of the smaller LECs, the complexity and cost of dealing with proxy models cannot be justified; and (9) the proxy models do not produce accurate information on the actual costs of the smaller LECs.

The Small LECs recommend that with respect to the smaller LECs, the Commission should conclude their pending rates cases that are currently under way. The Commission should make a determination in those proceedings whether there is any need for intrastate universal service funding for the smaller LECs.

The Smaller Independent LECs' comments to D.95-07-050 stated that contrary to the Commission's conclusion that the redesign of universal service should apply to all service areas within the state, the Legislature in PU Code § 709.5(a) only expressed an intent that local service competition was a goal.

The Smaller Independent LECs recommend that the current CHCF be left intact for addressing the high cost element of

universal service issues in their territories. They state that except for the one time recovery of IRD impacts in 1995, the draws from the CHCF have not been significant, and that the smaller LECs do not anticipate that draws from the CHCF in 1996 and thereafter, under the current rules, will be significant. They also contend that it will take some time before competition actually occurs in the smaller, rural exchanges.

The Smaller Independent LECs state that the proposed high cost voucher program may be appropriate for the larger LECs, who will need a new source of revenue to replace the internal subsidies that flow between high cost and low cost exchanges. However, the smaller LECs should be exempted from the use of a proxy model. Instead, their universal service funding requirements should be determined by reference to the actual cost data developed in their GRCs.

Roseville takes the position that the universal service funding requirements of the smaller and mid-size LECs should be determined from their actual costs rather than from a model estimate. The use of a proxy model to estimate the amount of subsidies for the smaller and mid-size LECs should not be used until the adopted model's accuracy has been validated through the experience of GTEC and Pacific.

Roseville makes four arguments as to why the proxy model should not be used. First, the evidence clearly shows that the magnitude of a model's error is related to the size of the LEC. Thus, if there is an error in the model estimates for the smaller LECs, there will be many multiples of error for the large LECs. Second, both models utilize only data derived from the large LECs. Third, there is no evidence that the two models reasonably estimate

the costs of the smaller and mid-size LECs.[30] Instead, there is substantial evidence which suggests that the models do not reasonably estimate these costs. And fourth, the models are unnecessary when the actual costs are available.

3. **Discussion**

When we originally proposed our universal service rules in D.95-07-050, we felt that all carriers should be subject to the same universal service rules. In light of the Telco Act, and for the other reasons discussed below, we have reconsidered that position.

PU Code § 709.5(a) states as follows:

> "It is the intent of the Legislature that all telecommunications markets subject to commission jurisdiction be opened to competition not later than January 1, 1997. The commission shall take steps to ensure that competition in telecommunications markets is fair and that the state's universal service policy is observed."

Subdivision (c) of PU Code § 709.5 provides that the Commission shall expedite its universal service proceeding so "that whatever additional rules and regulations that may be necessary to achieve fair local exchange competition shall be in place no later than January 1, 1997."

The Legislature clearly intended that the local exchange market be opened to competition, and that the rules and regulations regarding universal service be in place by January 1, 1997. The broader issue raised by this code section is whether different universal service funds can be adopted for different size carriers.

30 The Smaller Independent LECs cite these three reasons as well in support of their argument that they should be exempted from the proxy cost modeling process.

In light of the Telco Act, we believe that such an approach is permissible.

The Telco Act recognizes that certain LECs should be treated differently. The Telco Act specifically exempts certain rural telephone companies[31] from resale, number portability, dialing parity, and interconnection obligations. These obligations will not apply to rural telephone companies until such companies have received a bona fide request from another carrier for interconnection, services, or network elements, and the state commission determines that such request is not unduly economically burdensome, is technically feasible, and is consistent with Section 254 of the Telco Act. (Telco Act, § 251(f).)

As the Commission noted in D.89-10-031 (33 CPUC2d 43, 91.), the smaller LECs will face much lower levels of competition than GTEC and Pacific. Local exchange competition is likely to take a longer time to reach the service territories of the smaller LECs. The Telco Act appears to account for this as it exempts rural telephone companies from interconnection obligations. GTEC, Pacific, CTCC, Contel, and Roseville operate, are in, or are located in close proximity to, urban areas. Competition is likely to occur in those areas in the near future.

Another reason why the smaller LECs should be treated differently is that the smaller LECs are currently regulated under rate of return regulation. The two large LECs, and the three mid-size LECs, are, or have requested to be, regulated under an incentive based ratemaking framework. Under rate of return regulation, the Commission examines the revenues and expenses of the company. Due to the smaller LECs' size, it is relatively easy

31 A rural telephone company is defined in Section 3(a)(2)(47) of the Telco Act.

to determine what their actual costs of service are. We agree with the arguments of the smaller LECs that there is no need for a proxy model to estimate these costs.

Another compelling reason as to why we should maintain two separate universal service funds is because the federal funding mechanisms for rural telephone companies may change in the future. These funding mechanisms are currently being studied by the Joint Board. Currently, the smaller LECs receive, most if not all, of their universal service funding needs through these mechanisms. At present, very little support is provided to the carriers through the CHCF-A. The Commission should wait to see what the FCC does with the federal funding mechanisms before deciding whether the smaller LECs should be treated like the large and mid-size LECs.

For the above reasons, we will include GTEC, Pacific, CTCC, Contel, and Roseville in the CHCF-B fund for determining universal service subsidy support in their high cost areas.

As for the seventeen smaller LECs, we shall exclude them from the CHCF-B.[32] Instead, we shall continue to allow them to draw from the CHCF-A fund under our existing procedures. Once the FCC decides what federal universal service funding mechanisms should be in place, we should revisit the smaller LECs and the CHCF-A.

If a bona fide request to enter a smaller LEC's service territory is received, the Commission will make a determination in accordance with § 251(f) of the Telco Act. We are currently undecided as to what type of mechanism we should use to determine the high cost area subsidy support in such a situation. We are contemplating two possible options. The first is to compute the

32 As shown in Appendix C, an adjustment to the CPM has been made to remove the seventeen small LECs.

costs of providing universal service in the GSAs that the competitor wants to enter using the smaller LEC's actual data. The other option is to conduct an auction to determine the level of cost support needed. Since it is unlikely that a bona fide request to enter the small LECs' service area will be filed soon, we will decide how this situation should be handled at a later time.

D. The Costing Standards To Be Applied

1. Introduction

In shaping the development of the proxy cost models for use in the universal service proceeding, we have attempted to achieve some consistency with the TSLRIC studies being developed in the OANAD proceeding. In D.95-07-050, we proposed that the subsidy should be based on the TSLRIC of providing basic service to residential customers. (D.95-07-063, App. B, proposed Rule 6.A.3; See D.95-12-021, p. 6.) We originally suggested that the costing methodologies for the two proceedings be performed jointly in the OANAD proceeding. (D.95-07-050, p. 54.) However, this joint arrangement proved impractical and in D.95-12-021, the Commission decided that an independent, proxy-based cost model should be developed in the universal service proceeding. It was left to the workshops to determine if a TSLRIC methodology was appropriate for the proxy models. (D.95-12-021, p. 6.)

In D.95-12-016, a decision in the OANAD proceeding, the Commission adopted a set of costing principles which the parties in that proceeding had agreed to. These costing principles are based on TSLRIC, and have been referred to as the "consensus costing principles" or CCPs. The principles relevant to universal service are as follows:

Principle No. 1: Long run implies a period long enough that all costs are avoidable.

Principle No. 2: Cost causation is a key concept in incremental costing.

Principle No. 3: The increment being studied shall be the entire quantity of the service provided, not some small increase in demand.

Principle No. 4: Any function necessary to produce a service must have an associated cost.

Principle No. 5: Common costs, if any, are not part of a TSLRIC study, except for a TSLRIC study of the firm as a whole.

Principle No. 6: Technology used in a long run incremental cost study shall be the least-cost, most efficient technology that is currently available for purchase.

Principle No. 7: Costs shall be forward looking.

This section will address the costing principles discussed during the universal service proceeding. We will focus on whether the least-cost technology and forward looking principles imply that new technologies, such as the use of a hybrid fiber coaxial cable (HFC) network, should be incorporated into the cost analysis.

2. **Positions of the Parties**

AT&T/MCI believe that the CCPs contain a number of fundamental concepts which govern how basic service costs should be determined. In accordance with that belief, AT&T/MCI evaluated the proxy cost models in terms of their consistency with the CCPs. AT&T/MCI argue that adherence to these principles means that: (1) shared and common costs should not be included as part of the cost of universal service; and (2) the cost savings of HFC should be reflected in universal service cost studies.

AT&T/MCI contend that the cost model Pacific is sponsoring should reflect the cost savings of HFC technology for providing basic service. AT&T/MCI's witness Lee Selwyn notes that in Pacific's Section 214 application that it filed at the FCC for video dialtone service, Pacific asserted that the HFC technology would reduce forward looking costs by 36%. In a quote from

Pacific's testimony in support of its Section 214 application, Selwyn notes that Pacific stated that a HFC architecture leads to lower costs because: (1) it is a more efficient network design; (2) that such an architecture will generate substantial operational cost savings; and (3) it is a multiple use network. Pacific's Section 214 testimony also asserts that: "The cost of a 'telephony only' HFC network would result in a capital cost saving of 36% per subscriber line over conventional outside plant." (Ex. 7, p. 74.) Selwyn argues that if the testimony provided by Pacific in support of its Section 214 application is to be believed, then the HFC architecture represents the least cost form of new network construction, and Pacific's CPM should incorporate the HFC architecture in order to correctly model forward looking incremental costs.

The Coalition commented that the use of unreliable TSLRIC studies could result in the substantial inflation of the subsidy requirement. The Coalition stated in its December 1, 1995 reply comments at page 12 that the Commission should "incorporate a check of the LECs' TSLRIC estimates using independent estimates of TSLRIC that rely on publicly available data and assumptions, rather than proprietary LEC data and assumptions."

Contel stated in its comments that the proposed mechanism for determining high cost support requirements must include the TSLRIC of basic service, as well as a reasonable level of contribution to the joint and common costs of the firm.

GTEC supports the use of forward looking TSLRIC costs in the proxy cost models, but states that the model must be adjusted to account for overhead costs, which are not captured by a TSLRIC estimate. Failure to include a reasonable level of contribution would inadequately compensate a COLR.

GTEC argues that neither the AT&T/MCI model nor the Pacific model come close to producing costs that reflect TSLRIC. GTEC asserts that both models failed to compare the total costs of

providing all services, including basic service, which is what a true TSLRIC study should have done. Instead, GTEC contends that the two models are a "hodge-podge" of cost concepts that estimate the replacement cost of today's network, using only those technologies and engineering practices which are appropriate on a going forward basis.

Pacific recognizes that the goal of the Commission is to rely upon the TSLRIC cost studies in OANAD to help estimate the cost of basic service. Pacific has also evaluated the cost models in terms of the CCPs. Contrary to the position taken by AT&T/MCI, Pacific believes that the cost of basic service should include some shared and common costs, in addition to the TSLRIC.

Pacific also argues that HFC technology is not appropriate as part of a forward looking cost study. Pacific asserts that the HFC technology deployment is just beginning and will not be the primary serving technology for many years to come. Pacific also claims that its estimates of the HFC cost savings were projections based on a long-term view. Instead of a HFC network, Pacific contends that the existing network should be the basis for any universal service cost study because that is the network that is actually being deployed and used.

In Roseville's comments to the proposed rules in D.95-07-050, it was opposed to the use of TSLRIC to estimate the cost of providing universal service. Roseville argues that TSLRIC fails to account for administrative costs, which are a legitimate part of providing universal service. Roseville recommends that in order to accurately determine costs, the Commission must include fully allocated costs.

3. Discussion

We believe that, for the most part, we should follow the TSLRIC CCPs as the cost standard for the development of a proxy model. By this we mean that costs should be long run in nature, the least cost technology that is being deployed today should be

used, costs should be forward looking, and the costs should incorporate all the costs caused by providing basic residential service. Although the HPM and the CPM sponsors assert that their respective models adhere to the CCPs, the cost estimates of the two models vary dramatically.

As we noted in D.95-12-021 at page 7, we did not anticipate that the proxy cost model adopted in this proceeding would be a pure TSLRIC model. For example, a pure TSLRIC model would not include shared and common expenses. GTEC has also pointed out that TSLRIC studies look at the total quantity of a service. By focusing on geographically deaveraged costs, the universal service proxy cost models look at isolated segments of demand rather than at the entire quantity of demand. The emphasis on identifying the costs of specific areas makes the total service view difficult to realize.

We do not believe that the forward looking and least cost technology principles mean that the purported cost savings of a HFC network should be incorporated into an estimate of basic residential service at this time. Notwithstanding Pacific's prior claims that HFC is the least cost network for providing basic telephone service, we believe that more substantive experience with HFC is needed before we estimate the cost of providing universal service based on an unproven technology.

We do not agree, however, with Pacific's view that a new technology must be deployed universally before it is incorporated into a universal service cost study. Instead, if it can be shown that such an architecture provides service to a significant number of residential customers, and that such architecture represents the least cost technology for providing basic residential service, then it should be incorporated into the cost model.

E. The Competing Proxy Cost Models

1. Introduction

In D.95-07-050 at page 50, we proposed that the costs for all the GSAs be developed by way of proxy cost studies. In D.95-12-021, we left open the possibility that there might be competing proxy cost models. During the scheduled workshops, various models were discussed, but no agreement as to a particular model was reached. Since no agreement could be reached, evidentiary hearings were scheduled to address all the proxy cost model issues. (See ALJ Ruling, February 21, 1996.)

Parties sponsored two proxy models for the Commission's consideration. AT&T/MCI sponsored the HPM. The HPM is based in part on the Benchmark Cost Model (BCM).[33] Pacific sponsored the statewide CPM.[34]

2. The Size Of The Fund

a. Background

In deciding which proxy model to choose, the parties have also taken positions on the size of the fund.

AT&T/MCI witness Cornell testified that in deciding the size of the fund, the Commission should not err on the high side. She stated that if the Commission were to err on the high side, the long term consequences are much more likely to be irreversible than if the fund is set too low. The recipients could then use the monies for anticompetitive behavior that the market cannot necessarily correct. (14 RT 1421-1422, 1424.)

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33 The BCM was developed for use at the FCC. The joint sponsors of the BCM are US West, NYNEX, Sprint, and MCI.

34 During the workshops in March 1996, Pacific had proposed using the CPM for its service territory only, rather than a statewide model. The statewide CPM was made available in April 1996, and is the CPM that is being sponsored in this proceeding.

AT&T/MCI witness Selwyn testified that if the fund is oversized, that would be contrary to the goal of encouraging the development of competition. As Selwyn stated:

> "I think that as we move toward reliance upon competitive marketplace forces, to replace the forces of regulation, you're going to have to be very careful in making sure that competition has an opportunity to develop and to provide the discipline in the market that regulation was formerly responsible for bringing up." (15 RT 1619-1620.)

But if the fund is undersized, Selwyn believes that the recipients are still in a position to viably furnish the service, and to take any needed corrective measures, such as focusing on efficiency.

Citizens contends that the Telco Act directs that the universal service fund must be structured to assure quality services at just, reasonable, and affordable rates. The support mechanisms must also be specific, predictable, and sufficient. Citizens believes that the Commission should adopt a funding mechanism which will provide sufficient funds to assure that quality services are available to all potential users at just, reasonable, and affordable rates.

DCA believes that the Commission's CHCF-B fund should be narrowly defined, and specifically targeted.

GTEC contends that the market will be distorted if the fund is either too large or too small. GTEC believes that the Commission should establish a fund of the correct size. According to GTEC, that size is one which funds the difference between the local rate ceiling and a proxy measure of the market rate.

ICG cautions that in determining the size of the universal service fund, the Commission must be careful not to oversize the fund. ICG argues that if the fund is oversized, the incumbent LECs will use the monies to subsidize the cost of

competitive services. This will create a barrier to market entry, and the incumbent LECs will retain their market dominance.

Pacific agrees that there are risks to both oversizing and undersizing the fund. Pacific contends, however, that undersizing the fund runs the risk of disrupting telephone service to the high cost areas of the state, and that it will discourage facilities based competition in high cost areas. Contrary to what the AT&T/MCI witnesses believe will happen if the fund is oversized, Pacific argues that it must still abide by the competitive safeguards that are still in place. Pacific asserts that with these safeguards, anticompetitive conduct cannot occur.

b. Discussion

In deciding which proxy model to adopt, and what estimate of universal service the Commission should adopt, we must be vigilant that the fund is neither oversized or undersized. If it is oversized, the subsidy provided to carriers will exceed the actual cost of subsidizing residential basic service in high cost areas. This will allow recipients of such funds to cross subsidize other services, and to engage in other anticompetitive behavior. Oversizing the fund will deter new carriers from entering all markets because of the recipients' ability to subsidize the prices of certain services. The danger in undersizing the fund is that the ability of carriers to serve high cost areas may be impaired.

Our approach to deciding which model to adopt, and the results produced by the model, has been guided by this cautious attitude. Recognizing the disparity between the results produced by the competing models, and the respective interests of the model proponents, and other interested parties, we have crafted a fund which some may think is oversized, while others may think is undersized, but one which we think is appropriate in light of all the evidence. The CHCF-B that we adopt is appropriately sized to encourage competition in all markets, while at the same time preserving and promoting universal service throughout the state.

3. The Two Proxy Models

a. The Cost Proxy Model

The CPM was developed by Pacific, and its consultant, INDETEC. The CPM can estimate residential service costs on a number of geographical bases, including the CBG and wire center. Pacific presented two versions of the CPM during the workshops in this proceeding. The proprietary version relies on precise information about Pacific's customers, while the statewide version relies on more general, commercially available data about subscriber location to estimate costs for the entire state.

One of the primary innovations of the CPM is its use of a grid cell pattern to locate customers. These grid cells identify customer locations within 1/100th of a degree of longitude and latitude, roughly 1/4 mile. The quantity of facilities are estimated by measuring the distance between the center of the grid cell and the central office. These grid cells are also used to determine the density of a given household. The density of the household is used to identify the distribution plant to be used. The CPM uses the overall density of the wire center to identify the feeder plant to be used.

The cost inputs, engineering and financial assumptions of the CPM are based on Pacific's practices. Some of this underlying cost data, specifically the switch and pair gain investments, are proprietary due to agreements with vendors. Pacific used operating expenses and per unit capital costs from its OANAD cost studies. The allocation of shared and common costs was performed by using a specially modified version of Pacific's Profitability Index (PI) model. The operating expenses for the areas served by other LECs were estimated using the relationship between Pacific's per line operating expenses and the other LECs' operating expenses.

Pacific contends that the CPM is the best available model for estimating the cost of providing residential service.

Pacific asserts that the CPM's geographic division of the state is more reliable than the HPM. Pacific also argues that the CPM has been designed by experienced network engineers. In addition, Pacific contends that the CPM produces TSLRIC estimates that are consistent with the OANAD proceeding. Finally, Pacific argues that the Commission should adopt the CPM because it can be adapted to suit the Commission's needs.

Citizens, DRA, and GTEC support the use of the CPM with certain adjustments and modifications. Citizens supports the use of the CPM because the model is consistent with the data being formulated by Citizens and the other LECs for the OANAD cost studies. The CPM also uses verifiable input data, and uses economic lives for depreciation rather than prescribed lives. Citizens also points out that the CPM's use of grid cells more accurately estimates costs in rural areas. Citizens also states that the CPM is more readily adaptable than the HPM. Citizens suggests that more company specific data be used for the smaller LECs' territories.

DRA believes that the Commission should use the CPM because: (1) it is easier to use than the HPM, and most of the inputs and assumptions can be changed in the CPM; (2) the CPM's inputs and assumptions are more easily verified than the HPM; and (3) the CPM relies more on California-specific numbers than the HPM. As discussed later in this decision, DRA recommends several specific modifications to the inputs and assumptions of the CPM regarding utilization factors, fiber/copper feeder cut-off, calculation of drop costs, costs for cable and conduit placement, and depreciation rates.

GTEC supports the use of the CPM with modifications because it believes that the CPM's estimates are closer to actual cost estimates than the HPM. The CPM also reflects the least cost means of serving customers today. In addition, GTEC contends that the CPM is flexible because it can use company-specific data or

general data. The model can also process information on a grid cell, census block, or wire center level. GTEC recommends a series of modifications to the CPM. These include the following: (1) classifying wire centers based on the number of lines served; (2) an external process for developing non-company specific unit cost inputs and standards; and (3) a new copper/fiber feeder cut-off of 12,000 feet. GTEC also suggests investigating some further modifications such as using carrier records to determine business line and additional residential line counts.

b. The Hatfield Proxy Model

The HPM is based on the BCM. The HPM uses the BCM to estimate the capital cost of providing the residential local loop. The HPM departs from the BCM by: (1) adding the cost of certain critical network components, such as the drop and terminal; (2) calculating maintenance expenses using plant specific factors; (3) replacing the switching module with a new one; and (4) explicitly accounting for billing and collection, and white page listing costs. In addition, the HPM modifies some of the user-changeable inputs such as the distribution fill factors.

The HPM relies on a variety of sources for its extensions to the BCM. For additional network components, the HPM relies on selected portions of particular incremental cost studies from other jurisdictions. For plant specific expense factors, the HPM relies on historic relationships between LEC investment and maintenance expense. Generally, the HPM uses historical California LEC cost relationships. However, for switch repair and maintenance cost, the HPM uses historical relationships from New England Telephone Company (NET). For switching costs, the HPM relies on published information and industry expert opinions.

AT&T/MCI contend that the HPM is competitively neutral. AT&T/MCI point out that the HPM bases its cost assumptions on a number of sources rather than the historical experience of any single incumbent LEC. It is also consistent with

TSLRIC costing principles because it reflects the costs an efficient, cost-minimizing competitor would incur. AT&T/MCI also argue that the HPM has been approved in other jurisdictions, such as in the state of Washington. They also contend that the HPM is adaptable.

c. Discussion

It would have made our task much easier if the two models produced similar results. Unfortunately, the outcomes of the models are quite extreme. As a result, we have to analyze both models, and decide which model is better suited for developing the cost of providing basic service throughout the state.

To evaluate the two models, we examined a number of criteria. These criteria are based on our discussion of proxy models in D.95-12-021 and the criteria applied by DRA. (Ex. 109, p. 3-2.) These criteria are: (1) the ability to estimate costs for the entire state on a CBG level; (2) the degree to which the design of the model can accurately reflect costs; (3) the openness and accessibility of the model to changes in assumptions and inputs; (4) the ability to model costs based on today's placement of technology; (5) the ability to model the proposed definition of basic service and subsequent changes to this definition; and (6) the verifiability of inputs and assumptions. In evaluating the models, more emphasis has been placed on the model design and the ability to change the inputs and assumptions rather than the inputs themselves.

(1) Can The Model Estimate Costs for the Entire State on a CBG Basis?

The purpose of choosing the CBG as the GSA for determining the subsidy is to reduce the averaging that would occur if a larger GSA was used. The Commission first proposed CBGs as the basis for determining the costs to serve an area in

D.95-07-050.[35] This designation was subsequently reaffirmed in D.95-12-021.

Both models can produce costs for the entire state, but only the CPM can generate cost data for the entire state on a CBG basis. The HPM does not generate output on a CBG basis, but instead is generated by density zones. The CPM is also capable of generating cost on a wire center basis, or some other grouping. The BCM apparently has this capability, but the designers of the HPM appear to have eliminated this capability from their model. (See 18 R.T. 1987-1988.)

(2) Does the Model Design Accurately Reflect Costs?

During this proceeding, parties, especially GTEC and the Small LECs, have identified design flaws in both models.

GTEC has identified a number of design flaws with the BCM which have not been addressed by the HPM. Many of these structural flaws have been recognized by the joint sponsors of the BCM, who at the close of hearings, were attempting to correct them. It is unclear whether the joint sponsors will be successful in their ongoing attempts to improve the BCM. It is also unclear whether the sponsors of the HPM will embrace the revised BCM. The primary problems as identified by GTEC are the following: (1) the BCM assumes that the population is uniformly distributed within the CBGs; (2) the BCM assumes that the cost of placing facilities is linearly related to the cost of materials; and (3) the BCM assumes that the CBGs are square, and that the feeder plant reaches the border of the CBGs and that the

35 D.95-07-050 also proposed that a COLR be required to serve on a CBG basis.

distribution plant covers the interior. Each of these items are discussed below.

The BCM assumes that the population in CBGs is evenly distributed throughout the CBG. This assumption is not accurate for rural areas where the population tends to be clustered around roads and the towns. Consequently, the BCM would tend to overestimate the cost of serving less dense remote areas, all else being equal. The joint sponsors of the BCM have recognized this deficiency with the BCM, and at the time hearings concluded, were modifying the model to correlate the population with the road pattern in these less dense areas. The CPM's grid cell design avoids this problem by identifying the location of population in a more precise manner.

The BCM assumes that structure costs vary in direct proportion to the costs of those facilities. This means that a discount on material costs, for example, copper cable, will lead to a corresponding drop in the supporting structure costs, such as trenching costs. This also means that the model incorrectly assumes that the costs of placing facilities will vary with the size of cable. For example, the BCM assumes that a cable one quarter the size of the standard cable, will cost roughly one quarter as much as the standard cable, and will require a trench one quarter as deep. The joint sponsors of the BCM have recognized this problem as well, and are working to rectify it.

The HPM attempts to rectify this problem by essentially multiplying the installation factor for facilities in these two lowest population density areas. This installation factor adjustment represents somewhat of an ad hoc fix solution. It fails to address this deficiency in the more populated density areas. The CPM avoids this problem by separately identifying costs for facilities placement from their cable costs, and separating per foot and per pair cable costs.

The BCM's process of taking irregularly shaped CBGs, assuming that they are square, and placing feeder and distribution plant accordingly, also raises a number of concerns. In rural areas where CBGs can be quite large, the BCM assumes that copper distribution plant can serve the entire interior. It is unclear whether the BCM allows for sufficient electronics in the distribution plant to ensure that these households could actually receive telephone service from the network as modelled. This deficiency has been recognized by the developers of the BCM. (Ex. 62, Att. A, Item 10.) By relying on a regularly shaped grid, the CPM avoids creating this artificial geography and its attendant difficulties.

GTEC points out that the CPM also contains some design flaws. First, the CPM assigns central offices according to the density of the wire center, rather than according to the number of lines served by the central office. This type of categorization in turn drives the switching costs, and the application of unit costs to feeder plant. According to GTEC, classification of lines by density, instead of by wire center size, fails to take into account the economies of scale by wire center size. In contrast, the HPM uses actual central office line counts to size switches. GTEC has proposed this change to the CPM, which the designers of the CPM have accommodated. The CPM model that the Commission's Telecommunications Division has been using for this proceeding includes that change.[36]

Another weakness of the CPM is that it gathers inputs from a series of tables. Much of the modeling of the network has already been performed at a lower level to generate the data to populate these tables. This design is not necessarily

36 The Telecommunications Division staff responsible for reviewing the CPM was formerly organized within the Commission's Advisory and Compliance Division (CACD).

problematic, but caution must be exercised to ensure that the inputs from the tables are consistent with the base data which generated the tables. The BCM appears to be a more self contained model, but some pre-processing of data is also necessary.

One of the primary advantages of the BCM is that it allows for the sharing of feeder cable between CBGs on the same feeder route belonging to the same wire center. According to AT&T/MCI's witness Mercer, this produces an accurate depiction of the distribution network associated with each wire center. **[[Ex 22, 7]]** The BCM allows for the gradual tapering of feeder plant as it extends from the central office. This allows CBGs more distant from a central office to share in some of the economies of scale they receive by being served by a large central office.

The CPM does not contain an explicit method for accounting for the sharing of feeder cable by households served from the same wire center. The tapering effect is simulated by averaging segments of distribution plant used to serve sample loops. The CPM attempts to account for this through averaging. It is unclear, however, whether this process is sufficient. Consequently, the CPM may tend to exaggerate the cost of feeder plant in less dense areas served by large central offices.

Although both models have their flaws as far as reflecting costs, the CPM's shortcomings appear to be more easily resolved than those in the HPM and BCM.

(3) Is the Model Open and Accessible to Changes in Inputs and Assumptions?

AT&T/MCI assert that the HPM is an open and flexible model. While the HPM's extensions of the BCM are open and flexible, the underlying inputs and assumptions in the BCM model are not. By contrast, Pacific has offered to turn the universal service edition of the CPM over to the Commission after it runs any mandated revisions the Commission might require.

Certain critical assumptions and inputs to the BCM cannot be changed by the user because: (1) they are locked; and (2) changes are restricted by copyright. Pacific points out that many of the assumptions of the HPM and BCM are not user changeable. The fiber/copper cut-off, the cable multipliers and the mix of aerial, buried and underground are all fixed. However, in the CPM, all similar assumptions are user changeable.[37] As Pacific points out, the BCM is a proprietary model which can be modified by the joint sponsors, but not necessarily by the Commission or even the HPM's sponsors in California.

(4) How Well Does the Model Comply With the Relevant Consensus Costing Principles?

The sponsors of the models spent a great deal of time evaluating the models to determine how well the models conformed to the consensus costing principles.

AT&T/MCI argue that the HPM is consistent with the CCPs. They maintain that the HPM reflects efficient technology under a long run planning horizon for the entire demand of residential basic service. AT&T/MCI contend that by separately identifying certain structural costs, the HPM is able to separate the costs caused by providing basic service from other loop based services. AT&T/MCI also claims that the HPM appropriately includes overheads and excludes common costs. In contrast, AT&T/MCI argue that the CPM violates CCP 4 because it: (1) uses historical expenses from 1994; and (2) incorporates shared and common costs.

Pacific argues that its implementation of the CPM is consistent with the CCPs. The CPM is a scorched node model

37 MCI/AT&T's witness Selwyn asserts that the fiber/copper crossover point in unchangeable in the CPM. However, GTEC and DRA did not encounter this, and were able to make this change in the CPM.

which assumes the current LEC switch topography. Pacific contends that the CPM uses forward-looking assumptions, and includes the entire demand for service.

Pacific argues that the HPM should not be used because it violates certain TSLRIC principles. According to Pacific, the HPM fails to acknowledge the existing topology of the network by misassigning wire centers. In addition, the HPM does not account for all costs caused by basic service, and understates cost to such an extent that it fails to identify associated costs. In addition, Pacific argues that the HPM is not forward looking because it estimates operating expenses based on the relationship between embedded investments and expenses.

Both the CPM and HPM are designed to model the costs of providing basic residential service using today's placement of technology. Neither model is well suited to account for new technologies, such as a HFC network or wireless technologies. Neither of those two technologies are currently being used to offer basic residential service on a wide scale in California. Both the HPM and CPM use a scorched node approach whereby the current topology of central offices is assumed. The models are provisioned with facilities as they would be deployed today.

Both models rely on historical LEC data to predict forward looking maintenance and repair costs. For some repair and maintenance expenses, the HPM applies a factor derived from the historical relationship between plant investment and repair expenses to the forward looking investment estimates generated by the BCM. For other operating expenses, such as network operations, the HPM adds a fixed per line expense based on historical data. In this respect the HPM differs from the BCM which uses an investment/expense factor for all operating expenses.

The CPM uses Pacific Bell's 1994 per line maintenance and repair expenses, adding a fixed amount per loop.

Some adjustments are made to reflect the forward looking model assumptions, for example, maintenance of analog switches is excluded. As with other operating expenses, the CPM estimates repair and maintenance for other companies by adjusting the per line ratio between Pacific's operating expenses and other operating expenses.

(5) Can the Model Estimate the Cost of Basic Service and Subsequent Changes to this Definition?

Both models can estimate the cost of providing voice grade residential service. However, it is unclear whether the HPM fully accounts for two elements of the definition of basic service: the directory assistance allowance and access to billing information. The HPM's estimates of directory assistance allowance costs do not appear realistic given the labor required to answer each directory assistance call. Also, the HPM makes little allowance for the cost of billing inquiries. The HPM could probably be modified to account for these services by adding a greater fixed amount for directory assistance and billing inquiries.

(6) Can The Inputs And Assumptions of The Model be Readily Verified?

The HPM and CPM each present unique difficulties for verifying inputs and assumptions. There are three classes of difficulties with the HPM: (1) it relies on assumptions in the BCM which AT&T/MCI cannot alter or explain; (2) it relies on unnamed experts; and (3) it relies on selected portions of cost studies from other jurisdictions. The designers of the HPM did not participate in developing the BCM, and were not familiar with how the BCM inputs were derived. Consequently, the designers of the HPM could not validate the data contained in the BCM or respond to questions about how the BCM worked. This difficulty is compounded by the fact that the BCM's inputs are not readily comparable to

other data sources. For example, GTEC claims that the BCM's structure factor is in such a form that a company cannot compare these costs to its own experience.

The HPM extensions to the BCM frequently relied on unidentified experts rather than any concrete source. For example, in response to a DRA data request, Hatfield Associates indicated that they relied on informal conversations with a person from a major switch manufacturer to identify switching costs. In addition to switching cost adjustments, several types of network costs, such as the network interface device, digital loop carrier equipment capacity and switch installation, were based on informal, undocumented conversations.

During the proceeding, DRA illustrated that the origins of many of the HPM's inputs were unclear. The HPM had to add certain critical network components which were not included in the BCM. For example, the HPM uses drop costs from a NET study, yet AT&T/MCI's witness could not explain how those costs were derived. Pacific also questioned whether the NET study is a TSLRIC study as defined by the Commission's CCPs.

In contrast, the CPM depends largely on Pacific's own data. However, Pacific's reliance on pre-existing models in implementing the CPM complicates the verification of Pacific's data. However, the availability of alternate sources for this data mitigates this problem. For example, the A & B costs in the CPM are derived from Pacific's PLAN COSTDEC model. Switching costs are derived by the Switching Cost Information System (SCIS) model, and shared and common costs are allocated using a specially modified version of the PI model. Each of these models are highly complex on their own.

d. Summary

Using the criteria above to evaluate the two models, we conclude that the CPM is a more appropriate model for estimating the cost of providing basic service in California. The CPM can