not designed to run data for small companies, period. Paragraph 277(8) further states, "... the model should include the capability to examine and modify the critical assumptions and engineering principles."[9] None of the models meet this criteria to date. Many of the engineering principles are hard coded and require significant modifications to change limiting the types of sensitivity analysis that can be performed by a small organization.

B. Appropriateness of Engineering Decisions

The appropriateness of engineering decisions is critical to the viability of the results produced by any model when applied in a small company arena. Data runs completed to date exhibit widely varying results from one model to another. These variations are attributable to differing engineering decisions and/or inputs.

1. Inconsistent estimates of loop investment result from variations in pricing assumptions and type of cable placed. In the case of the BCM model, underground and buried cable are treated similarly and there is no provision for poles or manholes. Obviously, different cost characteristics are attributable to underground cable which is placed in conduit and buried cable which is armored and trenched into the ground. Although the models do consider terrain variables, none of the models consider topical engineering decisions made to directionally drill or place cable around a land obstruction. Other areas of concern within the loop investment include representation of air miles versus actual route miles, whether sufficient distribution cables are placed for the modeled demand, or whether a sufficient number of serving area interfaces were placed.

2. The actual mapping of wire centers to census blocks or census block groups may result in outside plant designs which assign a customer serving area to the closest switch. In reality, this is not

[9] CC Docket 96-45 in Paragraph 277, pages 147-148.

always the case. The significance is that the model may not calculate proper cable sizes or distances. Further, unrealistic uniform density distributions are assumed in each model and the density distribution categories may not be adequate to evaluate small telephony providers. More information is required on the mapping methodology and data used by each of the model developers.

3. All three models address ownership of the plant differently. Hatfield assumes 100% joint ownership, CPM assumes 25% solely owned and 75% joint owned for densities of 0 to 500. It is not clear the BCM addresses this issue at all.

4. Results indicate that models deploy a much greater percentage of digital loop carrier than found in an actual network, overstating digital loop carrier costs. This is due to a shortened copper/fiber crossover point of 9,000 to 12,000 kft. In addition to specifying the crossover point, the model should also address deployment of bridge tap, loading and gauge of wire. For instance, if the maximum loop length is 12 kft, 19-, 22- and 24-gauge cable facilities should be used. If the loop length is 9 kft, 26-gauge cable should be used. All loops in a customer serving area should have non-loaded cable with a maximum bridged tap of 2.5kft.

5. Networks are not built on a wholesale basis, they are built incrementally over time. The BCM, CPM and Hatfield all assume a "desert start" approach. This does not consider the capital investments of a network over time. For instance, given a current population density and anticipated growth, a 200 pair cable may have been placed. Later demand may require that an additional 200 pair cable be placed. Placing a 400 pair cable at the onset of construction results in excessive first costs and extremely low utilization rates. Conversely, placing a small capacity transport system at 85% capacity doesn't allow for maintenance or growth potential. Undersizing a network element is a very costly way to meet demand. The desert start approach does not consider current network configurations, the

varying migration strategies required to move towards a forward-looking network, the impact of new technologies which are not known, or the financial capability of a telephony provider to engineer, furnish and install the forward-looking technology. There must be some consideration of model results which may incent the unnecessary abandonment or early retirement of good technologies that are not considered forward-looking. The evolutionary aspect of the network is simply not captured adequately by these models.

6. Network elements are incorporated into each model differently. CPM and Hatfield clearly identify the cost of poles, where the BCM does not. The Hatfield incorporates cost for SS7 signaling elements, where the BCM and the CPM do not. Switch and transport parameters differ widely. The Hatfield goes to greater length to address interoffice facility requirements, where the BCM adds an overall 3%. The CPM doesn't really address interoffice facilities at all. Common cards, circuit costs labor and installation are applied differently, further restricting the ability to analyze the differences without the underlying data or input from the developer.

7. The number of residence lines, business lines and special service lines vary between models. An agreement is necessary as to how these numbers will be determined.

8. It is not clear how common systems (power, mainframe, channel banks, test gear, spares and operational support systems) are treated between models.

9. The treatment of switching requires a great deal of attention. BCM uses the current central office locations reported by Bellcore's LERG database. The Hatfield assumes the placement of one switch per wire center, which understates costs, "... the model will equip the wire center with a single switch if the number of switched access lines served by the wire center is no greater than

80,000..."[10] Interestingly, their documentation also states that average switch line sizes deployed are considerably different. "... average BOC (11,200) and independent (2,671) switch line sizes derived from data published in the FCC's *Statistics of Communications Common Carriers*. Switch investments in the BCM are calculated using generic digital switch investments for five switch sizes. Developers of the CPM model developed a switch investment curve based on proprietary customer data. The Hatfield uses per-line average prices which include remotes, hosts and stand alone offices although per line prices between stand-alone and remote systems vary greatly. Hatfield disregards the placement of remote switches which is not representative of large or small telephony networks. The placement of remote switches avoids major hardware and software costs for the provider. If the switch type (hosts, remotes, stand-alone and tandem switches) is not modeled correctly, the differentiation in cost for the various switch types will not be captured and costs will likely be overstated. The Hatfield assumes a TR-303 interface which impacts the complexion of the network and its cost. Many companies, however, are not yet deploying TR-303 interfaces.

10. The models do not identify the portion of expense attributable to providing diversity and survivability within a Bell Operating Network, an element of design which is not as pervasive in a small company environment.

11. The size of the study area should be evaluated by wire center, by density zone, by census bureau group or census bureau, etc. to determine the amount of variance that occurs as the study area is increased or decreased. The point is to be able to evaluate the resulting network design adequately enough to isolate high cost from low cost areas so that the subsidy can be provided to the proper provider, where geographically necessary, to maintain universal service.

[10] Model Description, the Hatfield Model, Version 2.2, Release 2, page 23.

12. Paragraph 277(5) states, "the model should estimate the cost of providing service for all business and households within a geographic region."[11] Yet the proposed recommendation indicates that vacation homes and second lines should be eliminated from consideration. Network designs must include that 100 pair cable to the lake for lifeline service even though the residents are only there one-half of the year. Network designs MUST take into consideration multiple lines per business or residential location or demand will not be met in a timely fashion. The models must exhibit rational deployment decisions that occur day to day.

14. Switching and interoffice traffic considerations, a significant portion of the timing and sizing of network elements, is not included in either the BCM or the CPM models.

15. Consideration for the three major support networks synchronization, signaling and power should be depicted similarly between models. Signaling is currently only considered in the Hatfield model

16. The BCM addresses wireless technologies by capping the loop investment per line Wireless is not addressed by either the Hatfield or CPM, nor is any other loop technology.

17. All of the models assume plant and capacity efficiencies of a single network provider. However, as competition enters, efficiencies may be lost as plant capacity is shared, duplicated or stranded. The models must recognize that density and geography will influence the number of providers, possibly deteriorating plant and capacity efficiencies. If this is not recognized, efficiencies demonstrated in the models, may never be realized resulting in support which is not sufficient.

[11] CC docket No. 96-45, Released November 8, 1996 at Paragraph 277(5)

C. Relevance of Model Inputs

Model inputs represent the other half of the equation which signify how accurately the model represents reality. A cursory review of the inputs between the BCM, the Hatfield and the CPM models, where possible, indicate a significant degree in variation.

1. The Hatfield per-line switch prices are an average of remote, host and stand-alone end offices. Experience evidences that the per line price of a remote is significantly different from that of a host or stand-alone switch. The fixed portion of the switch is represented at $250,000 to $1,500,000 in the BCM and $600,000 for the CPM model. It is unclear what software is included. In addition to operational (generic) and application (feature) software fees, recurring right-to-use fees are increasingly used.

2. Business lines are reported as ten lines per location for the BCM and four lines per location for the Hatfield.

3. The drop investment per line reported in the BCM is determined on a cost/foot, the CPM varies the drop cost on the basis of density and the Hatfield reports $40/line.

4. Placement of the serving area interface is based on density in one model and cable size in another.

5. Cost elements are shifted from one category to another depending on which model you are considering.

6. The treatment of expense parameters also warrant significant discussion. As previously stated, all three models rely on the use of ARMIS data which is primarily populated by the major telephony providers. ARMIS is not applicable for small service providers, it represents historical data

and may include expenses for technologies that may not be deployed in a forward-looking network design.

7. Considerable discussion is also required for the treatment of depreciation factors, especially for a small telephony provider.

8. Manufacturer discounts are utilized in the Benchmark but not in the Hatfield. There are two components to evaluating the manufacturer discounts, first the discount itself and second, the base material price.

9. There are a considerable number of factors which are applied throughout each model for different purposes. The appropriateness and basis for each of these factors demands additional review.

Further discussion during the workshops should evaluate the reasonableness of input assumptions along with the underlying data that supports them and align the parties to a set of inputs or multiple set of inputs given specified criteria.

D. Impact of Model Results

The Joint Board recommendation requires that the models exhibit forward-looking costs. An apples to apples comparison of the results supported by proxy models to current embedded based cost studies, we agree, is not accurate and does not explain the errors of the models. However, the impact and application of Part 32, Part 36 and Part 69 rules in the cost proxy models should be known. An understanding of these differences will foster an understanding of the potential differences between the support levels a company may be entitled to via actual cost study methods versus support levels determined via cost proxy models.

APPENDIX C TO COMMENTS ON ACCESS CHARGE REFORM

The Federal Comunication Commission seeks comment on the Notice of Proposed Rulemaking for CC Docket No. 96-262 concerning the matters of access charge reform, Price Cap Performance Review for Local Exchange Carriers, Transport Rate Structure and Pricing and Usage of the Public Switched Network by Information Service and Internet Access Providers.

1. Background

Docket 96-325 refers to a competitive trilogy, Section 251 (Interconnection), access and universal service. This new competitive realm requires that elements of the industry move towards a cost-based philosophy. A number of parties supported the use of a proxy based system as the methodology to determine forward-looking economic costs. Docket 96-325 postured itself in favor of moving forward with the evaluation and potential implementation of a cost proxy model. Several models were introduced, the Benchmark Cost Model (BCM), the Cost Proxy Model (CPM), and the Hatfield Cost Model. Recently developers of the Benchmark and Cost Proxy presented a new "best of breed" model called the BCPM, the Hatfield group presented a Version 3 and Ben Johnson Associates presented the Telecom Economic Cost Model. The vast majority of comments in this Appendix are based on studies of the Benchmark 2, the Cost Proxy Model and the Hatfield Version 2.2.

2. Issues and Concerns

One of the criteria specified by the joint board is that any model adoped realistically represent the cost of a forward looking network. There are striking elements of the models which cast doubt on the compliance of any model. The following statistics demonstrate some of our concerns.

a. Network Design

First and foremost, does the cost presented by the models represent a network that is viable? Can the network provide quality service? Is it positioned for the future? Are there adequate numbers of physical elements represented? How does the model move forward as technology changes? Do the models represent the extensive variation in network design for small, medium and large? The models present designs for a fiber deep, all digital network utilizing integrated digital loop carrier. For the most part the framework is in place for a network that can provide voice grade service yet be positioned to provide services that may be deemed "universal" in the future. However, a more probing review reveals striking deficiencies.

a1. Outside Plant

Of the most basic design concerns is the census bureau group, the mapping of wire centers within that group and the resulting number of access lines produced. The following statistics were observed across 1326 study areas.

Modeled vs. Actual Access Lines

Number of Study Areas	% Different from Actual
10	greater than 1000%
25	greater than 500%
164 or 12%	greater than 100%
405 or 31%	greater than 50%
725 or 55%	greater than 25%

Another way of looking at the access line discrepancy is by company size in terms of access lines. The following reflects that the smaller the company, the less accurate the result.

Modeled vs. Actual Access Lines

% Different from Actual	Ave. # of USF Loops
greater than 1000%	304
greater than 500%	978
greater than 100%	1337
greater than 75%	1639
greater than 50%	2746
greater than 25%	7920
from 0-10%	393282

Loop investment has been claimed by many to be understated. Our evaluation for small telcos shows just the opposite--loop costs that are overstated. The concern is that this will improperly incent competition in smaller study areas. In a sample size of 12, we found the following loop differentials

Outside Plant
Embedded vs. Forward-Looking Costs

BCM % Different	CPM % Different
495%	70%
67%	172%
50%	-8%
30%	133%
16%	55%
587%	1832%
98%	-4%
112%	515%
-59%	299%
94%*	135%*
AVE: 149%	AVE: 320%

*consolidated from several companies

a2. Switching

The Cost Proxy and the Benchmark combined their switching and transport investment. When comparing with embedded, the following discrepancies resulted.

Switch and IOF
Embedded vs. Forward-Looking Costs

BCM % Different	CPM % Different
-54%	-87%
-11%	-30%
-37%	-35%
-49%	-62%
-58%	-65%
0	-6%
-63%	-71%
-62%	-100%
-80%	-57%
-70%*	-70%*
AVE: -48%	AVE: -58%

*consolidated from several companies

Looking at switch invesment from a per line perspective also indicates that the regressions haven't revealed the correct data and variables yet. Previous comments submitted by GVNW shows that switch costs vary greatly from small to large switches.

Subscribers Per Switch	Number of Switches	Number of Subscribers	Average Subs. per Switch	Switch Gross Investment	Switch Gross Invest Per Subscriber	Switch Revenue Requirement	Switch Rev. Req. Per Subscriber
<100	96	6,773	71	10,605,864	1,566	3,773,745	557
100 to 199	156	25,853	166	30,182,528	1,167	10.099.159	391
200 to 499	1,181	385,612	327	326,063,417	846	94,213,016	244
500 to 999	5,859	4,394,889	750	2,159,544,365	491	654,241,219	149
1,000 to 1,999	4,138	6,258,969	1,449	2,984,442,259	477	911,484,384	146
2,000 to 4,999	34,138	12,563,579	3,036	6,165,482,731	491	1,837,478,089	146
5,000 to 9,999	3,679	27,354,651	7,435	11,164,844,111	408	3,398,889,574	124
>10,000	5,732	78,801,536	13,748	28,274,999,934	359	9,193,435,365	116

This chart clearly demonstrates that costs in small switches are four to four and one-half times the costs in large ones. However, the inputs that the Hatfield model uses for switches are based on the average investment per new line of digital switching paid by BOC's at $102 and by independents at $235 (in 1995). This data was from a McGraw-Hill publication entitled, U.S. Central Office Equipment Market. The BCPM model does not make a distinction in the type of switch. It uses a switch curve that is sensitive to the number of lines. Using regression analysis, several significant variables were dropped which reduced the R^2 factor from 70% to 44%. The switch curve equation is

Investment per line = 225 + 261,871/Line Size of the Switch

Switch Per Line Costs

Number Lines	Actual Inv/Subs	Model Inv/Subs
71	$1556	$487
166	$1167	$487
327	$846	$356
750	$491	$251

No formal results can be obtained from the Hatfield model because the input structure for expenses does not account for the different reporting structure of small telco's. As a result, incomplete calculations prohibit final results.

a3. Transport Costs

The BCPM model allocates 3% of the in place switch cost for transport. The Hatfield model does a better job of identifying the transport components of a network. However, as stated above, results are not available at this time. Using a previous sample of 13, the results show that transport costs account for a much more significant portion of

overall network investment. Again, results seem to indicate that the models represent the environment of an RBOC rather than a small telco.

Transport Costs as a Percentage of Overall Investment

# Lines	% Overall Investment
366	23%
625	28%
1,233	35%
3,922	11%
4,245	40%
4,289	19%
4,940*	25%
6,078	7%
6,876	13%
14,200	13%

*consolidated from several companies

b. Other General Results

Further sensitivity analysis was performed to try to determine what percentage of the variability was due to the structure of the model versus the inputs. Three variables were evaluated, material cost inputs, crossover point and fill rates. The results show a high degree of variance. At this point it is unclear whether inputs or model structure causes most of the variation.

GVNW INC./MANAGEMENT
CC Docket No. 96-262 @ January 29, 1997

Variable	Maximum Mo. Cost	State Ave. Monthly Cost
Material Input Changes		
Standard Deviation	13.86	10.85
Variance	192.19	117.71
Range	58	48
CrossOver		
Standard Deviation	27	24.83
Variance	730.09	616.48
Range	147	129
Fill Factors		
Standard Deviation	30.75	21.87
Variance	945.69	478.38
Range	118	77

APPENDIX D

PROPOSED PART 69 RULE CHANGES

Add as Part 69.130 Network Ubiquity Policy Element

A charge that is expressed in dollars and cents shall be assessed upon all presubscribed interexchange carriers by a local telephone company for the provision of universal availability and network ubiquity on the basis of presubscribed lines.

This element is calculated as the difference between the total interstate access revenue requirement and the sum of the revised access charge elements for the same base period, with historical demand levels, as prescribed in CC Docket No. 97-Xxx.

NOTE: Concomitant changes would be required in Part 69.4 and throughout subparts D and E to enable such a change to occur. These will be provided in part in the reply segment of this docket and in their entirety in the pending Commission proceeding on access reform for non price cap LECs (CC Docket No. 97-Xxx).