TABLE 3
Comparison of 2- Wire Loop Costs

Method	Cost Per Loop
Synthesis Model Default Methodology	$5.49
Mr. Pitkin's Adjustments-All DS-0s on Physical Loops	$5.92
Predetermined Pair Requirements for Special Access Lines	$8.65

Note: All loop costs are based on Mr. Pitkin's erroneous 2002 demand levels.

Q. Please describe what each loop cost shown above represents.

A. The $5.49 cost per-loop is the product of the Synthesis Model's default methodology, which develops total loop costs based on somewhat more, but not totally, appropriate loop requirements for special access lines and divides inappropriately total loop costs by the total number of DS-0 equivalents, rather than physical loops required.

The $5.92 cost per-loop assumes that all special access DS-0 equivalents are provisioned inappropriately on individual loops. However, as I explained above, Mr. Pitkin's unrealistic special access line forecast combined with his equating the need for an individual loop based on DS-0 equivalents exaggerates the Model's efficiencies by overbuilding the loop plant.

The $8.65 cost per-loop reflects a more, but not totally, appropriate methodology to treat special access lines in the Modified Synthesis Model despite

the fact that the Model itself cannot produce an accurate loop cost because of its inherent flaws. This estimate mirrors the Synthesis Model's calculation for total loop cost, but predetermines more realistic physical loop requirements for special access lines by dividing the total loop cost by the total number of actual physical loops required. The only purpose of this demonstration is to show the relative effect on costs that each treatment of special access lines produces and should not be construed as an accurate display of loop costs. The Modified Synthesis Model simply cannot handle DS-1 and DS-3 services properly.

Looking at the cost of the 2-wire loop as compared to the cost produced by the Synthesis Model's default values, Mr. Pitkin's erroneous manipulations understates loop costs by almost 50 percent. Mr. Pitkin's artificial reduction in the 2-wire loop cost will also decrease the cost of all other loops that are based on this 2-wire cost.

Q. Have you estimated the extent to which Mr. Pitkin's treatment of special access DS-1 and DS-3 services has caused the Modified Synthesis Model to overbuild Verizon-VA's loop plant?

A. Yes. Verizon-VA had approximately ***Begin Verizon-VA proprietary***XXX ***End Verizon-VA Proprietary** DS-1 special access services and approximately ***Begin Verizon-VA proprietary***XXX ***End Verizon-VA Proprietary** DS-3 special access services at year end 2000. The DS-1s require approximately ***Begin Verizon-VA proprietary***XXX

1 ***End Verizon-VA Proprietary** physical loops (e.g., 2 copper pairs per DS-
2 1)[36] that terminate at no more than (and probably significantly less than)
3 ***Begin Verizon-VA proprietary*** XXX ***End Verizon-VA Proprietary**
4 customer locations and the DS-3s would require ***Begin Verizon-VA
5 proprietary*** XXX***End Verizon-VA Proprietary** physical fiber and/or
6 coaxial loops terminating at no more than (and probably significantly less than)
7 ***Begin Verizon-VA proprietary*** XXX ***End Verizon-VA Proprietary**
8 customer locations. As I have previously explained, the Model does not build any
9 fiber or coaxial loops that terminate at any customer locations.
10
11 In attempting to address previous criticisms, Mr. Pitkin has
12 inappropriately set the Modified Synthesis Model input for "pct_ds1" special
13 access lines at zero instead of the Commission determined default value of 91.75
14 percent. He would thus have caused the Model to build approximately 1.4 million
15 physical loops (e.g., pairs) based on year 2000 data as opposed to the ***Begin
16 Verizon-VA proprietary*** XXX ***End Verizon-VA Proprietary** physical
17 loops actually required for the DS-1s. These exaggerated loops and the attendant
18 and unsubstantiated economies of scale are then spread across all business
19 customer locations rather than the actual termination points of the services. The
20 net result is a significant dilution of OSP costs. Although Mr. Pitkin claims that
21 this "correction" is in response to my criticism (which he obviously agrees is

[36] Even these copper pairs are an absolute upper limit since a significant number of DS-1s are provisioned on multiplexed fiber systems or fiber DLC systems to the premise and use no copper at all. Again, the Model is simply not sufficiently sophisticated to reflect this real-world network architecture.

valid) of the Model's inappropriate division of total loop investment by total derived channels (special access DS-0 equivalents plus POTS loops), in reality it is nothing more than an abuse of the Model's shortcoming and its lack of sufficient sophistication to properly handle special access services. He has even more severely exacerbated this problem by his inappropriate and inflated forecast of year-end 2002 special access line counts. The Commission should not countenance this abuse of the Model's shortcomings.

Q. Does the Modified Synthesis Model account for the loop electronics required to provision special access DS-1 and DS-3 services?

A. No. The Modified Synthesis Model does not include the investment for the electronic multiplexing equipment that enables special access DS-1 services to function over copper cable and DS-3 services to function over coaxial or fiber optic cable. Without provisioning this equipment, the modeled loop lacks the necessary functionality to deliver DS-1 or higher speed services. Not surprisingly, the omission of this necessary equipment serves to further understate the estimated loop cost produced by the Model.

In fact, the Commission can and should summarily reject the Modified Synthesis Model on the basis of this lack of sophistication and inability to properly account for "All Services" that use the network.

Q. Does Mr. Pitkin's manipulation of the Modified Synthesis Model's inability to handle special access services comply with TELRIC principles?

A. Absolutely not. It is a blatant violation of TELRIC principles to model anything more than total demand and the specific forward-looking network components required to provide that demand.[37] As I have demonstrated, Mr. Pitkin has grossly exaggerated loop demand and the Model is not sufficiently sophisticated to model the requisite network components to provision that demand.

6. AT&T/WorldCom's Improper Treatment Of 4-Wire, DS-1 And DS-3 Loops Produces Inaccurate Cost Estimates That Are Not TELRIC-Compliant

Q. Does Mr. Pitkin employ TELRIC-compliant methods in developing the costs for four-wire, DS-1 and DS-3 loops?

A. No. Mr. Pitkin's calculation of the cost for 4-wire, DS-1 and DS-3 loops is flawed conceptually and as implemented. Specifically, the Modified Synthesis Model does not calculate the costs of provisioning 4-wire, DS-1 or DS-3 loops or identify the cost differences between any functionalities.

Mr. Pitkin was forced to rely on a string of assumptions and non-cost based rate relationships to manipulate an already understated and non-TELRIC compliant 2-wire loop cost to produce an out-of-model estimate for the other loops. The starting point for Mr. Pitkin's calculations is the flawed assumption

[37] First Report and Order at ¶ 682.

that the Modified Synthesis Model's loop cost accurately identifies the cost of a 2-wire loop that meets the Commission's definition of a loop element -- in fact, nothing could be further from the truth. Significantly, Mr. Pitkin employs a different method to develop the cost of a 4-wire loop than the method he uses to develop DS-1 and DS-3 loop costs, but offers no explanation as to why the conceptual approach should be different.

Q. What assumptions underlie Mr. Pitkin's development of the 4-wire loop cost?

A. In estimating the cost of a 4-wire loop, Mr. Pitkin inappropriately assumes that each of the components (NID, Concentration, Feeder and Distribution) that make up a 2-wire DLC and Non-DLC loop are accurate. He thus assumes that only minor adjustments are required to develop a 4-wire cost.

Consequently, Mr. Pitkin employs non-cost based assumptions to adjust the 2-wire loop cost to a 4-wire loop cost. For example, he states for the DLC Concentration element, the "DLC channel unit investment will increase (estimated to double) for a 4-wire loop. Thus, overall DLC costs are estimated to be approximately 40 percent higher for a 4-wire loop than for a 2-wire loop."[38] Similarly, he assumes that the Feeder and Distribution elements will double, and the NID value will increase by $0.03 to account for an additional overvoltage

[38] Pitkin Direct Testimony at p. 24.

protector. The total effect of Mr. Pitkin's adjustments results in a 4-wire loop cost that is 1.7 times greater than the cost of the 2-wire loop.

Q. Is Mr. Pitkin's methodology for developing a 4-wire loop cost correct?

A. No. The Synthesis Model, with or without AT&T/WorldCom's modifications, designs a network that can only provision POTS, and assumes that all lines consume the same portion of each element. As a result of this averaging across all lines, Mr. Pitkin's initial cost estimates are understated. For example, 4-wire services would typically be provisioned to businesses that have larger NIDs, or as is often the case, an inside terminal instead of a NID. These inside terminals are connected by cables rather than drops, which are typically used with NIDs. The cost of each element produced by the Synthesis Model does not reflect these differences and as I previously discussed, understates costs because of its inappropriate treatment of special access lines. Even assuming that the cost of an average NID was a reasonable starting point, which it is not, Mr. Pitkin's adjustment for an overvoltage protector does not reflect any of the cost for the NID enclosure.

Q. What is the concentration function inherent in the assumed GR-303 IDLC?

A. The GR-303 remote terminal is designed to concentrate the traffic generated by switched analog distribution lines over significantly fewer DS-0 paths to the central office switch. This capability is also referred to as dynamic time slot assignment in the GR-303 IDLC architecture. For illustrative purposes, in my

discussion below, the remote terminal will require one DS-0 to the central office for every four POTS lines in the distribution area served by the DLC remote terminal.

Q. Does Mr. Pitkin correctly account for the cost of the concentration function inherent in the assumed GR-303 IDLC in his development of a 4-wire loop cost estimate?

A. No. Mr. Pitkin inappropriately assumes that no adjustment is required for the DLC common equipment, the Feeder/Distribution Interface or the fiber feeder. Mr. Pitkin makes no adjustment for the additional DLC common equipment required by 4-wire circuits and mistakenly assumes they can be concentrated in the same fashion as 2-wire POTS lines are. Switched lines operating over the switched network are the only lines that can take advantage of the GR-303 IDLC dynamic time slot assignment (concentration) capability. Four-wire loops are not susceptible to the concentration and dynamic time slot assignment assumed in the Model's GR-303 architecture. Four-wire loops are generally "full period" loops, meaning they have a full time, 100 percent dedicated transmission path, available exclusively to the subscriber of the 4-wire loop. Whereas a basic POTS line only should be assigned a quarter of the cost of a DS-0 (within the DLC and connecting to the central office) because of the concentration feature, a 4-wire loop needs to be assigned the full cost of a DS-0 because it requires this dedicated path. Therefore, the 2-wire POTS DLC costs associated with the concentration and transport to the central office associated with a 2-wire POTS circuit more

appropriately should be increased by a factor of 4 (the 4:1 line concentration ratio).[39]

Mr. Pitkin also did not capture additional common equipment allocations that should be made. Specifically, a 4-wire private line circuit requires a special services channel unit termination. These special services channel units provide less capacity than a switched POTS line card occupying the same plug-in shelf slot. In general, a given number of 4-wire circuits will require from 2 to 4 times as many channel units (line cards, and thus shelf slots as POTS lines require). That means 4-wire circuits will require from 2 to 4 times as many plug-in slots, shelf space and cabinet space than a 2-wire POTS line. Therefore, the component common equipment cost allocation per circuit for a 4-wire circuit should be 2 to 4 times higher than a POTS line card.

Attachment I to AT&T/WorldCom's cost study also shows that the 4-wire loop cost and the DS-1 loop cost are a statewide average rather than deaveraged by density zone. This statewide average is inconsistent with the Commission's geographic deaveraging requirements and Verizon VA's presentation of its 4-wire and DS-1 loop costs.

Q. Are Mr. Pitkin's out-of-model adjustments to produce the cost of DS-1 and DS-3 loops appropriate?

[39] If the Model uses a higher concentration ratio, the multiplier should be increased proportionally. For example, the multiplier should be 6 for a concentration ratio of 6:1.

1 **A.** No. Mr. Pitkin's estimate of DS-1 and DS-3 loop UNE costs completely
2 abandons the cost relationships used, albeit incorrectly, to adjust the 2-wire cost to
3 produce a 4-wire cost. Unlike his 4-wire cost calculation where he attempted to
4 adjust individual 2-wire loop components to develop a 4-wire cost, Mr. Pitkin
5 does not account for any of the physical equipment components necessary to
6 provision DS-1 and DS-3 services. Instead, Mr. Pitkin inappropriately assumes
7 that DS-1 and DS-3 costs can be estimated using cost/price relationships. Based
8 on this inconsistency alone, the Commission should reject Mr. Pitkin's non-cost
9 based approach.
10
11 However, Mr. Pitkin's cost/price approach to cost development is also
12 flawed. Mr. Pitkin assumes that there are 8 DS-0 equivalents per-pair, which are
13 adjusted down for DS-1s, and up for DS-3s, using an unsupported relationship in
14 demand for DS-1 and DS-3 services and a 1994 nationwide benchmark DS-3 to
15 DS-1 non-cost based price relationship. However, it is clear that Mr. Pitkin's
16 premise of 8 DS-0 circuits, which was developed from intraLATA private line
17 loops and special access DS-0 equivalents, is fundamentally flawed because Mr.
18 Pitkin inappropriately assumes away any difference in the mix among analog, DS-
19 1 and DS-3 services underlying the private line and special access values he uses.
20 Consistent with these flawed assumptions, Mr. Pitkin further assumes,
21 inappropriately, that 90 percent of the network is DS-1s and 10 percent is DS-3s.
22 Applying a 1994 nationwide non-cost based price benchmark to these figures, Mr.

1 Pitkin estimates that the price of a DS-3 was 9.6[40] times the price of a DS-1.
2 Using these relationships, Mr. Pitkin produces a 2-wire cost multiplier to develop
3 DS-1 and DS-3 costs (4.3 times 2-wire cost for DS-1 and 41.3 times 2-wire cost
4 for DS-3). Interestingly, Mr. Pitkin's DS-1 and DS-3 multipliers ignore the DS-0
5 equivalent demand used in the Synthesis Model based on 12 DS-0 equivalents
6 per-line.
7
8 Additionally, as previously explained, DS-3 and higher special access
9 services simply cannot be provisioned over copper facilities. They must use
10 either fiber or coaxial cable (or a combination of both) all the way to the customer
11 location. Neither of these types of cable is modeled to the customer locations.
12
13 The 2-wire loop cost, as I previously discussed, is significantly
14 understated and Mr. Pitkin's out-of-model application of various multipliers to the
15 2-wire cost to develop DS-1 and DS-3 loop costs is inappropriate, inaccurate and
16 fails to reflect the actual costs incurred by Verizon VA.
17
18 **Q. What impact do the platform, engineering and input flaws you discussed**
19 **have on the Modified Synthesis Model cost estimates?**
20 A. Each of the flaws and errors I have identified individually and collectively
21 decrease the Model's cost estimates for the loop and sub-loop elements. For

[40] In the Matter of Transport Rate Structure and Pricing, CC Docket No. 91-213, *Third Memorandum Opinion and Order on Reconsideration and Supplemental Notice of Proposed Rulemaking,* FCC 94-325 (rel. Dec. 22 1994) at ¶ 33.

example, since the Modified Synthesis Model only builds approximately 50 percent of the serving areas that actually exist in Verizon VA's network and does not maximize the length of the feeder portion of the loop, the loop investments required to serve Verizon VA's customers will be substantially understated. Also, the Modified Synthesis Model underestimates costs by incorrectly modeling access to unbundled, fiber-fed loops using the GR-303 IDLC switch interface and ignoring required equipment elements and certain technical limitations. The Modified Synthesis Model incorrectly assumes the use of exaggerated quantities of individual loops when DS-1 and DS-3 are used in the network, and thus understates the cost of a 2-wire copper loop typically used to provision basic exchange service. Finally, the underlying loop design, platform and associated inputs drastically reduce plant investment and produce an average loop cost for Verizon VA of only $5.92. This sum is a mere fraction of what any efficient carrier would incur to provide the unbundled loop.

Q. What would be the result if a network were built to conform to the loop design criteria and assumptions in the Modified Synthesis Model?

A. The result would be a loop network that is non-functional. The loop design does not adhere to the CSA standard, and thus the network modeled may not even support basic digital services such as ISDN and DDS, and would introduce inefficiencies in the ILEC's operations. The network would not have enough plant to meet current, future or churn demands. In addition, because the Modified Synthesis Model does not build outside plant to vacant residential and business

units or known new construction sites, service delays would result. Because the Model builds an average drop length of only 24 feet, numerous housing units and business locations will not get physically connected to the network. As a result, the network will be unable to meet the service standards mandated by the Virginia Commission for the provision of residential and business services. Moreover, the Model does not account for the fact that local ordinances often prohibit the placement of aerial cable in certain locations.

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B. Switch And Inter-Office Facilities Module

Q. For which UNEs does the Modified Synthesis Model's switch and IOF module generate cost estimates?

A. The Modified Synthesis Model's switch and IOF module is instrumental in determining UNE costs for local switching, tandem switching, transport, operator services, and signaling.

Q. Would flaws in the switch and IOF module affect the cost estimates for all these UNEs?

A. Yes. The deficiencies that I have found in the switch and IOF module will affect the cost of each of the aforementioned UNEs -- local switching, tandem switching, transport, operator services and signaling.

1

2 **1. Switch Functionality And Cost**

3

4 **Q. Should a forward-looking cost model design a switched network capable of**
5 **handling all traffic demands?**

6 A. Absolutely. Accepted engineering practices, proper design parameters, necessary
7 switch functionality, and appropriate quality standards require that a forward-
8 looking cost model design a network that can handle all traffic demands,
9 including peak period traffic. The Commission confirmed the importance of this
10 approach in the Tenth Report and Order, stating that, in order to appropriately
11 estimate forward-looking costs, a model must "ensure that adequate capacity
12 exists in that switching facility to process all customers' calls that are expected to
13 be made at peak periods."[41]

14

15 **Q. Can the switches designed by the Modified Synthesis Model provision the**
16 **UNEs required by the Commission?**

17 A. No. The Modified Synthesis Model's data inputs, some dating back to 1983,
18 involve switches that are not capable of provisioning the technology for which the
19 Modified Synthesis Model is developing UNE costs. A study by the National
20 Regulatory Research Institute ("NRRI") states:

21 "During the years covered by this data set the overwhelming
22 majority of the lines were for voice service. Therefore, to a large
23 extent, the per-line investment estimates do not reflect the

[41] Tenth Report and Order at ¶ 12.

> additional costs associated with providing ISDN lines on a digital switching machine."[42]

While this might have been appropriate for a USF proceeding, this proceeding requires inclusion of these additional ISDN costs, as well as the ability to discretely identify them, which the Modified Synthesis Model cannot do. The NRRI study also states, "Subsequent to the initial installation, equipment may have been modified to provide new services or functions. For example, in the late 1980s and early 1990s, the hardware of both the Nortel and Lucent family of switches was modified due to the technical requirements of the Signaling System Seven ("SS7") and the Custom Local Area Signaling Services ("CLASS")."[43] By failing to account for the full range of technologies (both hardware and software related) currently being deployed, the Modified Synthesis Model cannot develop a switching cost that properly compensates Verizon VA or any efficient carrier for all of the switch functions required in a forward-looking network or for the services it provides to CLECs.

Q. Did the Commission address the Synthesis Model's switching and IOF module for UNE applications?

A. Yes. In its USF Order, the Commission adopted the HAI Model's switch and IOF module, with modifications, and noted that "...for universal service purposes, where cost differences caused by differing loop lengths are the most significant

[42] David Gabel, Scott Kennedy, "Estimating the Cost of Switching and Cables Based on Publicly Available Data," National Regulatory Research Institute (NRRI) (April 1998) at p. 114.

[43] *Id.* at pgs. 120-121.

cost factor, switching costs are less significant than they would be in, for example, a cost model to determine unbundled network element switching and transport costs."[44] Accordingly, the Synthesis Model's, and by implication the Modified Synthesis Model's, treatment of the costs associated with the switching and IOF module, as well as its input values, are less exacting and thus are less representative of a carrier's switching and IOF costs.

Q. Can the Modified Synthesis Model accurately estimate state-specific or company-specific switch costs?

A. No. The Modified Synthesis Model cannot accurately estimate state-specific or company-specific switch costs. The Model uses the following flawed methodology for developing a switch usage UNE:

1. The Modified Synthesis Model calculates the average total switching cost per-month. The Model uses a regression of the rural utilities service ("RUS") data and the Commission depreciation data to estimate switch investment. The cost is determined by taking into account only two factors: the office line size and the type of office (remote or host). As a result, the total switching monthly costs generally reflect only the average usage for the switches contained in the sample.[45]

2. The average total monthly cost is then split: 30 percent for port and 70 percent (model default values) for usage.

3. The total usage cost is divided by some company-specific usage values, as if the usage amount were actually calculated based on the particular state-specific company usage and cost characteristics, which it is not.

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[44] Fifth Report and Order at ¶ 75.

[45] In those cases where the initial investment based on line demand does not pass the busy hour capacity tests, then additional switching investment will be generated by the Modified Synthesis Model based on the forecasted year 2002 ARMIS usage data.

Because the total usage cost is simply a reflection of a dated average, the resulting values have no real meaning and do not reflect state-specific or company-specific inputs.

2. Switch Engineering

Q. Does the Modified Synthesis Model adhere to standard switch engineering principles?

A. No. The Modified Synthesis Model produces a network on which customers would frequently be denied service. Specifically, the Modified Synthesis Model fails to recognize that each central office and its associated trunking network experience an annual busy season, which is characterized by periods of high or peak traffic loads.[46] Instead, the Modified Synthesis Model assumes that a fixed amount of traffic is spread equally over 270 business days and 10 percent of the average business day traffic occurs during the busy hour. As a result, the Modified Synthesis Model's network is only equipped to handle the same busy calls every day.

Mr. Turner suggests that busy hour traffic loads are accounted for in the Model since Dial Equipment Minutes ("DEMs") are divided by 270 days instead of 365 days to compensate for weekend traffic that is historically lower than business day traffic, and the busy hour load is 10 percent of the average daily

[46] Even though the wording might suggest a single busy period, actually, various parts of the switch and various trunk groups experience different busy hours during the day in which they reach peak (designed/engineered for) traffic loads.

1 load.[47] However, even after adjusting for lower weekend traffic,[48] Mr. Turner
2 offers no quantitative support to show that the Model, with its simplistic
3 determination of the busy hour, is capable of accommodating the higher traffic
4 loads experienced during the busy season's peak traffic periods.
5
6 **Q. Why do central offices experience different traffic loads during the year?**
7 **A.** Most, if not all, central offices experience different traffic loads during the year
8 for a variety of reasons. Central offices serving a college town or resort
9 community are good examples of why some periods of the year are considerably
10 busier than others. In September, an influx of college students into a community
11 substantially increases a central office's traffic load. Similarly, resort
12 communities experience peak traffic during a much shorter 2 or 3-month vacation
13 period. Therefore, an exchange in such a community might experience upwards
14 of 60-75 percent of its total annual traffic during a 2 or 3-month peak busy period.
15 The switched network modeled by the Modified Synthesis Model, which is
16 engineered to accommodate an inadequate average daily load, as opposed to
17 higher seasonal or peak-loads, would not be equipped to handle the amount of
18 traffic carried over the network during these peak periods.
19

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[47] Before the Federal Communications Commission, CC Docket Nos. 00-218, -249, -251, *Direct Testimony of Steven E. Turner* (July 31, 2001) at p. 6.

[48] Mr. Turner offers no explanation to explain the derivation of the 270 days he supports. Additionally, the fact that the Modified Synthesis Model must rely on this approach to approximate business day traffic reveals another Model shortcoming. More appropriately, an engineer would remove weekend and holiday traffic, before determining a representative business day value for the approximately 251 business days of the year.

1 **Q. Do engineers take specific traffic patterns into account when sizing the**
2 **components of a central office switch and trunking network?**
3 A. Yes. In the real world, the switching and trunking networks that serve each and
4 every wire center, including college and resort communities, are engineered to
5 handle higher seasonal and busy hour call volumes. For example, in a resort
6 community, engineers would size the central office to ensure it could handle the
7 very high calling demands of the busy hour(s) during the peak busy season
8 period.[49] Even within the switch, various components (e.g., lines and trunks) are
9 engineered to different standards and sometimes different busy hours, reflecting
10 their own specific traffic demands (load).

11 **3. Switch Traffic Sensitive And Non-Traffic Sensitive**
12 **Apportionment**

13

14 **Q. Is switch investment apportioned between traffic sensitive and non-traffic**
15 **sensitive elements?**
16 A. Yes. A switch is comprised of traffic sensitive and non-traffic sensitive
17 equipment. In order to distinguish traffic sensitive equipment from non-traffic
18 sensitive equipment, one must understand how a switch operates. In those
19 instances when a switch is not processing calls, the switch monitors subscriber
20 lines for dial tone requests. Until a subscriber picks up the handset or a call

[49] "Although traffic theory is useful in predicting the performance of a given load submitted to a given number of servers, considerable engineering judgment is required to select the particular load levels (engineering periods) about which to be concerned. One consideration is the type of equipment being engineered. For trunk groups (Circuits between switching systems) the average of the twenty BDBH measurements is used, giving rise to the concept of the *average busy season busy hour* (ABSBH)." Technical Staff and Technical Publication Department of AT&T Bell Laboratories, *Engineering and Operations in the Bell System* (2d Ed. 1983) at p. 153.

comes in on the trunk side, most of the switch investment is not utilized. However, upon receiving a call request, the switch performs a multitude of tasks to determine the eligibility of the calling line for services, route the call, bill the call, and deliver services during the duration of the call. It is, therefore, appropriate to categorize a significant portion of the switch as traffic sensitive.

Q. What switch components are non-traffic sensitive?

A. The initial equipment stage of the line termination is the only portion of the switch that is non traffic sensitive -- it is dedicated to a single subscriber and is never used for any purpose other than establishing a communications path with that one subscriber. However, additional line termination equipment (such as that comprised of analog line units in the 5ESS and line concentrator modules (LCMs) in the DMS-100) is traffic sensitive -- with the amount of required equipment determined based on the engineered usage (busy hour CCS) of the lines. The initial equipment stage of the line termination typically consists of a wire terminal appearance on the main distribution frame, a shelf, and associated wiring that accepts a line card, as well as the plug-in line card itself.

Q. Is Ms. Pitts' recommendation to change the Modified Synthesis Model's default value for the traffic sensitive part of the switch appropriate?

A. Absolutely not. Ms. Pitts states that the traffic sensitive portion of the switch, which is used to determine the usage cost of a switched UNE, should be changed from the Synthesis Model's default value of 70 percent to 40 percent. Her

1 recommendation, however, is unfounded and results in significantly understated
2 usage costs (and overstated non-traffic sensitive costs). Ms. Pitts claims that
3 switch memory and processors should be allocated as non-traffic sensitive costs
4 that do not vary with respect to usage or features.[50] Ms. Pitts assumes cost
5 causation dictates that variable costs should be assigned to usage, and fixed costs
6 assigned to ports. But that notion is incorrect. Assigning costs between non-
7 traffic sensitive (port) and traffic sensitive (usage) is determined by taking into
8 account switch resources dedicated to a single user, and resources shared among
9 all users. Dedicated resources should be recovered by the particular user
10 dedicated to that resource (such as a port). Shared resources should be recovered
11 by each user sharing those resources in a fair cost causation manner (such as a per
12 minute of use charge.) Switch features such as local number portability, call
13 waiting, and caller ID have an impact on call processing time, and are shared
14 between users, and thus are clearly traffic sensitive. In addition, other parts of the
15 switch involved in setting up, connecting, and billing the call, such as the
16 switching matrix, the initial equipment stages of analog line termination
17 connection, trunks, signaling processor, and automatic message accounting
18 functions, are shared among users and are sensitive to the traffic generated by
19 those users. Even engineered port capacity can exhibit usage sensitive features
20 since the maximum fill might have to be reduced to accommodate heavy usage
21 (i.e., Internet) impacting the concentration ratio of the first stage switch matrix.
22 Ms. Pitts ignores all of these switching functions and components in making her

[50] Before the Federal Communications Commission, CC Docket Nos. 00-218, -249, -251, *Direct Testimony of Catherine E. Pitts* (July 31, 2001) at p. 7.

proposal to significantly alter the portion of the switch that is traffic sensitive. Her flawed estimates are unsupported and have no justification in theory or practice.

Second, Ms. Pitts also bases her proposed reduction on a badly flawed cost causation argument. Mistakenly, she suggests that a switch's exhaustion is solely a function of its port capacity, and therefore, much of the fixed cost of the switch should be assigned to the port.[51] To the contrary, exhaustion of port capacity is only one factor that contributes to exhaustion of the entire switch. Ms. Pitts claims that port exhaustion in the Modified Synthesis Model drives the placement of a second switch, and therefore the fixed cost of the second switch should be assigned to the non-traffic sensitive port cost. This assumption is absurd. The Modified Synthesis Model places a second switch after performing several capacity checks, including a check of the processor's real time usage. Failure of this real-time usage check will produce a second switch. Ms. Pitts, however, ignores this fact, which is referenced in the Modified Synthesis Model's own documentation, when arguing for her proposed reduction.[52]

[51] Ms. Pitts also fails to recognize that switch port limitations are a combination of line ports, which are partially traffic sensitive, and trunk ports, which are entirely traffic sensitive. Thus, the more traffic demand placed on the switch, the more trunk ports that are required, and the lower the quantity of lines that can be engineered to operate on the analog line module components of the switch. In addition, as traffic demand increases from a static number of lines, the line-to-trunk ratio decreases because more trunks must be added. This requires a greater amount of switch matrix capacity to handle a fixed quantity of lines. Thus, high volumes of usage (traffic) can and often are the main cause of total switch exhaustion.

[52] HAI Model Release 5.0a, Model Description at p. 56.

1 Even Mr. Pitkin seems to have recognized the infirmities in Ms. Pitts'
2 arguments, ignoring her recommendation in favor of using the Model's default
3 "End Office Traffic Sensitive Fraction." The very fact that Ms. Pitts
4 recommended the value in the first place highlights her flawed reasoning and lack
5 of thorough analysis, thereby signaling to the Commission that it should proceed
6 with caution with respect to her proposed recommendations. In addition, Mr.
7 Pitkin's track record of declining, initially, to adopt various recommended inputs,
8 and then, at the eleventh hour, incorporating some of them into the Modified
9 Synthesis Model,[53] should alert the Commission to be prepared, if necessary, to
10 reject any attempted change of the Model's default value from 70 to 40 percent.
11
12 **Q. What effect would the reduction of this traffic sensitive input have on the**
13 **cost estimates produced by the Modified Synthesis Model?**
14 **A.** The effect of this change would reduce the switching element cost estimate for
15 local usage nearly in half (43 percent). Conversely, it would double the cost
16 estimate of the switch port functionality, thereby driving up prices for residence
17 and business customers with lower usage. This proposed change appears to be a
18 backdoor effort by AT&T/WorldCom to adjust access usage fees by using UNE
19 local switch usage as a proxy for access local switching. The Commission should
20 reject Ms. Pitts' proposal outright.
21

[53] Before the Maryland Public Service Commission, Case No. 8745, *Hearing Transcript, Volume VI* (July 5, 2001) at pgs. 1692-1703.

1 **4. Inter-Office Facilities**

2

3 **Q. Does the Modified Synthesis Model produce the requisite number of inter-**
4 **office trunks?**

5 A. No. The Modified Synthesis Model uses projected year 2002 demand data and
6 produces approximately 605,000 trunks, which are spread among its seven types
7 of trunk groups. The number of trunks is the result of Mr. Pitkin using
8 inappropriately projected year 2002 line and call usage data.

9

10 **Q. Is AT&T/WorldCom's year 2002 projection of trunk needs valid?**

11 A. Absolutely not. Mr. Pitkin determines year 2002 trunking needs without using
12 appropriate forecasting methods or even considering the realities of the industry;
13 as a result, there is no verifiable or credible support for his year 2002 count of
14 interoffice facilities.

15

16 **Q. How do Mr. Pitkin's trunk estimates for year 2000 compare to Verizon VA's**
17 **trunk count?**

18 A. Mr. Pitkin's trunk estimate for the year 2000 fell 18 percent short of Verizon VA's
19 trunk count. The Modified Synthesis Model, as I discussed, ignores standard
20 engineering principles and considerations when designing the trunk network, and,
21 as a result, produces too few trunks.

22

23 **Q. What else accounts for this understatement of trunks?**

1 **A.** The Model also fails to account for trunk modularity in which current digital
2 technology makes it more efficient to install transport in groups of 24 trunks
3 rather than on an individual basis as suggested by the Model. Ms. Pitts concurred
4 with this modular concept during a recent USF proceeding in Maryland.[54]
5
6 **Q. How does trunk modularity cause an understatement of trunks?**
7 **A.** The Modified Synthesis Model builds a trunk network based on the assumption
8 that there are only seven types of trunk groups, a number that represents
9 approximately one-third of the trunk group types deployed in Verizon VA's
10 network. It is this combining of trunk group types as well as the combining of
11 trunks within each group, that contributes to the understatement of the trunk count
12 since trunks are built on an end-office to end-office basis in groups of 24 in the
13 real world.
14
15 The Modified Synthesis Model, in building its direct trunk plant, is unable
16 to identify the specific end-office to end-office trunk groups that need to be built,
17 but instead treats all direct trunks from each end-office as a single group. It is this
18 aggregated approach that, in part, causes the Modified Synthesis Model to
19 understate direct local trunks as well as other types of groups and IOF investment.
20
21 **Q. Does the Modified Synthesis Model correctly calculate the number of access**
22 **trunks that would be required in a network?**

[54] Before the Public Service Commission of Maryland, Case No. 8745, *Hearing Transcript, Volume IV* (June 28, 2001) at p. 916, lines 9-11.

1 **A.** No. The Modified Synthesis Model understates the number of access trunks
2 because it fails to recognize that demand for access trunks (trunks connecting
3 ILEC switches to interexchange carriers ("IXCs"), CLECs, and Cellular switches)
4 is a function of how many trunks are ordered by these carriers. It is not a function
5 of DEMs or Call Completions as assumed by the Modified Synthesis Model.
6 IXC, CLEC, and Cellular companies operate in an extremely competitive
7 environment and by necessity must order the number of trunks they believe are
8 required to meet their growth and load forecasts. I doubt that AT&T/WorldCom
9 would be satisfied if Verizon VA supplied fewer access trunks than it requested in
10 Virginia or any jurisdiction.
11
12 **Q. Does the Modified Synthesis Model include the capitalized labor costs**
13 **associated with trunk installation?**
14 **A.** No. The Modified Synthesis Model fails to include the capitalized labor costs
15 associated with trunk installation, thus ignoring the fact that the installation of
16 switched trunk transport requires circuit design, central office translations, and
17 testing prior to the activation of trunks. The labor cost associated with these
18 activities is capitalized, and should be included with trunk investment in the
19 Uniform System of Accounts' circuit equipment account. The Modified Synthesis
20 Model does not account for these capitalized labor costs, and thus understates IOF
21 investment.
22

Q. Does the Modified Synthesis Model's understatement of IOF comply with the Commission's TELRIC principles?

A. No. The Commission's TELRIC methodology requires that all demand be assumed as a given. In the First Report and Order, the Commission stated:

> We conclude that, under a TELRIC methodology, incumbent LECs' prices for interconnection and unbundled network elements shall recover the forward-looking costs directly attributable to the specified element, as well as a reasonable allocation of forward-looking common costs. Per-unit costs shall be derived from total costs ... the per-unit costs associated with a particular element must be derived by dividing the total cost associated with the element by a reasonable projection of the actual total usage of the element.[55]

By understating the number of trunks required to accommodate the demands of competing carriers, the Modified Synthesis Model violates a fundamental TELRIC principle -- that UNE prices reflect all of the forward-looking costs incurred to serve total demand. In failing to capture all of the trunk demand, AT&T/WorldCom is unable to accurately estimate both the costs of IOF and the cost of tandem switching.

Q. Are there other problems with the trunk quantities in the Modified Synthesis Model?

A. Yes. As explained more fully in Dr. Tardiff's testimony, the Modified Synthesis Model overestimates special access line counts and in-turn, SONET ring capacities.

[55] First Report and Order at ¶ 682 (emphasis added).

1 **5. SONET**

2 **Q. What is SONET?**

3 **A.** SONET is a forward-looking format for transporting a wide range of digital
4 telecommunications services over the public network. In addition to offering a
5 standard signal format among different vendor systems, SONET technology
6 reduces network transport costs, promotes self-healing networks, and supports
7 high-speed services.[56]

8

9 **Q. Does the Modified Synthesis Model accurately determine SONET add-drop**
10 **multiplexer requirements?**

11 **A.** No. The Modified Synthesis Model is incapable of properly engineering the
12 correct number of Add-Drop Multiplexers ("ADMs") that are required to drop and
13 insert terminating and originating traffic at wire centers on the SONET rings.
14 Each OC-48 SONET ring consists of one ADM at each add-drop point along the
15 OC-48 fiber ring. In order to correctly determine the number of SONET rings
16 needed to transport traffic between and through central offices on the fiber path,
17 the origination and termination point of each DS-3 traveling along the ring must
18 be known. The Modified Synthesis Model simply does not contain or develop
19 this very basic data, and without it, there is no way to accurately calculate the
20 required number of SONET rings (and therefore the correct number of ADMs).[57]

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[56] Telcordia Technologies, "Telcordia Notes on the Network," Issue 4 (Oct. 2000) at Section 14.15 (Synchronous Optical Network).

[57] HAI Model Release 5.0a, Model Description at p. 61. The Modified Synthesis Model assumes an OC48 SONET ring.

Since this information is not generally present in the Modified Synthesis Model, it must resort to using a simplistic approach to develop its SONET ring configurations. For example, the Model initially generates 19 inter-office SONET rings with a total of 117 nodes and 117 ADMs for Virginia.[58] The Model adds 452 additional ADMs to account for traffic on the ring, including transiting traffic between rings that exceed the capacity of the electronics, and for connections between rings. The Model, therefore, calculates 569 (117 plus 452) inter-office ADMs. Without knowledge of the actual office-to-office traffic requirements along the fiber rings developed in the Model, there is no way of determining whether the quantity of ADMs is anywhere near correct.

If, for example, it was assumed that all of the traffic along each ring was delivered to a single hub (such as a tandem)[59] along the ring, the demand for DS-3 equivalents in each ring would be divided by 48 (the maximum number of DS-3s in a 4-fiber BLSR OC48 ring where all traffic is hubbed). This would determine the possible maximum number of rings required to handle DS-3 demand for each set of offices on the rings.[60] The total number of requisite ADMs are then determined by multiplying the possible maximum number of rings by the number

[58] The quantity of nodes includes both central offices and tandem switches.

[59] The Model assumes all special access and all switched access traffic is routed through the tandem.

[60] The illustration used is representative of a possible high end situation. The requirement could be lower depending upon the amount of adjacent node to adjacent node traffic. This amount of traffic (which is essential to accurately design and optimize the rings), however, cannot be determined from the data available in the Modified Synthesis Model.

of nodes. In Virginia, 1,293 inter-office ADMs would be required, not 569 as the Modified Synthesis Model calculates. As a result, the Modified Synthesis Model could understate ADM investment by up to $39 million.[61]

Q. Does the Modified Synthesis Model understate SONET costs in other ways?

A. Yes. In addition to failing to determine the appropriate number of required ADMs, the Modified Synthesis Model also fails to accurately calculate ADM and certain DCS investment. For example, AT&T/WorldCom calculate approximately $14.15 per-line for ADM and DCS investment. However, the Modified Synthesis Model inappropriately applies this per-line investment on a per-wire center basis, as opposed to a per-line basis. In other words, the Model calculates just $14.15 for this investment category for each wire center rather than appropriately multiplying the number of lines in each wire center by $14.15 to derive the correct investment. This modeling error understates ADM and DCS investment by more than $94 million.[62] After Verizon brought this problem to AT&T/WorldCom's attention, AT&T/WorldCom corrected the latest version of the HAI Model. Surprisingly, however, AT&T/WorldCom failed to make this correction in the HAI Model components of the Modified Synthesis Model sponsored in this proceeding.

[61] $54,200 per OC48 ADM x 724 ADMs = $39.24 million.

[62] $14.15 per line x 6,673,747 lines = $94.43 million (less the $1,599 the Model actually calculated).

1 **Q. Does the Modified Synthesis Model violate other SONET engineering**
2 **principles?**
3 A. Yes. SONET rings interconnect in central offices and, in some instances, a
4 central office is an interconnection point between several rings. Thus, these rings
5 should interface through a DCS.[63] However, the Modified Synthesis Model fails
6 to account for these central office DCS units, thereby understating investment by
7 approximately $651 million.[64] Again, AT&T/WorldCom attempted to correct this
8 problem in later releases of the HAI Model but failed to do so in the model
9 sponsored in this proceeding.
10
11 **Q. What impact do the platform, engineering and input flaws have on the**
12 **Modified Synthesis Model's output?**
13 A. Each of the flaws I have identified will, to some degree, decrease the cost output
14 associated with switching and the inter-office facility network, and in some cases,
15 will shift costs from usage elements to the non-traffic sensitive switch port
16 element. The proposed reduction of the traffic sensitive input in the Modified
17 Synthesis Model reduces the switching cost per minute for local usage by
18 approximately 43 percent. However, the cost of the switch port functionality
19 would double, thereby driving up switch port prices for all switched subscriber
20 lines, including those with minimal usage levels. It appears that this shift in cost
21 is intentional. The IXC's attempt to use this fabricated low cost for local

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[63] A DCS provides the ability to remotely perform digital cross connections between SONET rings.

[64] 452 ADMs x 48 DS-3s per ADM x $30,000 per DS-3 per DCS = $650.88 million.

switching minutes to justify a lower cost of a switched access local minute. The effect of shifting the revenue requirement of the millions (or billions) of local access minutes to the line port element will negatively effect low usage subscribers of switched lines. Furthermore, the Modified Synthesis Model does not account for trunk modularity, which requires that trunks be provided in groups of 24. By assuming trunks can be provided one at a time the Model is able to understate real-world costs. The Modified Synthesis Model also fails to include the capitalized labor costs associated with the installation of trunks, thereby understating IOF investment even further. In addition, the Modified Synthesis Model understates ADM and DCS investment by approximately $750 million. Collectively, the impact is producing switch costs and costs associated with inter-office facilities that are vastly understated and that shift significant costs from IXCs to subscribers of switched lines.

Q. What would be the result if a network were built utilizing the switch functionality and the inter-office facility network designed by the Modified Synthesis Model?

A. The result would be a network incapable of handing traffic demands through its switches and an IOF network that does not have a sufficient amount of inter-office trunks and equipment to function. The Modified Synthesis Model's switch data, some of which is almost twenty years old, contain switches that are not capable of provisioning the technology for services such as ISDN and CLASS and they will not work with the SS7 signaling network. Because the Model builds

insufficient switches and inter-office facilities, customers would frequently be unable to complete calls on the network. Because the Modified Synthesis Model does not recognize that each central office and its associated trunking network has unique busy season demands, the network will result in call blockages and busy conditions for customers in exchanges with seasonal demands. Because the Modified Synthesis Model fails to provide the DCS investments required the interoffice network would not function. And since the Modified Synthesis Model does not recognize the total known demand for trunks, the network will contain only a portion of the trunks required to transport the switched calls and will have an insufficient number of access trunks to meet the demands of the Interexchange Carriers such as AT&T/WorldCom for facilities to provide service to their customers.

C. AT&T/WorldCom's Platform Modifications Are Conceptually Flawed And Result In Unrealistic And Unsupportable Cost Estimates

1. Node Selection Criteria

Q. What is the importance of node selection criteria and why is it used in the Model?

A. The node selection criteria, as explained in the Synthesis Model documentation, is the methodology used to find the least-cost solution to connect the reconstructed distribution areas to the central office.[65] For purposes of the Synthesis Model, the Commission selected a modified PRIM algorithm.

[65] AT&T/WorldCom Cost Model Documentation at Attachment B, pgs. 9-11.