The models being considered by the Commission implicitly incorporate a transmission standard. For example, if the models specify a copper loop length of less than 12,000 feet, such a design is capable of transmission speeds up to 6 Mbs. If that loop design were incorporated in the cost proxy models, then the costs of deploying a standard that exceeds the minimum design network standard should be excluded from the proxy costs. Alternatively, if there is no adjustment to cost proxy figures, incumbent carriers that are compensated based on the costs of a more advanced network should be required to make available such advanced services at no increment above the costs of a lower grade of service.

By advocating that cost proxy models incorporate a network design that facilitates access to advanced services, MFS is not suggesting that the costs (if any) of upgrading incumbent networks to conform with such requirements be included in universal service funding requirements, or that the costs of upgrading an incumbent's network be included in a cost proxy. Universal service support in high-cost areas should be independent of the incumbent carrier's (or any individual eligible carrier's) costs, and based only on the difference between a cost proxy for a high-cost area and a benchmark figure. A cost proxy should reflect an estimate of the forward-looking incremental costs of an efficient firm operating in a competitive market, not the costs of the incumbent.[26] Thus, it would make no difference to the

[26] Throughout their comments in the Commission's universal service proceeding, both MFS and WorldCom emphasized that universal service support should not be a "make whole" mechanism or a mechanism to fund incumbent carriers' network upgrades.

calculation of a cost proxy whether the incumbent (or any other individual eligible carrier) had to upgrade their network to conform with minimum network design standards.[27]

2. *Cost Proxy Model Should Develop Estimates of Incremental Costs Rather than Stand-Alone Costs*

Stand-alone costs are typically defined in the context of a multiproduct firm. Stand-alone costs are the costs that a firm would incur to produce only a particular product in isolation from the other products a firm could provide using its facilities.[28] However, incremental costs,[29] and not stand-alone costs are the economically relevant costs that should be developed by cost proxy models. Since incumbent firms and competitive firms both typically provide services and network elements in combination with other services and

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[27] Moreover, it is unclear whether an incumbent that upgrades its network to conform with minimum network design standards is necessarily burdened. An incumbent carrier that upgrades its network would be able to use that advanced network to provide new services, and thus, would realize additional revenues.

[28] In the Commission's rules governing the price of unbundled elements, "stand alone" costs are defined as "the total forward-looking costs, including corporate costs, that would be incurred to produce a given element if that element were provided by an efficient firm that produced nothing but the given element." 47 C.F.R. §51.505(c)(2)(A). See also, *e.g.*, J. TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION at pg. 20 (1989). In the academic economic literature, stand-alone costs are used to detect the presence of cross-subsidies. In general, the academic economic literature uses stand-alone costs to define when price generates a subsidy: a price generates subsidy if it exceeds the stand-alone costs, a product is subsidized when its price is below its incremental costs, and if the price is between stand-alone costs and incremental costs the presence of cross-subsidies is indeterminate. Most of the economic literature dealing with cross-subsidization relies on G. Faulhaber, *Cross-Subsidization: Pricing in Public Enterprises*, 65 AM. ECON. REV. 966 (1975).

[29] In this context, incremental costs are the total service long run incremental costs -- that is, the change in total costs that a firm would experience if it stopped offering an entire service or element. In contrast, stand-alone costs of a particular service are the total costs of a firm that offered only that service.

elements (*e.g.*, local service, toll access, and vertical services are provided over the same facilities), it is not clear why cost proxy models should be capable of producing an estimate of stand-alone costs. The relevant economic costs of a competitive new entrant are its incremental costs, not its stand-alone costs. For example, a cable television company that seeks to provide telephone service will evaluate the incremental costs of adding telephone service to its cable television network. If the market price for telephone service is greater than the incremental costs of modifying its cable television network to add telephone service, the firm will enter the market. The stand-alone costs of providing voice-grade telephone service in isolation from all other services are not relevant to such an entrant's decision to enter and compete in telephone markets. Likewise, the stand-alone costs of a service are not economically relevant to an incumbent's decision to offer service; an incumbent will willingly provide a service so long as the price exceeds the incremental costs of the service.

If cost proxy models are used to develop cost estimates for unbundled network components, they should estimate incremental and not stand-alone costs.[30] For example, the price of unbundled local loops should reflect the incremental costs of providing loops given the other services a firm might provide, and not the stand-alone costs of a firm that provides only loops. For purposes of developing universal service support, cost proxy models should develop estimates of the incremental costs of extending service to high-cost areas and not the stand-alone costs of a firm that only serves high-cost areas. *Basing universal service*

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[30] The Commission's *Interconnection Order* plainly requires that long run forward-looking incremental costs be used as the basis for unbundled network element prices. *Interconnection Order* at ¶¶ 672-703.

support on stand-alone costs would dramatically and unnecessarily inflate high-cost universal service support.

C. Estimates Produced by Cost Proxy Models Should be Bounded by Simple Ceilings that Reflect Real-World Information

The Staff asks for comments on how to independently evaluate the cost estimates produced by cost proxy models. Staff suggests comparisons with cable system costs, competitive bids for loop installation, econometric studies, engineering studies of a sample of census block groups, comparison with ARMIS data or independent auditing of the models and their algorithms.[31] MFS suggests that cost proxy models be adjusted, when appropriate, to reflect real world information.

Cost proxy models should reflect an estimate of the forward-looking costs of an efficiently configured new entrant, and not the embedded costs of the incumbent. Since cost proxy models fundamentally are not designed to reflect the expenditures of an individual company, it is inappropriate to use the embedded costs or other costs of incumbent providers as a "check" on the results produced by cost proxy models. The real world actions of firms, however, such as offering a service for a specific price, provide some insight into the economic costs of competitive firms and should be used to constrain the cost estimates produced by cost proxy models. Specifically, MFS suggests two simple rules:

- ***Proxy costs should not be higher than the lowest price willingly offered by an incumbent for a service***. For example, if an incumbent carrier willingly offers

[31] *Staff Cost Report* at ¶¶ 12-15.

unbundled local loops for $14.30, it should not be allowed to claim that the forward-looking costs of such a loop is any higher than $14.30. By willingly offering unbundled loops for $14.30, the incumbent carrier reveals that its costs are no higher than $14.30, and a cost proxy model should be adjusted to reflect that real-world information.

- ***Proxy costs should not be higher than the incumbent carrier's embedded costs***. For example, if an incumbent carrier argues that its embedded costs are $15 per loop, then it should be prohibited from subsequently arguing that forward-looking proxy costs are higher than what it claims its embedded costs are. If an incumbent asserts that $15 per loop is adequate to cover its embedded costs, it should be estopped from claiming that it is entitled to more because its estimate of a forward-looking cost proxy is higher.

These constraints may seem obvious. However, after participating in various state arbitration proceedings, MFS has found that some incumbent carriers will claim that their estimates of the forward-looking incremental costs of an efficient provider are higher than the prices they willingly offered to competitors and higher than the embedded costs they assert they have a right to recover. They will also paradoxically claim that their networks reflect the practices and technologies of a forward-looking, efficiently configured competitor.

For example, the tables that follow present data from MFS's arbitration with Southwestern Bell in Missouri dealing with the price of unbundled local loops.[32] Table 2

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[32] In the Matter of MFS Communications Company, Inc. Petition for Arbitration Pursuant to 47 U.S.C. § 252(b) of Interconnection Rates, Terms and Conditions with (continued...)

summarizes the analyses Southwestern Bell did of its loop costs relative to other carriers in Missouri as reported by various versions of the proxy models under consideration in the Commission's universal service docket as well as Southwestern Bell's embedded loop costs.

Table 2 -- SBC's Comparison of Its Loop Costs in Missouri
(Source: SBC Comments, Attachment 1 in CC Docket 96-45 (Aug. 9, 1996))

COST STUDY	SBC COSTS	TOTAL MO COSTS	SBC ÷ TOTAL MO
FCC Proxy		$18.32	
SBC "Actual" Costs	$17.31	$21.44	81%
BCM -- ARMIS	$13.12	$19.47	67%
BCM -- Hatfield	$9.51	$14.13	67%
BCM Ver. 2	$25.70	$31.08	83%

Thus, one would have expected Southwestern Bell's loop costs in Missouri to be no more than $17.31 (its reported embedded costs) or some fraction (67% to 82%) of the Commission's $18.32 interim proxy price since Southwestern Bell reported in the universal service docket that its loop costs were lower than the statewide averages developed by all the proxy models and lower than the embedded costs for all carriers in Missouri.

That was not, however, the case. Table 3 shows the alleged "cost-based" loop rates that Southwestern Bell proposed in Missouri, all in the same arbitration proceeding within 60 days. On August 12, Southwestern Bell filed a brief with the Missouri Commission indicating

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32/ (...continued)
Southwestern Bell Telephone Company, Case No. TO-97-23.

that it had offered MFS unbundled, averaged loop rates of $14.30.[33] These are the same unbundled loop rates that Southwestern Bell agreed to (and the Missouri Commission subsequently approved) in an interconnection agreement Southwestern Bell signed with Dial US, which operates in Springfield, Missouri.[34] Thus, since Southwestern Bell voluntarily offered unbundled loops to both MFS and Dial US, one would expect that its forward-looking economic costs to be no higher than the $14.30 price it willingly offered to its competitors.

On August 22 Southwestern Bell filed its forward-looking cost studies that substantially increased the loop prices it offered to MFS a month earlier. Two weeks later, on September 4, Southwestern Bell revised its forward-looking cost studies and again increased its alleged cost-based loop prices. As shown in Table 2, the alleged cost-based loop prices offered by Southwestern Bell for ordinary voice-grade service (8db) ranged from $17.15 (plus a $2.10/month cross-connection charge) to $43.10, an increase of more than 200% over the $14.30 price it offered a month earlier. Table 3 also shows cost differences between different types of loops -- 8 db, 5 db and 2-wire digital loops. MFS believes that these differences in transmission qualities are achieved with the different electronics a carrier might deploy rather than qualitiatively different types of copper loops, so there should be no cost difference between a loop used to a configure an 8 db grade of service and a loop used for a 5 db grade of service.

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[33] *In the Matter of MFS Communications Company, Inc. Petition for Arbitration Pursuant to 47 U.S.C. §252(b) of Interconnection Rates, Terms and Conditions with Southwestern Bell Telephone Company*, Case No. TO-97-23, Response and Answer of Southwestern Bell (filed August 12, 1996).

[34] The Dial US Agreement was approved in Docket TO-96-440 (September 6, 1990).

Table 3 -- SBC's Missouri Loop Prices
(Prices exclude proposed recurring $2.10 cross connection charge)

Loop Type	SBC's Proposed Aug. 12 Price	SBC's Proposed Prices Based on its Cost Studies			
		August 22 Testimony		September 4 Testimony	
		Proposed Price	% Increase in Aug. 12 Price	Proposed Price	% Increase in Aug. 12 Price
8db loop	$14.30				
Zone 3		$34.80	+143%	$43.10	+201%
Zone 2		$26.95	+ 88%	$27.40	+ 92%
Zone 1		$17.85	+ 25%	$17.15	+ 20%
5db loop	$15.70				
Zone 3		$41.45	+164%	$50.05	+219%
Zone 2		$33.60	+114%	$34.35	+119%
Zone 1		$24.50	+ 56%	$24.10	+ 53%
2-wire digital	$38.60				
Zone 3		$72.55	+ 88%	$85.30	+121%
Zone 2		$57.95	+ 50%	$60.35	+ 56%
Zone 1		$41.85	+ 8%	$44.90	+ 16%

In the hearings, Southwestern Bell witnesses testified that the $14.30 price was not below its costs, but that the higher, allegedly cost-based prices it proposed were due to the application of the Commission's forward-looking cost methodology.[35] Southwestern Bell

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[35] Under cross-examination, SBC's economist, Steve Parsons, testified as follows:

Q. Okay. As an economist, do you believe that Southwestern Bell or any competitive firm operating in a competitive marketplace would ever willingly offer a service at a price that's less than its costs?

A. Not willingly, no.

Q. Do you think Southwestern Bell would ever offer to sell a service to MFS, its competitor, at a price less than its costs?

A. Not willingly, no.

Parsons Cross-Examination, Tr. at pp. 192-193 through line 3.

asserted that its estimate of costs (which were developed using complex proprietary cost studies) reflected its network costs (not the costs of a new entrant) but that its network was indeed a forward-looking, efficient network. Much of the hearing was devoted to analysis of the assumptions made by Southwestern Bell and the data it used in its cost studies. The controversy in Missouri could have been minimized if the forward-looking proxy costs had been simply capped at the lower of costs predicted by a forward looking model, the prices offered by Southwestern Bell or Southwestern Bell's reported embedded costs. If Southwestern Bell actually has been conscientious in its network design and operation, then its embedded costs may be the lowest forward looking costs.

D. Cost Proxy Models Should Reflect the Incentives Competition Creates to Reduce Costs

Competition creates incentives for carriers to deploy technologies to more efficiently serve specific segments. Competition also creates economic incentives to reduce costs for all competitors. Cost proxy models should reflect the dynamic impact that competition has on costs. For example, a cost proxy model should be periodically adjusted to reflect the presence of new entrants and technologies that might be more efficient for serving specific segments of the market. It should also be adjusted to reflect the downward pricing pressure that competition can be expected to have on all competitors. The cost proxy models being considered by the Commission do not capture these competitive dynamics.

It may be impossible to develop a model rich enough to capture all of the potential market segments and technologies a market entrant might use or the expected impact that competition will have on incentives to reduce costs. In lieu of developing a comprehensive,

dynamic model, a simple adjustment mechanism could be developed that used the prices willingly offered by competitors as an indicator of their costs. For example, one might cap the proxy cost at the lowest price offered by a competitor of a specific minimum size (*e.g.*, at least 5% market share) for a specific bundle of services (*e.g.*, the functions included in universal service) in a defined geographic market area (*e.g.*, Basic Trading Areas). Thus, if a wireless carrier offers universal services to 5% of the subscribers in a specific market at a price lower than the incumbent's costs, the wireless price would become the new cap in that area.

Under price caps regulation, the price cap increases according to general measures of inflation (*e.g.*, GNP-PI) and is reduced by a productivity factor which reflects the expected efficiency gains of regulated firms. A simple alternative to capture the impact of competition on costs might be to use a cost proxy as a starting point and apply a price-caps like productivity adjustment to the costs to reduce costs in line with competition-driven productivity incentives.

II. MODEL STRUCTURE AND INPUT REQUIREMENTS

The Bureau seeks comments on the Staff's analysis of the various models' structure and inputs. As described above, cost proxy models should reflect the forward-looking incremental costs of an efficient competitor providing service in a competitive market, such cost estimates should be bounded by the lower of embedded costs and the incumbent carrier's prices, and such costs should be periodically adjusted to reflect the incentives competition creates to reduce costs. While the costs produced by existing cost proxy models are fundamentally the costs of a monopoly provider, to the maximum extent possible, MFS

recommends that inputs reflect the values of a efficient competitive firm to minimize the inflationary distortion caused by this assumption. To facilitate comparison between the models, MFS also recommends that the Commission require that the model use a consistent set of input values and a standardized output format. Because the cost proxy models under consideration are so complex, MFS also recommends that the Commission explore using regression techniques to simplify the models and reduce them to their most important variables.

A. Critical Input Values

The cost proxy models are very complex. Since each model sponsor recently released new models, MFS has not had time to fully analyze those models and their assumptions (see the discussion in Section III, below). Table 4, however, presents an analysis of several of the major numerical assumptions made by the Benchmark Cost Model, version 2 (BCM2), and presents MFS's suggestions for reasonable values.

Table 4 -- Critical Inputs to Cost Proxy Models

INPUT	BCM 2 VALUE	MFS SUGGESTED VALUE
Maximum Fiber Size	Maximum Fiber Cable size is 144; Maximum Copper Feeder Size is 4200; Maximum Copper Distribution size is 3600	Typical fiber size being deployed by new entrants is 216 and often 288 in metropolitan areas; 4200 pair cables are typical for copper facilities
Switch Fill Factor	80%	Too low. Switch fill factors should be in the 90% range.
Pedestal Cost	$48.22	Seems reasonable

INPUT	BCM 2 VALUE	MFS SUGGESTED VALUE
Business Lines	10 business lines per location	Seems far too low if locations are buildings, but may be reasonable if locations are defined as "suites"
NID Cost	$30	Seems reasonable
Special Access Ratio	13% of business lines are special access	Seems too low; seems to be developed based on current proportion of special access lines/private lines. As competition develops, one would expect a larger proportion of special access lines.
Volume Discounts	20% for digital switching equipment; 20% for SLC; 10% for AFC	Too low. In today's environment, manufacturers typically start with discounts of 15%. MFS's experience indicates a discount of up to 45% is more realistic.
Special Access Circuit Costs	DS3s to CO and DS3 to DS1 multiplexers cost $162,000; DS1s cost $1,133	Grossly excessive. Average cost of DS3 to CO and DS3 to DS1 multiplexers cost between $17,000 up to $34,000; DS1 cost seems reasonable
Depreciation Lives	Loop Plant, circuits and switching facilities will have an economic life of 4-5 years (factors between .2 and .25)	Unreasonable. Cable lives used by MFS and WorldCom range between 20 and 40 years. As new uses of copper plant are developed (e.g., ADSL, HDSL), one would expect such plant to have an extended economic life. Digital Circuit Switching lives range between 7.5 to 15 years; Switching Facility lives range between 7.5 to 10 years
Other Costs	Non-plant costs are 75% of total loop and switching costs	Grossly excessive. Operating expenses for competitive firms -- like MFS -- are about 25% of loop and switching costs
Conduit Pulling Costs	77¢ per foot to pull cable through underground conduit	Seems reasonable.
Local/TS Ratio	70% of switching costs are non-traffic sensitive; 74% of traffic sensitive costs are local traffic	Appears too low. Most switching costs are non-traffic sensitive, so should be closer to 100% non-traffic sensitive
Placement Costs	Varies by location	$5 per foot for placement in sandy soil (e.g., Florida); $7-$8 in loamy soil (e.g., D.C.); and $12-$13 in other non-rock, difficult soil seems reasonable.
Aerial and Underground Mix	80-90% of cable deployed underground in rural areas	Excessive. More than 10-20% of cable in rural areas would be deployed aerially.

While many of the numerical assumptions used in the BCM2 and Hatfield models can be modified, the default values used by the models are national values rather than state- or region-specific values. For example, one would expect that the number of business lines per location to differ in Denver when compared with locations around Topeka. To accommodate such differences, it might be appropriate to allow states to determine state-specific or even more geographically deaveraged values rather than using broad national averages.

The Staff asks for comments on the appropriate depreciation lives and factors to use to capitalize investments, perhaps the most important assumptions embedded in cost proxy models.[36] Staff seeks comment on various proposed depreciation models and factors used to annualize capital expenses. Because a cost proxy model is designed to determine the costs of an efficient competitor, MFS suggests that depreciation rates and capitalization factors used by competitive firms ought to be used in the cost proxy models. Reliance on ARMIS data (which are used to develop a ratio of operating expenses to investment in the BCM2 and Pacific Telesis models) are inappropriate unless one makes the heroic assumption that regulated telephone company practices represent the practices of a forward-looking efficient competitor. Further, ARMIS data and investments reflect a mix of all the technologies carriers have deployed in the past, and not necessarily the technologies that an efficient, forward-looking competitor would deploy. The Commission could simply solicit the depreciation lives and operating expenses/capital investment ratios used by competitive firms to determine the appropriate capitalization factors and depreciation rates for use in cost proxy models.

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[36] *Staff Cost Report* at ¶¶ 53-69.

B. Loop Design in Cost Proxy Models

Cost proxy models should reflect realistic forward-looking loop engineering practices. As described above, MFS believes that the appropriate forward-looking design is a copper loop design. Specifically, the proxy cost models should be designed to explicitly reflect a maximum length for copper loops, and should not force fiber optic facilities in the feeder plant when the total loop length is less than the maximum regardless of the length of the feeder. MFS understands that BCM2 has "built in" a maximum copper loop length of 18,000 feet and that Hatfield 2.2 has no maximum length for copper loops. Both should be modified to permit a variable maximum copper loop length. Both models have a factor that forces fiber in the feeder after a specified loop length. Those factors should be modified to allow the option to deploy fiber only when the maximum copper total loop length is exceeded.

But, the question of a loop standard has greater implications than just to define the minimum loop capabilities. It also should define the maximum grade of service that will be supported by universal service funding. Both the Hatfield and Benchmark models deploy too much digital loop carrier on fiber facilities for the minimal grade of service constituting universal service. This affects loop design in two ways. First, digital loop carrier on copper is more than satisfactory to provide voice services and it costs less than fiber to deploy. Although fiber allegedly costs less to maintain than copper facilities, in MFS's experience, companies have been unable to produce records that demonstrate maintenance costs have declined after fiber is deployed. Second, the fiber that is deployed is needed primarily to enable incumbents to provide new services also not included in the definition of universal service. Unless the Commission specifies a design standard in the cost proxy models, we will

end up with the worst of both worlds -- no guarantee that modern services actually can be provided over the loops designed by either model and inflated costs based on the deployment of unneeded technology.

A proper loop design would rely on 100% copper facilities for loops up to 18,000 feet long (considering both distribution and feeder cables). The design uses 26 gauge cable to 15,000 feet with 24 gauge from 15,000 to 18,000 feet with no load coils. Digital loop carrier is required on loops longer than 18,000 feet, but the most efficient design in many cases might be to put the digital loop carrier remote unit at 36,000 feet and home copper loops greater than 18,000 feet and shorter than 54,000 feet on this new facility node. Since the models don't have the ability to do "look ahead" design, neither is likely to identify the least cost solution for any distribution of subscribers. Nonetheless, it is instructive that a number of smaller telephone companies already have adopted network architectures as described above.

The design standard for wireline local loops specified in the interconnection agreement between MFS and Ameritech for 2-wire loops (an ANSI network standard -- T1.413-1995-007R2 or later) could be used in cost proxy models as the design standard that will allow for high-speed transmission speeds. In the interconnection agreement between MFS and Ameritech, 2-wire loops that meet this standard are made available at the same price as other loops. Thus, the standard establishes a design standard for advanced loops, but since all loops are priced the same in the agreement, the standard does not result in higher costs. This ANSI standard will also meet the minimum transmission standards established by Congress for rural carriers. Properly designed (*i.e.*, unloaded) copper loops less than 18,000

feet meet this standard, so adoption in cost proxy models should not impose a substantial burden on telephone companies. For loops greater than 18,000 feet, loop electronics or remote switch modules can be deployed.

As described in the *Staff's Cost Report*, the BCM2 and Hatfield cost proxy models use a "burnt node" approach to modeling local networks.[37] That is, they assume the locations of existing wire centers, and then assign census block groups to the closest wire centers. Based on that assignment, they develop estimates of the costs to deploy loops running at right angles from the wire centers to the census blocks. As noted above, this model design develops the costs of a monopoly provider that builds a plant sufficient to serve all of the census blocks that might be associated with a particular wire center. It does not develop costs associated with multiple providers who might deploy networks designed to serve a segment of the geographic area. Thus, the models assume that whatever firm is associated with a particular wire center will have a monopoly and serve all the customers in the census blocks closest to those wire centers. In reality, new entrants and incumbent firms can each be expected to serve a portion of the total market demand.

Assignment of census blocks to wire centers cannot be modified by model users. That is, with BCM2 and Hatfield 2.2, determination of the closest wire center is performed by a US WEST mainframe computer, and is not something that model users can readily change.[38] That may be somewhat problematic since the model may assign unrealistic numbers of

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[37] *Staff Cost Report* at ¶¶ 20-24.

[38] MFS understands that this limitation has been changed in the latest version of Hatfield and BCM, but would persist if the Commission decided to use BCM2 and Hatfield as the basis for cost proxies.

customers to central offices irrespective of the customers actually supported by a particular central office. For example, the model might assign 25,000 lines to an office that presently supports only 5,000 customers, or assign 5,000 customers to an office that presently supports 50,000 lines. At an extreme, it may also result in some existing end-offices without any assigned customers.[39]

The Commission has three options with regards to the assignment of census blocks to wire centers: (1) accept the assignment as a simplification that does not materially affect the results of the model; (2) require that models allow users to modify central office assignments; and (3) make adjustments to the models that mirror real-world loop assignments. Options (2) and (3) are warranted only if changes in the assignment would materially change the results of the models. Only the model developers can provide that analysis.

As the Staff notes,[40] the models develop deployment cost estimates that do not wrestle with the problem of deploying facilities in new developments (where installation costs are low) versus developed areas (where installation costs would be high). For example, the incumbent carrier which already has facilities deployed throughout an urban area could easily extend service to customers within its service area. However, a new entrant seeking to deploy its network must secure rights of way and building access in a developed area, which may be more difficult than deploying network facilities before an area has developed. This

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[39] MFS understands that both Hatfield and Benchmark will have significantly different algorithms for assigning census block groups to wire centers in their new versions, however, MFS has not fully reviewed these revisions.

[40] *Staff Cost Report* at ¶ 45.

creates the potential that the incremental costs of extending embedded plant will be far lower than the incremental costs of installing entirely new loop facilities.

As noted above, MFS recommends that cost proxy models be designed to reflect the forward-looking incremental costs that would prevail in competitive environment. In a competitive environment, a new entrant must meet or beat the costs of entrenched incumbent competitors. Thus, in a competitive market, the relevant economic costs are the lower of the incremental costs of extending embedded plant or the incremental costs of installing entirely new facilities. Thus, if a cost proxy model yields loop costs that are higher than the incremental costs of extending the existing plant (assuming that the existing plant can meet the relevant network standards), the proxy costs should be reduced to reflect the lowest costs. Similarly, if a cost proxy model yields costs that are lower than the costs of extending the embedded facilities, in a competitive environment, the results of the cost proxy model should be used since the market would equilibrate around the technology and network deployment that yields the lowest costs.

C. Simplifying the Cost Proxy Models

Both the Hatfield and BCM cost proxy models are grossly complex. They involve interactions between hundreds of variables and assumptions and require that users invest in substantial computing power to run the models. Both BCM2 and Hatfield 2.2.2 require computers with more the 100 Megabytes of RAM, and national scenarios typically take several hours to run.

In analyzing the models, MFS observed that simple regression models capture much of the variation in the models' results. For example, as noted in Table 1, above, a simple one-variable regression that regresses loop costs against density produced an R^2 of .82 for the Hatfield 2.2.2 model. If other variables were included in the regression, MFS suspects that even higher R^2s could be produced.

For example, once the Commission selects a cost proxy model, it might regress critical costs (*e.g.,* loop costs) against several key variables (*e.g.*, density, loop length, wire center size) to produce a regression that statistically explains most of the variation in those costs. State commissions and others who cannot invest in the computers required to run the models could then use the regressions to estimate cost proxies to apply to their circumstances. Even a regression with 10 variables would be easier to apply than either the Hatfield or the BCM models with more than 400 equations. If the regression could be developed that has an R^2 in excess of .95 (*i.e.*, more than 90% of the variation in the dependent variable is explained by the 10 independent variables), it hardly seems efficient to run and debate the details of these huge models. In instances where the cost proxies are used to identify high-cost areas, a regression equation is a reasonable mechanism to easily identify eligible (high cost) and ineligible areas without running the models. In instances where the cost proxies are used to set prices for unbundled elements bounded by the lower of embedded costs or the incumbent carrier's costs, then there may be instances where regression results are adequate.

III. COMMENTS ON THE LATEST VERSIONS OF BCM AND HATFIELD MODELS

A. The Cost Proxy Models Are Too Complex

Evaulating the major cost proxy models is a moving target as the model proponents have recently released revisions. The revisions purport to address several issues, but the models are still so complex that it is questionable how useful they are to state commissions and others who seek to develop cost estimates. For example, MFS was unable to run the latest version of the BCM (now referred to as the BCPM, Benchmark Cost Proxy Model) filed with the Commission on January 31, and the instructions were inconsistent with the screens confronting model users. Certainly, these "bugs" can be worked out and are likely the result of the pressure to release the model. However, at some point the Commission make a decision regarding cost proxy models and recognize that affected parties cannot continue to offer comments on models that evolve and become more complex on a monthly basis.

As described above, the purpose of a cost proxy model should be to provide a starting point estimate of the costs that would prevail in a competitive environment, bounded by real-world competitive data (*e.g.*, prices willingly offered by incumbents and embedded costs). Cost models should be rich enough in detail that they capture the major determinates of variation in those costs, but to be useful, such models should necessarily be a simplification of the real-world. An economic model is not useful to policy makers if it attempts to duplicate all the nuances of the real-world and thereby becomes too complex to understand or use on a day-to-day basis. It would be like trying to understand the principles of flight by building a "model" airplane that seats 400 passengers and is capable of trans-Atlantic flights.

MFS urges the Commission to dramatically simplify the cost proxy models rather than seek add to the models' complexity. As described above, the proxy models will be useful in developing data to derive a formula to define cost relationships based on one or two key determinates for each network element and for universal service. BCPM introduces this concept for switching costs,[41] and MFS herein proposes a similar construct for loops.

Given additional time, MFS might comment on the specific input cost values proposed for each model. Rather than do that, it merely points out that the models are driven to either over-estimate (BCPM, *e.g.*, assumes 100% "filled" cable for underground deployment and 100% filled and armored deployment for buried cable) or under-estimate costs (Hatfield, *e.g.*, assumes an unrealistic proportion of sharing between electric, gas and telecommunications services on various structures). After the models are modified to reflect whatever design standard the Commission decides to mandate, MFS suggests simply comparing the inputs and averaging for this round. Nonetheless, the Commission should create an advisory panel to review model inputs for future revisions. We further recommend the Commission reduce the outputs of both models to a single (likely exponential) curve that parties can use to estimate costs rather than requiring widespread use of either model.

B. The Models Reflect Different Assumptions About Loop Design

Although MFS has not had an opportunity to exercise either of the latest versions of the BCPM and Hatfield models, MFS has reviewed the documentation provided by each

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[41] In BCPM, switching costs are reduced to a simple one variable formula:
Investment per line = $225 + $261,871/(Line size of the switch)

sponsor and offers the following observations. Both models demonstrate considerable improvement over previous versions. Both likely will be easier to use and both seem to provide more explicit user inputs in critical areas. For example, BCPM now allows the investigator to specify capital costs including investment lives, net salvage, depreciation curves and depreciation reserves by class of plant, debt ratio and costs of both debt and equity capital. Both now agree that outside plant structure can be and is shared by multiple users, but they still diverge on the correct proportion of sharing.

Both models have chosen to define service areas in terms of CBGs. Hatfield has significantly improved the linkage between Census Block Groups (CBGs) and serving wire-centers. MFS agrees that CBGs provide a convenient metric to identify demand that is not controlled by the industry, but neither model has any capability to group or divide CBGs to minimize network design costs. Both use a standard rectilinear grid to define cable distances, but neither rotates the grid to minimize the weighted average sum of rectilinear distances to the CBGs actually served by each wire-center. Much more importantly, neither has defined an appropriate engineering algorithm for the local loop. It is this failure to appropriately design and then cost the local loop that requires immediate Commission attention.

Throughout these proceedings, and as described above, MFS has been asking the Commission to define the technical parameters of loop performance. A simple declaration that universal service be "voice-grade" is completely inadequate for two major reasons: first, it does not address the specific legislative mandate to provide access to advanced telecommunications and information services in all regions of the nation; and, second, it encourages manipulation of the model to serve the needs of its sponsors without

guaranteeing either a minimum level of service or constraining over engineering. Both models demonstrate the ill-effect of this Commission omission.

MFS believes that about 80% of all loops can be properly designed at no incremental cost to deliver data at a 1.544 Mbps rate over 100% copper facilities.[42] These loops would use 26 gauge twisted pair copper wires up to 15,000 feet extending another 3,000 feet on 24 gauge to remain within the supervisory signaling limit of modern digital switches. Loops with this design would not require load coils. The remaining loops will need some type of digital loop carrier on some portion of the loop. As BCPM acknowledges, there are several types of circuit cards to plug-in to digital loop carrier (DLC). The least expensive allows copper extensions beyond the DLC of almost 11,000 feet of 26 gauge cable. Longer distances are feasible with extended range DLC line cards, but high speed data transmission is not assured.

In the face of this standard loop design, both models over deploy fiber optic transmission facilities yet neither satisfy the above design standard. Using the provided default, Hatfield begins deployment of fiber where feeder lengths exceed 9,000 feet and uses coarser gauge cable with load coils on loops with more than 18,000 feet of copper. BCPM defaults to fiber in the feeder at 12,000 feet and constrains total copper length to 12,000 feet. Both fail by focusing on feeder length rather than total loop length. Long loops in the Hatfield model will not support modern modem data speeds and all loops in the BCPM as designed would appear to support data transmission speeds up to 6 Mbps using ADSL technology.

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[42] Today, HDSL is being used to provide 1.544 Mbps transmission speeds over unloaded copper loops rather than T-1. T-1 facilities require intermediate repeaters in the local loop at locations that would not otherwise have equipment, and thus, would be more difficult and costly to deploy and maintain.

MFS supports the ADSL technology and has asked the Commission to adopt the ADSL standard for universal service loops. The difference is the design option supported by MFS will provide 1.544 Mbps data over standard loops. BCPM errs by over-designing to provide 6 Mbps. In any event, for the models to be comparable and for end-users and competitors to know the capability of the loops they acquire, the Commission must specify a design standard.

No design "magic" is triggered by whether a particular section of cable is defined as feeder or distribution. The critical design criteria is total cable route distance (feeder, distribution and drop) to the most distant service point in each service area. Customers served by loops with a route distance to the serving wire-center shorter than 18,000 feet should be served on copper. Longer loops require additional electronics - in this case the preferred, but not exclusive, design utilizes DLC. DLC can be provided on cooper facilities or, at a slightly higher cost, over fiber. Both models use DLC over fiber. DLC cabinets come in specific sizes. While both models seem to equip the size closest to the needs of each CBG application, neither either sheds or adds lines to or from adjacent CBGs to find the most economic DLC configuration.

Both models also over deploy feeder-distribution interfaces (FDIs) or serving-area interfaces (SAIs). Both are intended to allow carriers to benefit from aggregating demand along cable routes to minimize unused capacity. Both models reflect this savings generally by showing higher fill factors in feeder cables compared to distribution cables. In fact, fill factors usually are almost identical in larger sized feeder and distribution cables most often found in urban loop plant. In these cases, standard loop design does not include a FDI/SAI. MFS believes about 20% of all loops fall in this category.

CONCLUSIONS

MFS applauds and supports the Commission's efforts to determine an objective mechanism for determining the costs to use in developing high-cost support and setting prices for unbundled network elements. With the modifications suggested above, particularly selection of a network design standard, MFS believes that the cost proxy models being considered by the Commission and its Staff could provide a very useful and effective mechanism for objectively determining costs delinked from the incumbent provider's embedded costs.

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