

BEFORE THE
FLORIDA PUBLIC SERVICE COMMISSION

 In the Matter of : DOCKET NO. 980696-TP
 :
 Determination of the cost of :
 basic local telecommunications :
 service, pursuant to :
 Section 364.025, :
 Florida Statutes. :

VOLUME 8

Pages 876 through 1006



PROCEEDINGS: HEARING

BEFORE: CHAIRMAN JULIA L. JOHNSON
 COMMISSIONER J. TERRY DEASON
 COMMISSIONER SUSAN F. CLARK
 COMMISSIONER JOE GARCIA
 COMMISSIONER E. LEON JACOBS, JR.

DATE: Tuesday, October 13, 1998

TIME: Commenced at 9:10 a.m.

PLACE: Betty Easley Conference Center
 Room 148
 4075 Esplanade Way
 Tallahassee, Florida

REPORTED BY: H. RUTHE POTAMI, CSR, RPR
 Official Commission Reporter

APPEARANCES:

(As heretofore noted.)

FLORIDA PUBLIC SERVICE COMMISSION

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FPSC-RECORDS/REPORTING

1 **ADDITIONAL APPEARANCES:**

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P R O C E E D I N G S

(Hearing reconvened at 9:10 a.m.)

(Transcript follows in sequence from

Volume 7.)

CHAIRMAN JOHNSON: If everyone could settle in, we're going to go back on the record in a few moments.

- - - - -

DON J. WOOD

continues his testimony under oath from Volume 7 as follows:

Q (By Mr. Williams) Good morning, Mr. Wood.

A Good morning.

Q Welcome back. Mr. Wood. When we broke last night I had asked you if you recalled the decision by this Commission in the MCI/AT&T arbitration with GTE and the basis upon which this Commission rejected the Hatfield model. Do you recall that discussion yesterday?

A I do.

Q And do you recall that one of the bases upon which this Commission rejected the Hatfield model, Version 2.2.2, was that its review led it to conclude that the Hatfield model appeared to understate costs? Do you recall that discussion yesterday?

1 A I recall your reading that to me, yes, or
2 suggesting that that was in the order.

3 Q And we did have a question which was
4 unresolved yesterday as to what the Hatfield loop cost
5 was for GTE that was the subject of that decision. Do
6 you recall that discussion as well?

7 A Yes.

8 Q And would you agree, subject to check, that
9 the Hatfield loop costs in the earlier arbitration
10 proceeding Hatfield 2.2.2 was \$11.44?

11 A For a -- what exactly? I'm sorry.

12 Q For all GTEFL loops as submitted by MCI and
13 AT&T in that proceeding, the Hatfield loop cost.

14 A As I told you yesterday, I don't recall what
15 it was.

16 Q Would you accept that, subject to check?

17 A I would certainly want to check it, yes.

18 Q And would you accept, subject to check,
19 Mr. Wood, that if you were to take Hatfield 5.0a and
20 run it for GTE's loops here in Florida it would give
21 us a loop cost for all GTE loops statewide of \$9.81?

22 A That's again something I would certainly
23 want to check.

24 Q I will give you these after our
25 cross-examination, and you may check them.

1 Now, as we were discussing yesterday, you
2 were familiar with a price survey entitled the
3 "Telephone Plant Index"?

4 A Yes, I am.

5 Q And you were aware -- by the way, I just
6 want to make sure -- you do not consider that
7 authoritative, although you do consider it helpful.
8 Is that the gist of your views on the Telephone Plant
9 Index?

10 A No. I hope I had been a little more clear
11 on that. I don't consider it to be the authoritative
12 source. You had asked me about some supporting
13 documentation for my view that the incumbent companies
14 feel that costs are tracking downward, and since this
15 is their document itself, I certainly consider it
16 indicative of that view, but not necessarily
17 authoritative in its own objective sense of where all
18 prices are tracking.

19 Q Who publishes the Telephone Plant Index?
20 It's the local ILECs? Is that what you're saying?

21 A I don't think anybody publishes it. I
22 think, though, the companies use their own version of
23 it.

24 Q I'm sorry. You said it was their document.

25 A Yes. "Their," being the incumbent LECs, but

1 it's not something that's published and then in
2 general use. I think each company prepares internally
3 its own projections and creates its own telephone
4 plant index.

5 Q And you are unaware of the document
6 entitled -- excuse me -- a price index titled the
7 "Turner Plant Index"?

8 A I have not seen something titled that, no.

9 Q So you don't know if the Turner Plant Index
10 was used in coming up with some of the default values
11 that are used in the Hatfield model?

12 A Well, I certainly would know that. I
13 haven't suggested that either of these, either the
14 Telephone or the Turner Plant Index, was used in
15 developing these default values.

16 These are internal documents to the
17 companies. I had only brought them up in response to
18 your question of what makes me think that the
19 incumbent companies believe that the cost of acquiring
20 these assets is trending down. They're your
21 projections not related to this model that I'm
22 sponsoring.

23 Q So you're saying the Turner Plant Index is a
24 document internal to the local exchange companies?

25 A No. I keep -- I'm describing to you the

1 Telephone Plant Index. I --

2 Q I see. All right. Thank you. You don't
3 need --

4 A I hope I've responded each time the Turner
5 Plant Index is not something I've seen a title to.

6 Q I understand. Let me turn your attention to
7 the expense module in the Hatfield model.

8 A Yes.

9 Q You are familiar with that? Yes? As a
10 general matter, am I correct in understanding that the
11 expenses are generally calculated as a percentage of
12 ARMIS reported expenses to investment?

13 A No. Some expenses --

14 Q Some expenses. I'd say as a general matter.

15 A Well, I don't want to overgeneralize this,
16 because it's a little misleading. Those expenses that
17 tend to vary with units of investment like
18 maintenance, the more you spend on switchings, for --
19 switching, for example, the more dollars of
20 maintenance you would have, those do track with
21 investment.

22 Some expenses track with the number of lines
23 in service rather than the number of dollars of
24 investment, and we have those as a percentage -- as
25 a -- on a per-line basis. And the model also gives

1 you the capability if you see a certain expense and
2 you feel like, well, that's something that really
3 ought to vary by line instead of by dollar, you can
4 make that adjustment and have the model allocate those
5 expenses based on lines instead of dollars.

6 So it's something that is done in both ways
7 depending on how the expense varies, and it's also
8 something that, if the Commission were interested,
9 they could actually go in and change how those
10 expenses are treated.

11 Q All right. Some are per line, and then some
12 are based upon an ARMIS ratio. Is that a fair
13 characterization?

14 A No.

15 Q You have some that are per line? How are
16 the other --

17 A And some are per dollar of investment.

18 Q Per dollar investment.

19 A Yes.

20 Q And which --

21 A And that it does come from ARMIS
22 information.

23 Q Per dollar investment from ARMIS. And how
24 about switching and circuit equipment expenses? Are
25 they per line or per dollar investment from ARMIS?

1 A It depends on expense, I believe. There are
2 certainly some switching expenses that vary by line.
3 There's circuit expenses that vary by dollar.

4 Q Is there a switching expense factor in the
5 Hatfield model that is taken from a New Hampshire
6 study?

7 A There is a specific maintenance factor --
8 let me look it up. (Pause) There is, yes.

9 Q Yes. And there is also a circuit equipment
10 factor taken from a New Hampshire study.

11 A I believe that's correct, and I believe both
12 of those are on a dollar of investment basis.

13 Q I'm sorry, Mr. Wood. I didn't hear what you
14 said.

15 A I believe both of those were on a dollar of
16 investment basis, but I'll confirm that for you, if
17 you'd like.

18 Q I believe you're right. I believe they are
19 per dollar, but you can check, if you wish.

20 And so those two factors are not taken from
21 ARMIS data; is that right?

22 A That's correct.

23 Q There is an override in the model that plugs
24 in these values from the New Hampshire study instead
25 of the per dollar investment from ARMIS?

1 A Well, there's actually no override. The
2 source of these inputs is a separate source. There
3 was --

4 Q They are replacing the ARMIS calculations.

5 A They are used instead of ARMIS data
6 because --

7 Q That's fine.

8 A -- those folks found them to be more
9 reliable.

10 Q And why is it that data from New Hampshire
11 was used nationwide instead of the per dollar
12 investment from ARMIS?

13 A Yeah. That's just what I was going to
14 explain. There's -- you have to take an objective
15 look at each of these inputs to determine the best
16 available public information. We don't want to be
17 relying on proprietary information.

18 There are a number of proprietary studies
19 available throughout the country showing a switching
20 expense that is comparable or certainly in this range
21 but are not values that can be divulged directly.

22 This particular cost study is one of those
23 that was consistent with others nationally, but which
24 was made public by the New Hampshire Commission. It
25 was simply a judgment call, and I think a sound

1 judgment call, that that represented the best
2 available public data for the percentage of expenses
3 compared to the cost of switching, because this
4 particular value is related to the price paid for new
5 switches and the maintenance of those new switches
6 versus what would be in ARMIS, which is an embedded
7 mix of previous purchases and expense and which would
8 capture this historic ratio rather than the most
9 current forward-looking ratio; and that was simply the
10 judgment that was made.

11 Q And of course this best available data from
12 New Hampshire provides factors that are lower than
13 what would have been if the general approach using per
14 dollar investment from ARMIS was used; isn't that
15 correct?

16 A That's not generally true. It can be higher
17 or lower depending on the company.

18 Q Now, you aware that the use of these New
19 Hampshire values has been specifically rejected by the
20 California Public Service Commission as being not
21 representative of real world situations in California,
22 are you not?

23 A I'm not aware of that language from the
24 California Commission. They may very well have
25 adjusted these inputs.

1 Q Thank you. Let me move on, Mr. Wood. You
2 are an economist; is that right?

3 A I have a master's in economics, but I
4 reserve the title of economist for those with a Ph.D.

5 Q All right. Well, having a master's in
6 economics, do you agree that cost models should be
7 based upon consistent information sources?

8 A I think they should be based on the best
9 available information source.

10 Q And should --

11 A And that always -- that won't always be the
12 same source certainly.

13 Q Of course not. But should an effort be made
14 to ensure that those sources are consistent?

15 A Well, an effort should certainly be made to
16 make sure that the input values are consistent with
17 each other and that they don't represent something
18 totally different, that you've got an apples and
19 apples basis, but I wouldn't say that you should err
20 on the side of getting all your information from a
21 single source, because that may not be the best source
22 of information.

23 Q Well, you would agree, though, that the
24 underlying assumptions used within a model should be
25 consistent?

1 A With each other, absolutely.

2 Q Are you aware of an AT&T model that is
3 entitled the "Transport Incremental Cost Model," TICM?

4 A I am.

5 Q And what is TICM?

6 A I actually -- what you just described is
7 about the extent of my knowledge. It's an internal
8 model that AT&T used to cost interoffice networks for
9 an internal purpose, and I don't know what that
10 internal purpose is.

11 Q And are you aware of an AT&T model entitled
12 the "Nonrecurring Cost Model"?

13 A If you're referring to the one that's been
14 sponsored in proceedings here, yes, I am.

15 Q And are you aware of an AT&T model that
16 deals with collocation issues?

17 A Again, if you're referring to the one that's
18 been presented in UNE proceedings, yes, although I
19 think I would characterize both of those as AT&T/MCI
20 models.

21 Q All right. I apologize.

22 A Just to be fair.

23 Q AT&T/MCI Collocation and Nonrecurring Cost
24 Models?

25 A Right.

1 Q But the TICM model is just unique to AT&T?

2 A That's right; and it's not a model that's
3 being used for the type of purpose that we would
4 normally see in these proceedings.

5 Q Now, Mr. Wood, have you checked to see if
6 the underlying assumptions in the Hatfield model are
7 consistent with the assumptions in the TICM model, the
8 Nonrecurring Cost Model, and the Collocation model?

9 A Yes, certainly, with regard to Nonrecurring
10 and Collocation. No for TICM, because it doesn't cost
11 any of the things we're trying to cost here. It's not
12 a local service model. It doesn't cost anything
13 related to local service.

14 Q Well, it does the cost circuit equipment
15 expense, doesn't it?

16 A For large interoffice circuit equipment,
17 yes; but we don't have any of that in what we're
18 studying here.

19 Q It does --

20 A But there's really no overlap in the network
21 facilities that we're dealing with.

22 Q What about power investment necessary to run
23 switches? Isn't there overlap there?

24 A There is -- certainly you would have two
25 things called power to run a switch. You would not

1 have similarly configured switches. We're dealing
2 with local Class 4, 5 switches here, local and tandem.
3 What's in, as I understand it, the AT&T study, are the
4 much larger interoffice switches.

5 Q Well, some of the AT&T switches are
6 similarly sized to some of the local ILEC switches,
7 are they not? Or are you unaware of that?

8 A If you mean in terms of processor capacity,
9 it's possible, but they wouldn't be similarly
10 configured, because those large AT&T switches don't
11 have the line configuration that a local switch has.

12 An interoffice has trunks coming in on both
13 sides. A local switch has lines coming in on one side
14 and trunks on the other. That's a very different
15 configuration. It's a different set of investments
16 and a different set of power requirements.

17 Q All right.

18 A It's just not something you can put side by
19 side and meaningfully compare.

20 Q Now, you have said that you compared the
21 assumptions used in the nonrecurring cost model and
22 the collocation model with those assumptions in the
23 Hatfield model; is that right?

24 A Where they're comparable, yes.

25 Q And you have determined, I take it, that in

1 all cases they are consistent?

2 A I've certainly not seen any inconsistencies,
3 no.

4 Q Thank you. Are you aware of the fact that
5 the AT&T TICM model has expense factors for switch
6 maintenance and circuit equipment that are higher than
7 the values used in the Hatfield model?

8 A They could very well be. Again, we're
9 talking about -- other than the fact that they're both
10 called a switch, we're talking about very
11 fundamentally different beasts here. It's a
12 completely different machine to do large interoffice
13 switching than to do local switching.

14 Q And I take it you're also aware of the fact
15 that AT&T's TICM model assumes power investment
16 significantly higher than the assumptions used in
17 Hatfield?

18 A I don't know that that's true. And, again,
19 there's no reason they would be comparable.

20 Q Now, are you aware of the fact that Hatfield
21 model assumes copper based T-1 technology over DLC,
22 although the technology -- that technology is not
23 considered forward-looking technology in the
24 nonrecurring cost model --

25 A I'm sorry --

1 Q -- sponsored by AT&T and MCI?

2 A I'm sorry. You need to back up there.

3 There was a lot of --

4 Q Well, let's take it in two parts. You are
5 aware of the fact, are you not, Mr. Wood, that the
6 Hatfield model uses, incorporates T-1 technology, T-1
7 over copper?

8 A Yes. We use that for those road cables to
9 those outlier clusters, or what we call the 1-4
10 people, the small serving areas that -- where we
11 actually have to run cable either to the person or to
12 a series of people.

13 Q And are you similarly aware of the fact that
14 the sponsors of the nonrecurring cost model have
15 testified that they do not consider that technology to
16 be forward-looking?

17 A I think they've said that they don't
18 consider digital loop carrier on copper to be
19 forward-looking for a feeder facility, and I agree.
20 That's not what we do with those facilities in this
21 model.

22 Q Are you aware that the land and building
23 investment in the Hatfield model is lower than similar
24 assumptions used in the AT&T collocation model?

25 A No. In fact, I don't think that's true, and

1 I think the key word there might be "similar". You
2 might be confusing what is, in fact, comparable.

3 Q Let me ask this question, Mr. Wood: Are you
4 aware of a publication entitled "Bellcore Notes on the
5 Network"?

6 A I've seen "Notes on the Bach --

7 Q Well, it's probably the same --

8 A I mean, there's a longer title than that,
9 but, yeah, I've seen that. It's an old document.
10 It's an early '80s document, I believe.

11 Q Well, it is an early '80s document, and it
12 is also used as the basis for some of the assumptions
13 in the Hatfield inputs portfolio summary, is it not?

14 A For those particular engineering constraints
15 that haven't changed since that time, yes.

16 Q Okay. Are you similarly aware of a
17 publication entitled "AT&T Outside Plant Engineering
18 Handbook"?

19 A I'm aware that there is one. I think
20 Mr. Wells would be more familiar with it. That's his
21 area.

22 Q Well, these two documents contain guidelines
23 and engineering standards that are relevant to the
24 construction of a local exchange network, do they not?

25 A In part. Again, there will be parts of

1 those that relate to technology that is still
2 applicable, and there will be parts of those that
3 represent technology that's no longer forward-looking.
4 So you would have to look very carefully at the
5 document to decide what is still the current
6 engineering standard and what's a 20-year-old
7 engineering standard.

8 Q I see. So you do not consider those two
9 documents to contain generally accepted design and
10 placement standard in the telephone industry?

11 A Oh, I certainly would, but I would also --

12 Q You --

13 A I certainly would, but I certainly would
14 also want to look at them very carefully, because a
15 lot has changed since they were published. You want
16 to make sure what is there still reflects
17 forward-looking technology and forward-looking
18 principles.

19 Q And are you capable to make that
20 determination, or would you rely upon engineers?

21 A I would certainly rely on engineers. I
22 think any cost analyst would.

23 Q Well, if --

24 A Or should.

25 Q So I take it that your opinion is that some

1 of the standards and guidelines reflected in the two
2 documents we've discussed are relevant in helping this
3 Commission determine the proper forward-looking
4 technology and some are not?

5 A My testimony is that I would certainly,
6 given the time that those were published and what has
7 changed, I would want to look at any given principle
8 very carefully to make sure that it still applied in
9 1998 as it did in 1984. Some will; some won't.

10 Q Is there any other publication or reference
11 material you could point us to that would contain
12 up-to-date specifications with respect to design and
13 placement standards in the telephone industry?

14 A Oh, there are an ongoing series. Bellcore
15 publishes what are called technical references, TR
16 documents, and also general references, GR documents.
17 They don't come out on any specific schedule. They
18 come out as issues come up. But those are still --
19 there will be a number of those every year that are
20 published.

21 Q Anything else?

22 A I would ask Mr. Wells.

23 Q So then to the extent there is inconsistency
24 between what is published by AT&T in the Outside Plant
25 Handbook and the Bellcore references in the -- what is

1 it? TR and GR?

2 A That's right.

3 Q You would suggest use of the latter; is that
4 right?

5 A No. I would suggest you look at the time
6 frame that each one was published, because one may, in
7 fact, supersede the other. They often do. You have
8 to stay current on these, and you have to look at the
9 most current document.

10 Q I see. So then I take it there is no
11 authoritative compendium of design and placement
12 standards that can be used in designing the network of
13 the future. You have to look at various different
14 publications.

15 A Absolutely. Anything -- if you try to
16 publish a comprehensive work, it would be out of date
17 in this industry before you ever got it to press.
18 That's why these technical and general references come
19 out of Bellcore as issues arise and as things are
20 revolved by the standards.

21 Q Now, returning for a moment to the Bellcore
22 Notes on the Network -- which, by the way, are also
23 republished, are they not; they're rereleased --
24 Bellcore continues to come out with updates to its
25 Notes on the Network, doesn't it?

1 A They do from time to time, yes.

2 Q Thank you. Any reason to believe that those
3 do not represent the most up-to-date engineering and
4 design specifications?

5 A At the time they're published, no. But,
6 again, I would urge you to be very careful in all of
7 these, as the engineers are certainly very careful to
8 make certain they're looking at the current
9 information.

10 Q With respect to the Bellcore materials and
11 the AT&T Outside Engineering Handbook, you are aware,
12 are you not, that there are instances in which the
13 expert engineering judgment that is reflected in the
14 Hatfield design is inconsistent with those guidelines
15 in those documents?

16 A I'm not aware of that, and I would urge you
17 to talk to Mr. Wells about it, because he's the
18 engineer.

19 Q Well, you were able yesterday to discuss
20 with us this issue about copper loops extending beyond
21 12,000 feet.

22 A I believe I described that in my
23 presentation yesterday morning as an engineering
24 debate that the Commission would hear quite a bit
25 about from engineers on both sides.

1 I have received some comfort in the
2 18 kilofoot figure because of the BellSouth press
3 release that says they can offer ADSL out to 18,000.

4 Q Right.

5 A But I certainly wasn't suggesting that I
6 don't rely on the engineers in that regard, because I
7 certainly do.

8 Q Well, I think your testimony yesterday when
9 you talked about the BellSouth press release was that
10 you had seen this press release and it was good enough
11 for you. Do you recall that testimony?

12 A Well, I assume that what they're saying in
13 their press release is, in fact, true, and that
14 they're not trying to mislead anybody; and that gives
15 me some comfort in this figure. But it is certainly,
16 as I characterized it, an engineering debate that's
17 properly between the engineers.

18 Q And just so we understand the engineering
19 debate, the Bellcore engineering guidelines specify
20 12,000 feet as the maximum carrier serving area
21 necessary to support advanced digital services; is
22 that right?

23 A I don't know. That's a question for
24 Mr. Wells.

25 Q All right. You don't know. But the

1 Hatfield model will go up to 18,000 feet; is that
2 right?

3 A Theoretically, yes; although there are no
4 18,000-foot loops in the run done for Florida for any
5 of the companies. In fact, less than 1% of the total
6 copper loops in this model are more than 12,000 feet,
7 and that's actually true for both models. Both this
8 model and the BCPM produce less than 1% of loops that
9 are more than 12,000 feet. So as a practical matter,
10 I'm not sure this debate is worth all the time it's
11 going to receive.

12 Q It may not be, but what I want to understand
13 is the underlying methodology and basis on which the
14 Hatfield sponsors arrive at their engineering
15 judgement. And now you indicated yesterday that you
16 had seen this BellSouth press release. You saw that
17 they were offering advanced ADSL up to 18,000 feet and
18 said that that was good enough for you.

19 Let me ask you what you know about that
20 press release. Let me ask you what you know about the
21 BellSouth offering up to 18,000 feet for ADSL.

22 A Okay. Let me be clear. You've prefaced
23 that with a lot of different things. If you want to
24 understand the source for the engineering inputs, you
25 have a witness for that, and that is Mr. Wells.

1 In terms of what -- how I characterize this,
2 again, I think I said that this gave me some comfort.
3 What I know is that I've read the press release, and
4 what I know about it is, in fact, what's written here
5 dated September 9th, 1998, entitled "BellSouth rolls
6 out ADSL."

7 Q And what is the maximum number of megabits
8 that can be provided under that press release?

9 A 1.5.

10 Q 1.5. And, Mr. Wood, would you tell us what
11 the FCC's definition is of the number of megabytes
12 necessary to offer ADSL for universal service
13 purposes?

14 A In the May 7th order they actually just
15 refer to enhanced digital services. That's the phrase
16 they use.

17 Q And how many --

18 A If BellSouth is offering something as ADSL
19 that isn't in fact ADSL, then I certainly --

20 Q That's the point, isn't it?

21 A -- stand corrected.

22 Q Doesn't the FCC say that you have to offer
23 6.144 megabytes in order --

24 A Again --

25 Q -- to qualify for ADSL?

1 A Not -- I think the -- I'll look up the
2 May 7th language. Specifically I don't think it
3 refers to any bit rates at all. In fact, the FCC
4 requirement refers to digital services. It refers to
5 advanced services.

6 Q Read the footnote, please, in that
7 paragraph.

8 A I'm just looking at 1(b). "The loop design
9 incorporated into a forward-looking economic cost
10 study should not impede the provision of advanced
11 services."

12 Q Does it have a footnote there, Mr. Wood?

13 A I don't, in my printout.

14 Q Well, we'll get that when we see you again.
15 Just so I understand it, does the BellSouth offering
16 at 18,000 feet comply -- does that give the necessary
17 amount of technology for everybody to have universal
18 service that's been defined by the FCC, knowing what
19 you know about it now?

20 A Well, knowing what I read here in the press
21 release, if BellSouth is telling the truth in its
22 press release, there's not a problem. Again, as a
23 practical matter, there are no 18,000-foot loops in
24 Florida produced by the --

25 Q Assume there are.

1 A Assume there are?

2 Q Right.

3 A Then according to BellSouth, ADSL will be
4 available where existing loop facilities can support
5 the service. The loop must be unloaded 2-wire copper
6 and not more than 18,000 feet.

7 MR. WILLIAMS: Thank you, Mr. Wood. I have
8 nothing further.

9 Madam Chairman, I would like to give
10 Mr. Wood the documents with respect to the Hatfield
11 loop costs. I can do it now or during a break,
12 whatever.

13 CHAIRMAN JOHNSON: Okay. Either is fine.
14 You can give it to him now. But you've finished all
15 of your questioning?

16 MR. WILLIAMS: I'm sorry?

17 CHAIRMAN JOHNSON: You said you have
18 finished all of your questioning?

19 MR. WILLIAMS: Yes. I'm sorry. I only have
20 one copy of these.

21 **CROSS EXAMINATION**

22 BY MR. COX:

23 Q Good morning, Mr. Wood. Will Cox on behalf
24 of the Commission Staff.

25 MR. COX: Before I begin, Chairman Johnson,

1 Staff would ask if we could at this time mark as a
2 late-filed exhibit -- you should have the cover sheet
3 in front of you, the deposition transcript. It was a
4 panel deposition.

5 Can you hear me at all?

6 (Technical difficulties. Microphones
7 adjusted.)

8 MR. COX: Okay. We're good, I think. If we
9 could mark at this time as a late-filed deposition
10 exhibit the deposition transcript. It was a panel
11 deposition taken of Mr. Wood and Mr. Pitkin, and it
12 also will include the late-filed deposition exhibits.
13 It's identified as DJW/BFP-22.

14 CHAIRMAN JOHNSON: DJW/BFP-22 will be marked
15 as 45.

16 MR. COX: Thank you.

17 CHAIRMAN JOHNSON: And is this accurate?
18 You said both the deposition transcript and the
19 late-filed deposition exhibits are not available yet?

20 MR. COX: I think they are actually finally
21 available today. I got an e-mail when I came in this
22 morning, but we didn't have them at the time we
23 prepared this.

24 CHAIRMAN JOHNSON: So should we do this as a
25 late-filed?

1 MR. COX: I don't know if we have all the
2 late-fileds yet, so I'd rather just call this a
3 late-filed exhibit at this point.

4 CHAIRMAN JOHNSON: Okay.

5 MR. LAMOUREUX: Just to clarify, I think we
6 handed out the late-filed exhibits for the Wood-Pitkin
7 deposition this morning.

8 MR. COX: So they're all available now?

9 MR. LAMOUREUX: So everyone should have
10 those, yes.

11 MR. COX: Okay. Well, then we can provide
12 those for the record.

13 MR. NELSON: And, Chairman Johnson, would
14 that include any errata sheet that Mr. Wood prepares
15 as well?

16 CHAIRMAN JOHNSON: Yes. Thank you.

17 MR. COX: So that will be Exhibit 45.

18 (Exhibit 45 marked for identification.)

19 CHAIRMAN JOHNSON: Anything else?

20 MR. COX: That's all.

21 Q (By Mr. Cox) Mr. Wood, I have some
22 questions regarding various versions or, depending
23 upon how you want to characterize them, revisions to
24 the version of Hatfield that you have filed in this
25 proceeding.

1 Did you file with your direct testimony on
2 August 3rd two exhibits, DJW-6 which was the CD
3 containing the HAI cost proxy model, Version 5.0a, and
4 DJW-5, results from that model for BellSouth, GTE and
5 Sprint for Florida?

6 A Yes.

7 Q On August 19th did you revise these
8 exhibits?

9 A Yes, we did.

10 Q What was the nature of those revisions?

11 A I had been asked by AT&T and MCI to include
12 costs associated with access and intraLATA toll
13 minutes and the calculation that we produced.

14 The model uses all of those minutes to size
15 the facilities, but then it goes back and applies
16 costs to local or access or toll based on how much
17 usage is represented by each service.

18 We had not added that into the originally --
19 the original filed exhibits, and that was added in in
20 that revision.

21 Q Okay. So an incorrect number of intraLATA
22 toll minutes had been used; is that correct?

23 A That's right. We had to revise that
24 calculation to get this proper add-on for access and
25 intraLATA toll minutes.

1 Q Staff in this process has requested through
2 Interrogatory 17 an explanation as to why, when the
3 Staff attempted to run the edition of the model you
4 provided, it generated results that did not match the
5 results of revised Exhibit DJW-5. Are you familiar
6 with that request?

7 A I am.

8 Q Did you provide the initial response to that
9 request?

10 A I did. I've also had conversations with
11 various Staff members on this topic to see if we could
12 figure out what the discrepancy might be that was
13 coming up, and apparently there were a couple things
14 that could have happened.

15 One was that just running the model without
16 putting in the inputs that we had changed for Florida
17 specificity would have yielded a different result, but
18 you actually had to put those in to make the run.

19 And, also, this modification to include the
20 correct access and intraLATA minutes was a process we
21 talked through with Staff to make sure that they
22 understood that process, because it's something that
23 we had added to the mix, if you will, based on the
24 revised exhibits.

25 Q But initially your thought was that there

1 shouldn't be or there weren't any discrepancies?

2 A That's right. When I went back and ran -- I
3 took DJW-6 and the CD ROM, took the model that was on
4 that, ran it with our inputs, and I got the same
5 results as we had filed in DJW-5. So I couldn't find
6 a discrepancy.

7 And then based on conversations with Staff,
8 we found a couple of sources where -- that were
9 potential reasons for an apparent discrepancy based on
10 Staff runs versus my runs.

11 Q And how did you end up resolving these
12 discrepancies that you discovered after further
13 discussion with Staff?

14 A Again in two parts. One was to make sure
15 that the inputs had, in fact, been changed to the ones
16 used in the run; you know, the cost of capital, the
17 depreciation, the labor factor and the like.

18 And then the second was to talk through this
19 process of adding in access and intraLATA toll
20 minutes, which has several steps to it; and that
21 needed to be talked through pretty carefully. But at
22 that point I thought we had resolved that issue
23 completely.

24 Q Okay. So just to clarify, your initial
25 response in Interrogatory 17 was not entirely correct,

1 but you since have discovered some discrepancies and
2 you've corrected those; is that correct?

3 A No. The interrogatory, as I understood it,
4 was why are there discrepancies between what's on the
5 CD ROM and what's in DJW-5. And my response was, I
6 checked, and I don't find any discrepancies.

7 So then the next step was to talk with Staff
8 and find out why they felt like when they ran the
9 model they were getting a different number, and we
10 found a couple of possible reasons for that; and I
11 thought we had, based on those, come to a conclusion
12 that there wasn't a discrepancy.

13 Q There was not a discrepancy?

14 A That's right.

15 Q Just one moment. (Pause)

16 Are you familiar with the revised response
17 you filed to Interrogatory 17?

18 A I didn't prepare it, so I'm not sure if --

19 Q You didn't prepare it?

20 A -- I've seen it or not.

21 Q Well, it involves the issues that we're
22 talking about trying to reconcile the two exhibits.

23 A Yes. I mean, there's been an ongoing effort
24 to talk with the Staff and make sure that we've gotten
25 everybody on the same page. And we'd certainly -- if

1 there's still an unresolved issue, I didn't know it,
2 but we'd obviously be more than happy to continue to
3 work on that.

4 Q Okay. Are you aware that in the response
5 you said that in order to run DJW-6 to reflect the
6 outputs on DJW-5, please refer to the following, and
7 you offer some instructions. And the first two
8 preliminary instructions were to -- you will need a
9 wire center run and a density zone run.

10 A Yes. That's part of the specific adjustment
11 to add in the access and intraLATA toll minutes.

12 Q Okay. I thought earlier in the questioning
13 when Mr. Carver was addressing you that you indicated
14 that a density zone level run would not be required.

15 A I don't recall that discussion with
16 Mr. Carver. You need the density level run simply
17 because the density zone USF worksheet has a specific
18 piece of traffic information that you need in order to
19 make this adjustment.

20 You don't really need the results of a run
21 on a density zone basis per se. What you need is the
22 specific access minute calculation that's included on
23 that worksheet.

24 Q Why does your revised response to
25 Interrogatory 17 say "Use a density zone run"? Is

1 that --

2 A Well, because that produces this worksheet
3 that includes the access information that you need to
4 make the adjustment.

5 Q Okay.

6 A We're not suggesting that USF costs be
7 calculated on a density zone basis; merely that by
8 running the model on that basis, it actually outputs a
9 piece of information that is an output on a wire
10 center run, and that is this access information that
11 you need in order to add those minutes in.

12 Q Mr. Wood, have you refiled the CD containing
13 the Hatfield model since the August 19th revised
14 filing?

15 A Yes, we did.

16 Q What was the date of that filing?

17 A October 4th or 5th, I think.

18 Q Subject to check, would you agree that it
19 was October 7th?

20 A That's -- yes, that's entirely possible.

21 Q What revisions were made to this filing of
22 the model?

23 A Simply one, and that was to add in the cost
24 of white pages listing. I had not realized, quite
25 honestly, in what we had filed that that had not been

1 included until the Staff interrogatory that asked if
2 it had been in there pursuant to the Florida Statute
3 definition of local service.

4 When we saw that, we realized that it hadn't
5 been included and that it should have been, and we
6 reran the model to include those costs.

7 Q And what was the impact of that revision?
8 How did it affect the output of the model?

9 A It increased it slightly. It's not a big
10 expense item compared to the other things we talked
11 about, but it does increase the cost somewhat; less
12 than 20 cents, I think, per line.

13 Q Are the steps necessary that we've talked
14 about that were outlined in your revised response to
15 Interrogatory 17, are they necessary to correct the
16 number of intraLATA toll minutes used within the
17 August 19th edition of the model? Are they still
18 necessary with the latest edition, the October 7th
19 edition?

20 A Actually -- the steps are actually not to
21 correct an improper use of minutes. The steps are to
22 actually include those minutes. So if you follow
23 these steps correctly, which we didn't do the first
24 time but did do with the subsequent filing, you should
25 get the same results.

1 They really aren't part of the correction.
2 They're simply the process to go and find information
3 that is in the model with regard to access and
4 intraLATA toll costs, and then include that in the
5 cost results in a way that is consistent with the
6 methodology and make sure that we just increase local
7 costs by that amount.

8 MR. COX: Okay. Thank you, Mr. Wood.

9 CHAIRMAN JOHNSON: Commissioners?

10 COMMISSIONER JACOBS: Mr. Wood, I wanted to
11 touch on briefly the issue of the geocode, success of
12 geocodes in rural areas.

13 WITNESS WOOD: Yes.

14 COMMISSIONER JACOBS: How do you deal with
15 that where you -- and I think I understand what -- the
16 response to it when you don't have a geocode of
17 address. That's where you put them along the boundary
18 of the grid; is that correct?

19 WITNESS WOOD: Well, of the census block;
20 that's right.

21 COMMISSIONER JACOBS: Census block --

22 WITNESS WOOD: Yeah. We don't do grids.

23 COMMISSIONER JACOBS: I'm sorry --

24 WITNESS WOOD: Yes. We do spread those out,
25 those people out, as far as we can.

1 **COMMISSIONER JACOBS:** The effect of that
2 would be in terms of the costs in that particular
3 block -- what would be the effect of that on the cost
4 that you would report for that block?

5 **WITNESS WOOD:** It increases the cost, and,
6 unfortunately, the more people that you have to do
7 that, the more it increases.

8 Now, what we have done is also run the model
9 for Florida by putting people not just on that outside
10 boundary, but also distributing along the inside
11 roads; in a sense, the BCPM methodology where we -- we
12 geocode everybody we can. That's the best case. But
13 then where we can't, we do essentially what BCPM does
14 as its first try on these things.

15 When you do that, it reduces the number of
16 route miles of cable, the amount of physical cable you
17 need by about 5%. So certainly moving those people to
18 interior roads as well as exterior would -- would
19 reduce the cost somewhat. So we do overstate the
20 costs by putting them on the outside.

21 **COMMISSIONER JACOBS:** Well, that brings me
22 to my real question. The impression I had is that
23 that would result in an overstatement of the cost.

24 **WITNESS WOOD:** It will.

25 **COMMISSIONER JACOBS:** But the criticism I've

1 seen says that it results in not enough plant being
2 placed there, and I'm trying to understand how that
3 would work. Not enough distribution plant being
4 provided for, how does that work?

5 **WITNESS WOOD:** We discussed that in a lot of
6 detail, Mr. Pitkin and I, in our rebuttal testimony --
7 and, unfortunately, you'll have to see me again later
8 in the week -- on this whole analysis and on this
9 criticism of insufficient cable.

10 But when you look at what's actually being
11 calculated, it is not a test for whether the model
12 produces enough cable to reach customers. That's not
13 what the test was ever intended to be. That's not
14 what the people of -- the creators of this test ever
15 intended it to be, but I think it's been suggested
16 that that's what the results indicate; and that's
17 simply wrong.

18 It would certainly be -- when we try to be
19 conservative in terms of overstating rather than
20 understating, moving these people out, certainly
21 moving them to interior roads, the costs would go down
22 some, and that's a possibility --

23 **COMMISSIONER JACOBS:** I'm sorry. I didn't
24 hear that last part.

25 **WITNESS WOOD:** It would -- the costs would

1 go down some, and, you know, that's a possibility here
2 if that's something -- you know, if you decided, well,
3 I see your second best solution for people you can't
4 geocode, and I think that does overstate costs and I
5 really think you ought to move these people
6 internally, we could do that.

7 COMMISSIONER JACOBS: Okay. Thank you.

8 COMMISSIONER DEASON: You estimate that that
9 inherent bias for that assumption is in the magnitude
10 of 5% more cabling required?

11 WITNESS WOOD: Yes. We've actually
12 calculated it. We had -- it is part of the -- an
13 ex parte filing at the FCC. We obtained from the
14 company that BCPM gets its data, road data, from the
15 information necessary to spread on those interior
16 roads, and it's an exhibit to our rebuttal, and I'll
17 look and see which one. I think it's a 5.1% decrease,
18 and it's not at -- that's a calculated decrease in the
19 total route miles of cable required.

20 COMMISSIONER DEASON: So it's 5.1% if you
21 change the assumption to distribution consistent with
22 interior road --

23 WITNESS WOOD: That's right. You'll use 5%
24 less cable in that scenario.

25 COMMISSIONER DEASON: Did you attempt to

1 look at just a random distribution within the census
2 block? Would that make any difference?

3 WITNESS WOOD: We have not -- that's
4 actually the old -- if you remember the earlier
5 versions of that model, we did try to spread
6 throughout. We got a lot of criticism for that.

7 COMMISSIONER DEASON: I'm just trying to get
8 an order of magnitude comparison.

9 WITNESS WOOD: We have -- I have not done
10 that analysis, and I don't think Mr. Pitkin has. What
11 we're trying to do here is where we can get it right
12 in terms of geocoding, we want to get it right.

13 The question then becomes, well, what's the
14 next best solution for the next set of people. And
15 it's either put them on the outside or move them on
16 the outside and the inside.

17 CHAIRMAN JOHNSON: Redirect?

18 MR. NELSON: I think just two questions.

19 REDIRECT EXAMINATION

20 BY MR. LAMOUREUX:

21 Q Could you just briefly explain, Mr. Wood,
22 what the difference is between making a density zone
23 run and using density zone results that come out of
24 the model? I just want to clarify that.

25 A Oh, sure. When you run the model on the

1 input screen, the one that has the run button that you
2 click on, it also has some choices for the level of
3 aggregation.

4 The model calculates costs down at this
5 customer group level, this cluster level, and then you
6 can aggregate that up by wire center, you can
7 aggregate it up by density zone or by census block
8 group, and you just choose that.

9 Certainly, as Mr. Guepe testified, we think
10 the results on a wire center basis are what are most
11 useful to you in the task that you have before you.

12 The difference in the two runs in this case
13 happens to be the way the output sheet is formatted.
14 There's a piece of information that comes out in a
15 density zone run that doesn't come out in a wire
16 center run. It happens to be this access data that we
17 use to add those minutes back in.

18 It's not like there's two fundamentally
19 different calculations; it's just rolling up the
20 costs. And this piece of information shows up on one
21 output sheet and doesn't show up on the other, so you
22 need to make the other run just to get the -- pull
23 that piece from the output.

24 Q Are there any wire centers in Florida with a
25 0% geocode success rate in the Hatfield model?

1 A No.

2 MR. LAMOUREUX: No further questions.

3 COMMISSIONER DEASON: I have one other
4 question. Mr. Wood, you indicated that you are not
5 aware of any loops which exceeded 18,000 feet in
6 Florida.

7 WITNESS WOOD: That's right. We actually --
8 let me pull this exhibit for you.

9 COMMISSIONER DEASON: Well, just let me ask
10 my next question.

11 What about between 12,000, 18,000; what
12 percentage of the loops fall in that category?

13 WITNESS WOOD: For both models, less
14 than 1%.

15 COMMISSIONER DEASON: Less than 1%?

16 WITNESS WOOD: Yes. We have an exhibit to
17 the rebuttal testimony that's actually a color chart
18 that's a distribution for the Hatfield model for, you
19 know, 1,000-foot increments, what number of loops fall
20 into each band. And they are predominantly much, much
21 shorter. There are only less than 1% that go beyond
22 12 for either model, and none go as far as 18.

23 CHAIRMAN JOHNSON: Exhibits?

24 MR. COX: Chairman Johnson, Staff would
25 request that Exhibit 45 be moved into the record at

1 this time.

2 **CHAIRMAN JOHNSON:** I'll show it admitted
3 without objection.

4 (Exhibit 45 received in evidence.)

5 **MR. CARVER:** BellSouth moves Exhibit 44.

6 **CHAIRMAN JOHNSON:** Show that.

7 (Exhibit 44 received in evidence.)

8 **MR. LAPOUREUX:** AT&T moves Exhibit 43.

9 **CHAIRMAN JOHNSON:** Show 43 and 44 moved
10 without objection.

11 (Exhibit 43 received in evidence.)

12 **MR. HATCH:** And 42, as well.

13 **CHAIRMAN JOHNSON:** Show 42 moved without
14 objection.

15 (Exhibit 42 received in evidence.)

16 **CHAIRMAN JOHNSON:** Thank you, Mr. Wood.

17 We'll see you later.

18 (Witness Wood excused.)

19 - - - - -

20 **MR. CARVER:** Should I call the next witness?

21 **CHAIRMAN JOHNSON:** Yes.

22 **MR. CARVER:** BellSouth calls Dr. Kevin
23 Duffy-Deno.

24 (Discussion off the record.)

25 (Brief recess.)

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CHAIRMAN JOHNSON: We're going to go back on
the record.

- - - - -

DR. KEVIN DUFFY-DENO

was called as a witness on behalf of BellSouth
Telecommunications, Inc. and, having been duly sworn,
testified as follows:

DIRECT EXAMINATION

BY MR. CARVER:

Q Dr. Duffy-Deno, could you please state your
full name and your business address?

A My name is Kevin Duffy-Deno, D-U-F-F-Y,
hyphen, D-E-N-O.

Q By whom are you employed and in what
capacity?

A I'm employed by INDETEC International as an
economist and quantitative analyst.

Q And have you caused to be prefiled in this
docket 20 pages of direct testimony, including two
exhibits?

A That's correct.

Q And have you also caused to be prefiled 44
pages of rebuttal testimony including 15 exhibits?

A That's correct.

1 Q Do you have any changes to your direct or
2 rebuttal testimony?

3 A I do not.

4 Q And if I were to ask you the questions today
5 that appear in your direct and rebuttal testimony,
6 would your answers be the same?

7 A They would.

8 MR. CARVER: Madam Chairman, I would like to
9 request that Dr. Duffy-Deno's direct and rebuttal
10 testimony be inserted in the record as though read.

11 CHAIRMAN JOHNSON: It will be so inserted.

12 MR. CARVER: And, also, if we could have the
13 exhibits to both his direct and rebuttal marked for
14 identification, please.

15 CHAIRMAN JOHNSON: We'll identify KDD-1
16 and 2 as Composite Exhibit 46. o

17 (Exhibit 46 marked for identification.)

18 MR. CARVER: And 1 and 2 are to his direct
19 testimony. He also had rebuttal exhibits, but I don't
20 think they're listed on the prehearing statement. On
21 the prehearing order, rather. And those are KDD-1
22 through 15, rebuttal.

23 CHAIRMAN JOHNSON: KDD --

24 MR. CARVER: 1 through 15.

25 CHAIRMAN JOHNSON: 1 through 15 of rebuttal

1 exhibits as 47.

2 (Exhibit 47 marked for identification.)

3 MR. CARVER: Thank you.

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**REBUTTAL TESTIMONY
OF DR. KEVIN T. DUFFY-DENO
ON BEHALF OF BELLSOUTH TELECOMMUNICATIONS, INC.
BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION
DOCKET NO. 980696-TP
SEPTEMBER 2, 1998**

1 **I. INTRODUCTION**

2

3 Q. PLEASE STATE YOUR NAME AND BUSINESS AFFILIATION.

4 A. My name is Kevin T. Duffy-Deno. I am the Managing Director-Market Research
5 at *INDETEC* International, a telecommunications consulting firm.

6

7 Q. ARE YOU THE SAME KEVIN T. DUFFY-DENO WHO FILED DIRECT
8 TESTIMONY IN THESE PROCEEDINGS?

9 A. Yes.

10

11 Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

12 A. The primary purpose of my testimony is to respond to Mr. Wood's assertion in his
13 testimony of August 3, 1998 on page 20 that:

14

15 "By developing costs based on the actual locations of most customers, this release
16 of the HAI Model provides a degree of precision in its results that simply cannot
17 be duplicated by a model such as the BCPM which uses a more simplistic
18 approach of arbitrarily distributing end users along roadways or within an

1 artificial grid structure.”

2
3 My testimony provides theoretical and empirical evidence that refutes Mr.
4 Wood's assertion. This evidence consists of a relative evaluation of three key
5 features of the HAI Model Release 5.0a (HAI 5.0a) and the Benchmark Cost
6 Proxy Model Release 3.1 (BCPM 3.1): (1) the customer location methodology;
7 (2) the customer aggregation methodology; and (3) a comparison of the minimum
8 distance, as the crow flies, required to connect customers and the distribution
9 plant provisioned in HAI 5.0a.

10
11 Q. PLEASE SUMMARIZE YOUR PRIMARY FINDINGS AND CONCLUSIONS.

12 A. The following summarizes key evidence that counters Mr. Wood's assertion that
13 HAI 5.0a is more "precise" than BCPM 3.1.

14
15 • The rate of successful geocoding is extremely low in the rural, low-density
16 areas of Florida. Consequently, the HAI Model customer location methodology is
17 reduced to estimating the lion's share of customer locations in these areas. HAI
18 simply places such customers on the perimeter of relatively large Census Blocks,
19 ignoring the importance of placing customers along interior roads.

20 • The HAI's sponsors claim that the model accurately locates customers
21 remains unsubstantiated because AT&T has refused to allow anyone access to the
22 underlying geocoded and surrogate data to BellSouth for Florida.

23 • The rectangular HAI clusters to which the HAI model engineers plant, do not
24 fully encompass the underlying geocoded and surrogate locations upon which these
25 HAI clusters are based. The geocoded and surrogate locations themselves are not

1 used in the HAI model.

2 • An analysis of the Yankeetown wire center in Levy County indicates that
3 BCPM's customer location methodology effectively identifies the actual distribution
4 of customers within this wire center.

5 • An analysis of whether HAI 5.0a estimates the minimum distance needed to
6 connect all of the customers in their main cluster locations identified by the model
7 indicates that HAI 5.0a substantially underestimates this distance by 1,866 miles for
8 BellSouth's Florida territory. In the lowest density zone, the model's estimated
9 distribution distance (including drop and connecting cable) is less than this minimum
10 connecting distance in 87% of its main clusters. Hence, HAI 5.0a's distribution plant
11 substantially underestimates the requisite plant by a substantial margin to provide
12 basic service, particularly in rural areas.

13 • In contrast to the pronounced internal inconsistency in HAI 5.0a determination
14 of requisite distribution plant, a comparable analysis of BCPM 3.1 reveals that
15 BCPM's modeling of distribution plant is internally consistent with BCPM's
16 modeling intent. The minimum connecting distance analysis of BCPM 3.1 indicates
17 that BCPM is only 465 miles short in the lowest density zone and short in only 32%
18 of its ultimate grids.

19
20 Q. HOW IS YOUR REBUTTAL TESTIMONY ORGANIZED?

21 A. Section II provides an overview of HAI 5.0a's and BCPM 3.1's customer location
22 methodology and an evaluation of the two methodologies. Section III provides
23 similar information for the model's customer aggregation methodologies. The
24 models' provision of distribution plant is addressed in Section IV. A summary of
25 key points is provided in Section V.

1

2 Q. ARE THERE EXHIBITS TO YOUR TESTIMONY?

3 A. Yes. The following is a list of the Exhibits that accompany my testimony:

4

5 KDD-1 The Road Network in Dixie County, FL

6 KDD-2 Geocoded Locations in Dixie County, FL

7 KDD-3 Geocoded Locations in Levy County, FL

8 KDD-4 Geocoded Locations in Washington County, FL

9 KDD-5 Satellite Observations in the Yankeetown Wire Center, FL

10 KDD-6 Effect of Surrogate Point Placement On Minimum Spanning Tree
11 Length

12 KDD-7 March 2, 1998 AT&T *ex parte* to the FCC

13 KDD-8 Concentric Ring Analysis of the Yankeetown Wire Center, FL

14 KDD-9 Figure 1. Yankeetown Wire Center: Distribution of Actual and
15 BCPM predicted Counts.

16 KDD-10 BCPM Ultimate Grids in the Yankeetown Wire Center, FL

17 KDD-11 HAI Distribution Cable Requirements

18 KDD-12 HAI 5.0a Clusters in the Yankeetown Wire Center, FL

19 KDD-13 Figure 2. Stylized PNR Polygon Cluster and the HAI Equivalent-
20 area rectangle (Access Database); Figure 3. Formation of the HAI
21 5.0a Rectangular Clusters

22 KDD-14 Using Minimum Spanning Trees to Estimate Subscriber
23 Dispersion and Minimum Network Length

24 KDD-15 The "Shorter-Than-Minimum-Spanning-Tree" Fallacy

25

1

2 **II. CUSTOMER LOCATION**

3 **A. HAI 5.0a Customer Location Methodology**

4 **Q. HOW DOES HAI 5.0a LOCATE CUSTOMERS?**

5 **A.** As explained in the HAI Model Documentation, "address geocoding" is used to
6 spatially locate customers. First, an address database is acquired from a source
7 such as Metromail, which supplies addresses to the mass-mail marketing industry.
8 These addresses are then input to geocoding software, which then determines the
9 latitude and longitude of the address on a map of the road-network.

10

11 When customers cannot be accurately address-geocoded, their locations are
12 placed uniformly on the perimeter of the Census Block in which they are located.
13 These estimated customer locations are called "surrogate" locations.

14

15 **Q. OF THE COMPLETE ADDRESSES METROMAIL PROVIDES, CAN THE**
16 **LOCATIONS OF ALL CUSTOMERS BE ADDRESS-GEOCODED?**

17 **A.** No. P.O. Box and Rural Route addresses cannot be accurately geocoded. Since
18 P.O. Boxes and Rural Route addresses occur much more frequently in rural areas,
19 this affects the ability to geocode in rural areas substantially more than it affects
20 geocoding in the urban areas.

21

22 Failure to address-geocode may also result from incomplete information in the
23 road network database. For example, consider a fictional Mrs. Emma Jones who
24 lives at 120 Town Road. To accurately geocode Mrs. Jones' location, one needs

1 three pieces of information in the road network database. First, the physical road
2 segment Town Road, the portion of road between two intersections, needs to be in
3 the database. Second, the physical road segment must be identified with the name
4 "Town Road." Finally, the address range associated with "Town Road" must
5 include "120."

6
7 The leading reason why customer locations in rural areas cannot be accurately
8 address-geocoded is this road network information requirement. As an example,
9 Exhibit KDD-1 shows the road network in Dixie County, Florida. Physical road
10 segments are shown in black, named road segments are shown in blue, and named
11 road segments with address ranges are shown in red. Customer locations can only
12 be accurately geocoded to the red road segments. The portion of total road
13 segments that are named and numbered is quite low. Less than 1% of the physical
14 roads in Dixie County are named and have address ranges.

15
16 Q. WHAT SHARE OF CUSTOMER LOCATIONS COULD BE ADDRESS-
17 GEOCODED IN FLORIDA?

18 A. The sponsors of HAI 5.0a filed with the FCC an *ex parte* on February 3, 1998
19 which presents the geocode rates obtained by the HAI Model developers, by
20 density zone, for the 50 states. For the < 5 line per square mile density zone, the
21 HAI Model developers could accurately address-geocode the locations of only
22 34% of customers in Florida. The national average was reported as being 15% for
23 this density zone. Table 2 below shows all of the geocode rates for Florida.

24
25 **Table 2. HAI 5.0a Address-Geocode Rates for Florida:**

30 - 40%	20	4.26%
40 - 50%	25	5.33%
50 - 60%	20	4.26%
60 - 70%	43	9.17%
70 - 80%	78	16.63%
80 - 90%	105	22.39%
90 - 100%	43	9.17%
100%	1	.21%
<hr/>		
Total	469	100.00%

1
 2 Another way to examine these wire center level data is to categorize wire centers
 3 into density zones using wire center level densities (density in Table 2 refers to
 4 Census Block Group density, the measure of density used by HAI 5.0a). This
 5 approach suggests that the address-geocode rate in the lowest density wire centers
 6 is lower than the 34% reported in Table 2. In fact, on average, the success rate in
 7 the less than 5 line per square mile density zone is 22%. These data for all HAI
 8 wire centers in Florida are shown in Table 4. Wire center area is taken from
 9 BCPM 3.1 as the HAI Access database does not provide these data.

10
 11 **Table 4. HAI 5.0a Address-Geocode Rates for Florida:**
 12 **Wire Center Density Zone**

DZ	WC Count	Average Geocode Rate
< 5	19	22.43%
5 - 20	71	23.30%
20 - 100	91	46.83%
100 - 200	52	68.17%

200 - 650	79	72.78%
650 - 850	20	79.84%
850 - 2,550	62	70.16%
2,550 - 5,000	55	60.17%
5,000 - 10,000	18	40.87%
> 10,000	2	21.19%
<hr/>		
Total	469	54.74%

1

2 Q. HAVE YOU EXAMINED THE ADDRESS-GEOCODE RATE FOR RURAL
3 FLORIDA?

4 A. Yes, I have. Table 5 shows the 1995 Census housing unit count for three
5 randomly selected rural Florida counties. Dixie and Levy Counties are located on
6 the western coast of northern Florida while Washington County is located just
7 east of Eglin Air Force Base. All three counties are characterized by low housing
8 unit densities (i.e., less than 15 housing units per square mile). These counties
9 were selected using a MapBasic random selection program from a list of the
10 state's counties with densities less than 25 housing units per square mile and
11 known to contain a BellSouth owned wire center. Wire centers containing Native
12 American reservations, major state parks, or predominantly water were rejected if
13 they were selected.

14

15 Also shown in Table 5, for each county is the number of Metromail complete
16 addresses provided to INDETEC on July 11, 1998, the number of these addresses
17 that can be geocoded, and hence, the share of 1995 Census housing units that can
18 be geocoded.

19

1 **Table 5. Address-Geocoding in Low-Density Counties of Florida**

2

	1995 Census Housing Units	Metromail Complete Addressee	Geocodable Addresses	Census Count Geocodable
Dixie	7,361	216	0	0%
Levy	14,011	7,074	3,748	27%
Washington	8,461	3,794	2,253	27%

3

4 Table 5 clearly shows that the share of total customer locations (Census housing
5 units) that can be geocoded varies across counties and can be extremely low, zero
6 in fact, consistent with the HAI Model sponsor findings.

7

8 Q. YOU MENTIONED THAT THE ADDRESS-GEOCODE RATE DIFFERS
9 BETWEEN RURAL AND URBAN AREAS. CAN YOU PROVIDE
10 EVIDENCE OF THIS IN THESE RURAL FLORIDA COUNTIES?

11 A. Yes. The geocode rates shown in Tables 2 - 5 do not show the fact that customer
12 locations in towns are much more likely to be geocoded than those out of town.
13 As evidence of this, consider the three maps of wire centers in these counties
14 provided as Exhibits KDD- 2, 3, and 4. These maps show, by red diamonds, the
15 geocoded locations in these wire centers. No customer locations could be
16 geocoded in Dixie County (KDD-2). Usually one sees that in rural counties,
17 geocoded locations tend to occur in clusters, centered on towns. This is the case in
18 both Levy (KDD-3) and Washington (KDD-4) Counties. In Levy County, the
19 geocoded locations are clustered around the towns of Inglis, Williston, Bronson,
20 and Chiefland. In Washington County, the geocoded locations are clustered

1 around Chipley, at the intersection of Interstate 10 and route 77.

2

3 In fact, the 34% geocode rate for the lowest density zone in Florida reported by
4 the sponsors of HAI 5.0a likely overstates the geocode rate in the truly rural areas
5 for this reason. The density zones used to report these geocode rates likely
6 contain both towns and out-of-town areas. Hence, an aggregate geocode rate is
7 typically higher than what is true for the out-of-town areas.

8

9 Q. IS IT LIKELY THAT ADDRESS-GEOCODED LOCATIONS ACCURATELY
10 REPRESENT THE TRUE DISTRIBUTION OF CUSTOMER LOCATIONS IN
11 THESE WIRE CENTERS?

12 A. No. By examining **actual** locations relative to geocoded locations, one can see that
13 indeed, geocoded locations tend to be only in and around towns, despite there
14 being housing units scattered throughout the wire center.

15

16 Q. DID YOU EXAMINE A WIRE CENTER IN RURAL FLORIDA FOR THIS
17 PHENOMENON?

18 A. Yes. Address-geocoded locations were obtained for the Yankeetown wire center
19 in Levy County. In addition, **actual** customer locations were obtained through the
20 analysis of a satellite image for this wire center.

21

22 Q. WHAT KIND OF SATELLITE IMAGE WAS USED FOR THE FLORIDA
23 ANALYSIS?

24 A. The satellite image used is referred to as a "10-meter product". That is, one pixel
25 equals 10 meters on a side. The image was taken on December 4, 1995 from an

1 altitude of 520 miles. It was purchased from SPOT Image Corporation and
2 analyzed by ERIM (Environmental Research Institute of Michigan).

3
4 Q. HOW WAS THE SATELLITE IMAGE ANALYZED BY ERIM?

5 A. Since the image is digitized, it can be loaded into a personal computer and
6 enlarged on the computer monitor. ERIM's experienced imagery analysts then
7 visually identified houses on a Census Block by Census Block basis.

8
9 Q. WHAT DID YOUR ANALYSIS REVEAL?

10 A. A map of the Yankeetown wire center Exhibit KDD-5 shows the locations of the
11 houses that could be identified from the satellite image locations. Six hundred
12 and thirty-three of the 2,119 housing units in this wire center could be geocoded
13 to the HAI Model standards. It is clear that geocoding does not capture a
14 significant portion of the customer locations in Florida low-density areas.
15 Moreover, Exhibit KDD-5 shows that actual customers are dispersed throughout
16 the wire center.

17
18 Q. CUSTOMERS WHOSE LOCATIONS CANNOT BE ADDRESS-GEOCODED
19 ARE PLACED ON THE PERIMETER OF CENSUS BLOCKS. IS THERE
20 EVIDENCE THAT CUSTOMERS ARE ACTUALLY LOCATED OTHER
21 THAN ON THE PERIMETER OF CENSUS BLOCKS?

22 A. Yes there is. It is true that people tend to live along roads. It is also true that
23 roads are not limited to the perimeter of Census Blocks. For example, in Florida,
24 44% of the populated roads in the low-density Census Blocks (densities greater
25 than 0 but less than equal to 20 housing units per square mile) are "interior roads."

1 The share of populated road mileage that is interior to Census Blocks for the four
2 lowest density zones in Florida is shown in Table 6.

3
4 **Table 6. Florida Interior Roads**

Density (HU / SQMI)	% of Populated Roads that are Interior to Census Block
< 5	48.2
5 - 20	39.5
20 - 100	38.3
100 - 200	32.7

5
6 In addition, when *INDETEC* geocoded customer locations in the counties of Levy
7 and Washington we found that 32% and 27%, respectively, are located on interior
8 roads. These findings are inconsistent with the placement of all non-geocodable
9 customers on the perimeter of Census Blocks. Thus, HAI inappropriately
10 disregards the fact that customers in rural areas live along both interior and
11 perimeter roads.

12
13 Q. IS THE PLACEMENT OF SURROGATE LOCATIONS ON THE PERIMETER
14 OF CENSUS BLOCKS A "CONSERVATIVE" ASSUMPTION AS THE HAI
15 PROPONENTS CONTEND?

16 A. No. By "conservative" I assume the reference is with respect to the *dispersion* of
17 customer locations. Exhibit KDD-6 provides an example of where uniform
18 placement of customer locations along roads both exterior and interior to a Census
19 Block yields a *greater* dispersion (as measured by the Minimum Spanning Tree
20 distance) than uniform placement along the Census Block boundary.

1 In addition, uniform placement along Census Block boundaries is not
2 conservative if artificial clusters are formed along contiguous Census Block
3 boundaries.

4
5 Q. HAVE THE DEVELOPERS OF HAI 5.0a PRESENTED AN ALTERNATIVE
6 METHODOLOGY TO THE SURROGATE PLACEMENT YOU DISCUSSED
7 ABOVE?

8 A. Yes. On March 2, 1998, AT&T filed with the FCC an *ex parte* that presents an
9 "alternative methodology for determining the location of customers who were not
10 geocoded to their precise street address location by the HAI Model, v5.0a." This
11 *ex parte* is attached to my rebuttal testimony as Exhibit KDD-7.

12
13 Q. WHAT IS THIS ALTERNATIVE METHODOLOGY THAT HAI PRESENTED
14 TO THE FCC?

15 A. The methodology discussed in this *ex parte* locates customers whose addresses
16 cannot be accurately geocoded within a Census Block on the basis of both interior
17 and boundary roads. This methodology uses the internal Census Block road
18 network much in the same way that BCPM has used all along. The *ex parte*
19 states, "We are currently using the same roads that are claimed to be used in
20 BCPM3." (Emphasis added).

21
22 Q. IS IT TRUE THAT A MODEL WHICH ADDRESS-GEOCODES SOME
23 CUSTOMER LOCATIONS IS NECESSARILY BETTER THAN ONE THAT
24 DOES NOT USE ADDRESS GEOCODING?

25 A. No. First, the mere use of address-geocoding does not necessarily make a model's

1 customer location methodology better than one which uses some other technique
2 to locate customers. This argument is especially suspect in the low-density areas
3 where the address-geocode rate is extremely low. Consequently, the assertion of
4 accuracy of HAI's placement of customers in rural areas depends critically upon
5 the erroneous assumption that customers live on only perimeter roads.

6
7 Second, the degree to which a model uses address-geocoding needs to be
8 determined. For example, as discussed later, the address-geocoded and surrogate
9 locations are used only to define the perimeter of the PNR polygon clusters in the
10 HAI preprocessing stage. Once HAI transforms the PNR clusters, generating new
11 HAI clusters that encompass a different geographic area than the PNR clusters,
12 the customer latitude and longitude information is discarded. This information in
13 no way enters the Access database used by HAI 5.0a.

14
15 Q. WHAT IS YOUR OVERALL ASSESSMENT OF THE HAI CUSTOMER
16 LOCATION METHODOLOGY?

17 A. First, the HAI customer location methodology is severely limited in its ability to
18 use geocoded data, especially in rural areas. Since the rate of successful address-
19 geocoding is low in rural low density areas, this methodology relies heavily on an
20 inadequate estimate of customer locations. This estimation places customers on
21 the perimeter of Census Blocks, disregarding the fact that customers live along
22 interior roads as well.

23 Secondly, despite claims by the HAI proponents that the HAI customer location
24 methodology more accurately locates customers than BCPM, particularly in the
25 low-density areas, this conclusion is counterintuitive given the limitations just

1 described. Furthermore, AT&T has not provided any quantitative evidence to
2 substantiate this claim, nor has it provided the underlying data for the geocoded
3 and surrogate locations as requested by BellSouth in discovery, to permit such an
4 analysis.

5 **B. BCPM 3.1 Customer Location Methodology**

6 Q. WOULD YOU PLEASE BRIEFLY REVIEW BCPM'S CUSTOMER
7 LOCATION METHODOLOGY?

8 A. BCPM 3.1 assumes that customers are located on or near roads and uses detailed
9 road-mileage information to allocate U.S. Census housing units counts within
10 Census Blocks. Specifically, a "fishnet" of microgrids, each roughly 1,500' by
11 1,700', is placed over a wire center. Census Block housing unit counts are then
12 allocated to each microgrid based on each microgrid's share of total Census Block
13 road mileage. The end result is a statistical distribution of customer locations
14 across the microgrids of a wire center. That is, the process yields the *likely*
15 (estimated) location of customers within a wire center.

16
17 Q. HOW ARE HOUSING UNITS DISPERSED WITHIN A MICROGRID?

18 A. The customer location methodology results in a housing unit count for each
19 microgrid. However, BCPM effectively assumes, for purposes of estimating
20 distribution cable distances, that housing units are evenly distributed along the
21 roads within a microgrid.

22
23 Q. DID YOU COMPARE BCPM'S CUSTOMER LOCATION PREDICTIONS
24 WITH ACTUAL CUSTOMER LOCATIONS?

1 A. Yes. A key test of any customer location methodology is whether the model's
2 estimated customer locations are consistent with actual customer locations. This
3 is of paramount importance in the rural, low-density area since Census Blocks are
4 quite large in these areas.

5
6 The first step was to choose a BellSouth - Florida wire center in a low-density
7 area. As described earlier, this selection was made randomly and resulted in the
8 Yankeetown wire center in Levy County. ERIM then analyzed two satellite
9 photographs that covered this wire center and identified house locations. These
10 locations (latitudes and longitudes) were then digitized with the result being the
11 map presented as Exhibit KDD-5. As Exhibit KDD-5 shows, house locations are
12 scattered through out the wire center.

13
14 The next step is to overlay this map with concentric circles each with a radius 1-
15 mile greater than the previous circle's. This yields "rings" around the central
16 office "bull's eye" with a width of 1 mile. The idea is to count the number of
17 actual houses that fall within each "ring." These counts are summed and then
18 plotted against the ring's outer-edge distance from the central office. The result is
19 the distribution of actual houses as measured against distance from the central
20 office.

21
22 The map shown in Exhibit KDD-8 (with the concentric rings) is next overlaid
23 with BCPM's microgrids. As noted earlier, housing units are allocated to the
24 microgrids in the wire center based on each one's share of livable road mileage.
25 Using the centroid of the microgrid, each microgrid is assigned to an appropriate

1 ring and the number of BCPM predicted housing units is summed for each ring.
2 This step yields the distribution of BCPM predicted housing units as measured
3 against the distance from the central office.
4

5 The actual house and BCPM housing unit distributions for Yankeetown are shown
6 graphically in KDD-9, Figure 1. As one would expect, the majority of houses
7 (62%) is actually located within 3 miles of the central office with the distribution
8 having a "long tail." Figure 1 also shows that the actual and BCPM distributions
9 are a very close match. Since the "actuals" are single, detached-houses and the
10 "predicted" are all housing units, there cannot be an exact one-to-one match.
11 What we are looking for is the tendency of actual locations to lie where BCPM
12 predicts them to be.
13

14 For example, 62% of actual locations are within 3 miles of the central office. The
15 comparable figure for BCPM's predicted housing unit locations is 66%. At 10
16 miles, the percentages are 86 and 88. Moreover, the simple correlation between
17 the actual house counts and BCPM's predicted housing unit counts across the
18 rings is 0.99. Hence, BCPM's customer location methodology, using this
19 benchmark, accurately identifies the actual distribution of customers within this
20 wire center.
21

22 Q. DID YOU PERFORM A SIMILAR EVALUATION OF THE HAI CUSTOMER
23 LOCATION METHODOLOGY?

24 A. No. BellSouth requested in discovery that AT&T provide the customer location
25 data necessary to perform this analysis. AT&T claimed that the information is

1 proprietary and refused to produce it. Thus, AT&T has refused to provide the
2 data needed to conduct a comparable test of the Hatfield model.
3

4 Q. WHAT IS YOUR OVERALL ASSESSMENT OF THE BCPM CUSTOMER
5 LOCATION METHODOLOGY?

6 A. Since the rate of address-geocoding is extremely low in the areas of primary
7 interest for universal service, most, if not all, customer locations must be
8 estimated in the low-density areas. Using road information is a logical approach
9 for estimating customer locations. Not only is the relationship between Census
10 Block road mileage and housing unit counts empirically verifiable but the
11 methodology is based on a comprehensive database. That is, road data are
12 reasonably complete for every Census Block in the country. Address databases
13 are not.

14
15 Moreover, the soundness of BCPM's approach has been validated by comparing
16 the customer locations predicted by the BCPM model with real-world customer
17 locations. As presented above, such a test of BCPM's road-based methodology
18 indicates that it effectively predicts the actual distribution of houses, as a related
19 to distance from the central office, in the Yankeetown wire center.

20
21 **III. CUSTOMER AGGREGATION**

22
23 Q. HOW DO THE COST PROXY MODELS USE THE CUSTOMER LOCATION
24 INFORMATION?

25 A. The next step in the modeling process is to aggregate customers into telephone

1 serving areas. These serving areas are the fundamental units that are served by the
2 wire-based network. A brief presentation of the models' aggregation process is
3 necessary as it bridges my discussion of the customer location and distribution
4 plant methodologies.

5
6 **A. HAI 5.0a Customer Aggregation Methodology**

7 **Q. HOW DOES HAI 5.0a FORM ITS TELEPHONE SERVING AREAS?**

8 **A.** Once the address-geocoded and surrogate customer locations are determined, a
9 process developed by PNR and Associates (PNR) determines clusters of
10 customers. This process is described in the HAI Model Documentation in section
11 5.5. The documentation indicates that there are several criteria used to determine
12 the ultimate size of a cluster. These stated criteria are: (1) no point in a cluster
13 may be more than 18,000 feet distant (based on right angle routing) from the
14 cluster's centroid; (2) no cluster may exceed 1,800 lines in size; and, (3) no point
15 in a cluster may be farther than two miles from it's nearest neighbor. The end
16 result of this process is a set of irregularly shaped polygon clusters.

17
18 **Q. WHAT ARE OUTLIER CLUSTERS?**

19 **A.** The process described above applies to the "main" clusters, which consist of 5 or
20 more locations. PNR also identifies very small clusters, called outlier clusters,
21 which consist of 4 or less locations. These outlier clusters are "homed" on a
22 parent main cluster and are strung together in HAI 5.0a by T1 road cable. In
23 BellSouth's Florida service territory, there are 5,948 main clusters and 210 outlier
24 clusters. The main clusters account for 99.99% of the locations and 99.99% of the

1 lines identified by HAI 5.0a.

2

3 In the discussion that follows, "serving areas" in HAI 5.0a are synonymous with
4 "main clusters."

5

6 Q. VISUALLY, WHAT DO THE PNR POLYGON CLUSTERS LOOK LIKE?

7 A. Given that AT&T refused to provide BellSouth the necessary data when it was
8 requested through the discovery process, it is not possible to graphically depict the
9 actual PNR polygon clusters for a wire center in Florida.

10

11 B. **BCPM 3.1 Customer Aggregation Methodology**

12

13 Q. PLEASE BRIEFLY REVIEW BCPM'S CUSTOMER AGGREGATION
14 METHODOLOGY?

15 A. Once housing units and business lines are allocated among the microgrids in a
16 wire center, microgrids (along with the estimated locations within each microgrid)
17 are aggregated into telephone Carrier Service Areas (CSAs), referred to as
18 "ultimate grids." Ultimate grids range in size from a single microgrid (in the
19 high-density areas) to approximately 12,000 feet by 14,000 feet, roughly 6 square
20 miles, in the low-density areas.

21

22 In rural, low-density areas, a BCPM ultimate grid situated away from the edge of
23 the wire center is typically a rectangle that is 8 contiguous microgrids wide by 8
24 contiguous microgrids tall.

1

2 Q. VISUALLY, WHAT DOES THE BCPM 3.1 ULTIMATE GRID NETWORK
3 LOOK LIKE?

4 A. Exhibit KDD-10 shows the Yankeetown wire center with actual locations,
5 overlaid with the BCPM ultimate grids. Also shown is the number of housing
6 units predicted to reside in each ultimate grid. There are 51 ultimate grids in this
7 wire center. The maximum sized grid is 8.3 square miles. BCPM 3.1 places
8 2,392 housing units (1,865 households) in this wire center and 350 business
9 locations.

10

11 Q. ONCE "ULTIMATE GRIDS" ARE FORMED, HOW ARE CUSTOMER
12 LOCATIONS TREATED WITHIN THE ULTIMATE GRID?

13 A. Customers are still located within the ultimate grid in the microgrids to which
14 they were originally assigned.

15

16 Q. HOW DOES THE BCPM CUSTOMER AGGREGATION METHODOLOGY
17 DIFFER FROM THAT USED BY HAI 5.0a?

18 A. The PNR methodology is a "nearest neighbor" methodology whereby a cluster is
19 formed from the "bottom up." Distance to the nearest neighbor is a primary guide
20 in this process. The BCPM methodology starts with a macrogrid, a 1/25th of a
21 degree latitude and longitude grid consisting of, at the most, 64 microgrids, and
22 seeks to determine if this area can be broken into smaller serving areas. Hence,
23 the BCPM methodology is a "top down" approach. Density, or concentrations of
24 lines, is the primary guide in the BCPM process. Both methodologies yield
25 serving areas of varying sizes, with larger areas serving the lower-density zones.

1

2 **V. DISTRIBUTION PLANT ESTIMATION**

3

4 Q. WHAT IS THE NEXT STEP IN THE MODELING PROCESS ONCE
5 CUSTOMERS ARE AGGREGATED INTO SERVING AREAS?

6 A. The next step is to design a distribution network to serve these areas from the
7 current location of the central office. My focus in this section is on whether the
8 models estimate enough "distribution" plant to serve customers in the locations
9 assumed by the models

10

11 **A. HAI 5.0a Distribution Distance Estimation**

12 Q. HOW DOES HAI 5.0a ESTIMATE THE AMOUNT OF DISTRIBUTION
13 CABLE DISTANCE NEEDED TO SERVE CUSTOMERS IN THE
14 LOCATIONS WITHIN THE PNR POLYGON CLUSTERS?

15 A. This is a multiple step process. The first step is a transformation of the irregularly
16 shaped PNR polygon clusters into rectangles. The second step is placement of
17 customers within these rectangles. The last step is the design of a branch and
18 backbone network to serve these customers.

19

20 Q. HOW DOES HAI 5.0a TRANSFORM THE PNR CLUSTERS?

21 A. HAI 5.0a converts PNR's irregular polygons into the model's rectangular serving
22 areas in two steps. First, for each of PNR's polygon clusters, HAI 5.0a forms a
23 "minimum bounding rectangle," a rectangle that exactly bounds the cluster's
24 "convex hull," by enclosing the polygon's four most northerly, southerly, easterly

1 and westerly coordinates. (See Exhibit KDD-11 for an illustration.) This
2 minimum bounding rectangle has a North-South, East-West orientation.

3
4 Next, HAI 5.0a converts each minimum bounding rectangle into an "equivalent-
5 area" rectangle. The model performs this second step by forming a rectangle with
6 the same area as the underlying PNR polygon cluster but with the "aspect ratio" of
7 the minimum bounding rectangle. An aspect ratio is the ratio of a rectangle's
8 height to its width. HAI 5.0a uses the resulting equivalent-area rectangles as the
9 telephone serving areas *internal to HAI 5.0a*. That is, these are the areas to which
10 the HAI model "builds plant."

11
12 Q. WHAT DO THE MAIN, "EQUIVALENT-AREA" RECTANGULAR
13 CLUSTERS LOOK LIKE IN FLORIDA?

14 A. Exhibit KDD-12 shows the Yankeetown wire center and the rectangular clusters
15 as derived from the cluster Access database accompanying HAI 5.0a. In this wire
16 center, HAI 5.0a assumes there are 15 main clusters and 3 outlier clusters.
17 Ninety-nine point eight percent of the locations assumed to exist in this wire
18 center are placed into the main clusters. The largest main cluster is 13.8 square
19 miles. In the State as a whole, the largest HAI 5.0a cluster is 20.2 square miles in
20 size.

21
22 Q. ONCE THE RECTANGULAR MAIN CLUSTERS ARE FORMED, FOR
23 MODELING PURPOSES, HOW ARE CUSTOMERS LOCATED WITHIN
24 EACH RECTANGULAR CLUSTER?

25 A. HAI 5.0a assumes that customer lots are, essentially, evenly distributed within

1 each cluster.

2

3 Q. HOW DOES HAI 5.0a DESIGN THE DISTRIBUTION NETWORK WITHIN
4 THE MAIN, RECTANGULAR CLUSTERS?

5 A. Distribution plant is modeled in a simple branch and backbone configuration.
6 HAI 5.0a assumes customer lots are essentially evenly distributed within each
7 main cluster. Each lot is assumed to be twice as tall as it is wide. The size of
8 each lot is simply the area of the polygon cluster divided by the number of
9 locations. If the model determines that more than one DLC is needed, then
10 connecting cable is also placed to connect the centroid of the main cluster (where
11 the subfeeder terminates) with the DLCs.

12

13 Q. DO THE EQUIVALENT-AREA, RECTANGULAR MAIN CLUSTERS
14 CONTAIN ANY INFORMATION ON THE LOCATION OF THE ADDRESS-
15 GEOCODED AND SURROGATE LOCATIONS USED TO DEFINE THE PNR
16 POLYGON CLUSTERS?

17 A. No. The equivalent-area rectangles are a modeling tool used by HAI 5.0a to
18 estimate the amount of distribution cable needed to serve customers in the
19 locations within the associated PNR polygon clusters. The address-geocoded and
20 surrogate locations are used only in the determination of the PNR polygon
21 clusters. Once the shape and area of the PNR polygon clusters are determined, the
22 information on the geocoded and surrogate locations is no longer used by HAI
23 5.0a.

24

25 A visual representation may help. KDD-13, Figure 2 shows a stylized PNR

1 polygon cluster (on the left) with 19 locations spatially located. Information on
2 the exact spatial placement (by PNR) of these 19 locations is not provided in the
3 HAI 5.0a Access database nor is information on the shape of the polygon cluster
4 provided. We only know that there are 19 locations associated with this cluster as
5 well as the area, location, and dimensions of the equivalent-area rectangle. What
6 is provided in the HAI 5.0a Access database is the corresponding equivalent-area
7 rectangle shown in Figure 2 (on the right).
8

9 Q. DO YOU HAVE A CONCERN WITH HOW THESE EQUIVALENT-AREA
10 RECTANGULAR CLUSTERS ARE FORMED?

11 A. Yes, since these rectangles are used in the determination of distribution plant
12 distances. The concern with these rectangular clusters is that, although the actual
13 sizes and shapes of the underlying (polygon) clusters are not revealed, the
14 equivalent-area rectangles can bear little relationship to the underlying shape of
15 the PNR polygon cluster. Exhibit KDD-11 discusses this in detail.
16

17 Q. WHY IS IT AN ISSUE IF THE RECTANGULAR CLUSTER BEARS LITTLE
18 RESEMBLANCE TO THE SHAPE OF THE UNDERLYING PNR CLUSTER?

19 A. The concern is that the transformation process can effectively result in a reduction
20 of customer dispersion. That is, the dispersion of customers *assumed* for
21 estimating distribution distances can be less than the level of dispersion that
22 occurs in the underlying PNR polygon cluster. The result is that HAI 5.0a can
23 estimate too little distribution distance to connect customers in the locations
24 within the PNR clusters.
25

1 Q. CAN YOU PROVIDE A VISUAL DEMONSTRATION OF THIS ISSUE?

2 A. Certainly. KDD-13, Figure 3 shows a cluster of customer locations, some
3 geocoded, some surrogate. This polygon cluster is transformed by HAI 5.0a into
4 a rectangle that is used in the estimation of distribution plant. Although HAI 5.0a
5 constrains the area of the rectangular cluster to the area of the PNR polygon
6 cluster, the resulting rectangular cluster may bear little resemblance to the shape
7 of the underlying PNR polygon cluster of customer locations. The original
8 customer locations as well as the original distance between these locations are not
9 preserved in the transformation process.

10

11 Q. DO YOU HAVE A CONCERN WITH THE HAI 5.0a DISTRIBUTION
12 NETWORK DESIGN WITHIN THE MAIN RECTANGULAR CLUSTERS?

13 A. Yes. There is an assumption that reinforces the effect on the estimated
14 distribution distance caused by the compression of customer dispersion discussed
15 above. This assumption concerns the placement of the branch and backbone cable
16 within the main rectangular clusters.

17

18 After producing the customer lots, HAI 5.0a places backbone distribution cable
19 vertically and branch cable horizontally. Because branch and backbone cable
20 extends to within one lot width (depth) from each rectangle's boundary, low-
21 density rectangles are characterized by locations (i.e., structures) that must be
22 compressed around the interior lots in order to be reached. Now this is not a
23 problem in clusters that are densely populated. However, in sparsely populated
24 clusters, the assumed lots are very large and the compression around the interior
25 lots is much greater. The total effect of the transformation process coupled with

1 this assumption concerning branch and backbone length is a tendency to
2 underestimate the distribution distance. Again, Exhibit KDD-11 illustrates how
3 this underestimation can occur.
4

5 Q. WHAT MEASURE CAN BE USED TO QUANTIFY THE EXTENT TO
6 WHICH THE HAI 5.0a UNDERSTATES DISTRIBUTION DISTANCE?

7 A. The Minimum Spanning Tree ("MST") can be used to provide an appropriate
8 lower bound for quantifying customer dispersion. The MST is the most
9 conservative measure of the minimum distance required to connect all customer
10 locations. As such, it provides a measure of customer dispersion.

11
12 Simply, the MST of a set of points is that set of connecting line segments whose
13 total length is the *shortest possible* for this set of points. The attached paper,
14 "Using Minimum Spanning Trees to Estimate Subscriber Dispersion and
15 Minimum Network Length" (Exhibit KDD-14) provides further rationale for the
16 usefulness of the MST. The attached paper also provides a step-by-step example
17 of how a MST is calculated.
18

19 Q. IN REALITY, ARE NETWORK DISTRIBUTION DISTANCES LIKELY TO
20 EXCEED THE MST DISTANCE?

21 A. Yes, for the simple reason that actual distribution distances likely exceed the MST
22 distance. For example, actual distribution paths must adhere to rights of way
23 (e.g., streets). The MST ignores any such constraints and simply measures the
24 shortest way to connect houses with a straight line. As such, a MST segment will
25 traverse straight across a lake rather than follow a road around the lake to reach

1 the other side.

2

3 Q. CAN YOU PROVIDE AN ANALOGY TO HELP EXPLAIN THE MST
4 CONCEPT?

5 A. Yes. Suppose that an interstate highway is to be constructed directly between
6 Gainesville and Jacksonville. We know that as the crow flies, the aerial distance
7 between these two cities is approximately 65 miles. Clearly, the constructed
8 interstate that connects these two cities cannot be shorter than 65 miles. If it were
9 then cars would have to "fly" over the gaps in the highway. Realistically, the
10 amount of interstate highway distance constructed would be greater than the
11 "crow" distance as natural barriers, rights-of-way, and other obstacles would have
12 to be factored into the routing of the highway.

13

14 Hence, the MST distance should be considered as a "reality check," not as the
15 amount of distribution distance that a model should estimate. A model should
16 estimate a distribution distance that *exceeds* the MST distance.

17

18 Q. SHOULD THE MINIMUM SPANNING TREE DISTANCE BE CONSIDERED
19 A 'LOWER BOUND' FOR A REQUIRED AMOUNT OF DISTRIBUTION
20 DISTANCE?

21 A. The MST should not be considered as a "lower bound" for a required amount of
22 distribution distance. Such a lower bound likely *exceeds* the MST for the reason
23 given above. Our analysis is based on the premise that if a model's calculated
24 distribution distance is less than the MST distance, then it is less than the

1 minimum distance required for a functional distribution network.

2

3 Q. IS IT TRUE THAT THE MST DISTANCE MAY NOT BE THE SHORTEST
4 DISTANCE CONNECTING A SET OF POINTS?

5 A. Theoretically speaking, yes. By adding points (nodes) one *may* be able to reduce,
6 under certain conditions, the distance needed to connect the original set of points.
7 However, in most cases of interest, i.e., *greater than 5 locations*, it is very
8 difficult to find a connecting distance that is less than the MST distance. Exhibit
9 KDD-15 discusses this in more detail.

10

11 Q. DOES THE MST TEST THAT YOU ARE PROPOSING CONSIDER ACTUAL,
12 I.E., "REAL-WORLD," CUSTOMER LOCATIONS?

13 A. No. It is important to realize that the test I am proposing is one for examining
14 whether HAI 5.0a estimates enough distribution cable distance to connect the
15 customers in the locations *assumed by HAI 5.0a, i.e., in the PNR clusters*, not in
16 their "real-world" locations. A *comprehensive* database on the real-world
17 locations of *all* customers is *not* available. Hence, this is a test of a model's
18 "internal consistency."

19

20 Q. DID YOU USE THE MST TO DETERMINE IF HAI 5.0a UNDERESTIMATES
21 DISTRIBUTION DISTANCE FOR BELL SOUTH'S FLORIDA SERVICE
22 TERRITORY?

23 A. Yes. We first calculated the MST distance for each PNR irregular polygon falling
24 within BellSouth's wire centers in Florida. The MST distance represents the

1 minimum distance required to connect the geocoded and surrogate coordinates
2 encompassed by each polygon. For each *corresponding* equivalent-area,
3 rectangular main cluster formed by HAI 5.0a, we then compared the MST
4 distance with the distribution route distance calculated by HAI 5.0a. In making
5 this comparison, we added drop lengths and connecting cable lengths to the
6 distribution route distance calculated by HAI 5.0a.

7
8 Q. DID YOU ACQUIRE THE COORDINATES FOR THE GEOCODED AND
9 SURROGATE LOCATIONS FROM THE ACCESS DATABASE THAT
10 ACCOMPANIES HAI5.0a?

11 A. No. As discussed earlier, the Access database that accompanies the HAI model
12 does not contain any information on the original locations in the PNR polygon
13 clusters. A data request was made of AT&T to obtain the MST distance, based on
14 a program supplied to AT&T by StopWatch Maps. We received for each HAI
15 5.0a cluster the MST distance, but was not provided any geocoded or surrogate
16 locations.

17
18 Q. HOW ARE YOU DEFINING "UNDERSTATEMENT OF DISTRIBUTION
19 DISTANCE"?

20 A. An understatement or "shortage" occurs if the MST distance is greater than the
21 distribution route distance calculated by HAI 5.0a. Again, this does not imply
22 that the MST is a lower bound for a required amount of distribution distance. It
23 simply means the model is not providing for enough distribution distance to
24 connect all the customer locations identified by PNR in the underlying polygon
25 cluster *using the shortest distance configuration that is theoretically possible.*

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Q. WHAT DID YOUR CALCULATIONS OF THE PERTINENT MINIMUM SPANNING TREES REVEAL?

A. Using the HAI 5.0a default drop lengths, we calculated the difference between the MST distance and the distribution route distance calculated by HAI 5.0a for each main cluster. Table 9 presents a summary of our findings, again by density zone. Table 9 shows the cumulative amount by which the HAI 5.0a calculated distribution route distance falls short of the MST distance ("shortage"), the cumulative MST for the clusters that are short, the average shortage, the number of main clusters that are short, the number of main clusters in each density zone, and the percentage of main clusters that are short.

HAI 5.0a does not use the 5 - 20 and 20 - 100 density zones but considers only the aggregate 5 - 100 density zone. To provide greater detail for low-density areas, we provide data for these two subcategories.

**Table 9. HAI 5.0a Distribution Route Distance Understatement:
 Default Drop Lengths, BellSouth Florida**

Data for Only Main Clusters That Are Short

DZ	HAI MC Dist Route Feet Shortage	MST for Short MC	% Short	Number of MC Short	Number of MC in DZ	Number of MC Short in LZ (%)
< 5	2,784,877	6,569,067	42.39%	136	157	86.62%
5 - 20	4,491,981	15,795,651	28.44%	265	396	66.92%
20 - 100	1,793,590	7,124,473	25.18%	142	415	34.22%
100 - 200	300,093	1,384,879	21.67%	31	227	13.66%

200 - 650	192,303	687,053	27.99%	32	604	5.30%
650 - 850	10,600	46,356	22.87%	5	216	2.31%
850 - 2,550	163,312	1,099,637	14.85%	43	1,491	2.88%
2,550 - 5,000	64,046	624,884	10.25%	31	1,376	2.25%
5,000 - 10,000	35,165	291,621	12.06%	24	832	2.88%
> 10,000	18,648	130,309	14.31%	15	234	6.41%
<hr/>						
	9,854,415	33,753,930	29.19%	724	5,948	12.17%

1 As Table 9 indicates, HAI 5.0a significantly underestimates the required distance
2 to simply connect the customers, as the crow flies, to the network. The
3 understatement by HAI 5.0a of distribution distance is greatest in the lower
4 density areas, specifically, zones with fewer than 20 lines per square mile.
5 Generally, the understatement declines as density rises. Estimated distribution
6 distances that are short of the MST distance characterize 87% of the main clusters
7 in the lowest density zone. This shortage in the lowest density zone is, on
8 average, 42%. For BellSouth's entire Florida service territory, HAI 5.0a
9 understates distribution distance by at least 9.9 million feet (1,866 miles) using
10 the HAI 5.0a default drop lengths.

11
12 Q. IS IT LIKELY THAT THE PLACEMENT OF SURROGATE LOCATIONS ON
13 THE PERIMETERS OF CENSUS BLOCKS LEADS TO AN
14 OVERSTATEMENT OF THE MST DISTANCES FOR THE PNR POLYGON
15 CLUSTERS?

16 A. No. Exhibit KDD-6 shows that a placement of locations on interior and boundary
17 roads can lead to greater dispersion than placement just on the Census Block
18 perimeter. Hence, this counters the argument that the MST distances calculated

1 for the PNR clusters are "too long," and the shortage in distribution distance is
2 overstated, because of the location of the surrogate points along the perimeter of
3 the Census Block boundaries.
4

5 Q. IS IT MORE APPROPRIATE TO FOCUS ON THE GROSS SHORTAGE OR
6 NET SHORTAGE IN DISTRIBUTION DISTANCE?

7 A. It is more appropriate to focus on the gross shortage in distribution distance.
8 First, a definition of terms is in order. A gross shortage is the total shortage that
9 occurs across main clusters when only the distribution distance shortages are
10 added together. A net shortage is the total shortage that occurs when both
11 shortages and "surpluses" are added together across main clusters.
12

13 Now, the shortage in one cluster (for which the MST distance exceeds the
14 distribution distance calculated by HAI 5.0a) cannot be offset by another cluster
15 for which the opposite is true. There are two reasons. First, the MST is not a
16 "lower bound" distribution distance for a functional network. Second, and more
17 fundamentally, distribution cable is not fungible across distribution areas.
18 Because a *physical* network is being modeled, 100 feet of distribution distance
19 beyond the MST amount in cluster X cannot be used to offset a 100 feet
20 deficiency in distribution distance in cluster Y. Each and every cluster should
21 have an appropriate amount of distribution distance so that *everyone* on the
22 modeled network can "talk," not just the "average" customer.
23

24 Q. BUT IF THE OBJECTIVE IS A COST ESTIMATE, THEN WHY DOES IT
25 MATTER THAT THE MODEL IS SHORT IN SOME CASES IF THERE ARE

1 POSSIBLE OFFSETS ELSEWHERE IN THE MODEL?

2 A. First, there has been no quantification of any offsets in HAI 5.0a. A *quantified*
3 shortage cannot be offset by a *speculated* overestimation. Second, from a
4 modeler's perspective, an identified error in the model should be fixed. This is
5 true whether it results in an under- or overestimation. This is particularly true
6 considering the use that will be made of the model selected, the identification of
7 high cost areas. The Hatfield proponents have suggested, in affect, that
8 overestimation of costs in each area will somehow average out. This is patently
9 inconsistent with the development of a fund to support Universal Service in high
10 cost areas. This process requires that cost be accurately determined for each high
11 cost area.

12
13 Q. WHAT IS YOUR OVERALL ASSESSMENT OF THE HAI 5.0a
14 DISTRIBUTION DISTANCE ESTIMATION METHODOLOGY?

15 A. The methodology can clearly result in too little distribution distance being
16 estimated by the model. That is, in many cases, the HAI model does not estimate
17 enough distribution distance to connect customers in the locations assumed by the
18 model. This underestimation is the most severe in the low-density areas, the areas
19 of concern for universal service purposes. Hence, the model is not internally
20 consistent. A MST check should be included as part of the distribution distance
21 estimation methodology.

22
23 B. **BCPM Distribution Distance Estimation**

24 Q. HOW DOES BCPM 3.1 ESTIMATE THE AMOUNT OF DISTRIBUTION

1 CABLE DISTANCE NEEDED TO SERVE CUSTOMERS IN THEIR
2 MICROGRID LOCATIONS WITHIN THE BCPM SERVING AREAS?

3 A. BCPM employs two modeling tools in this estimation. First, each ultimate grid is
4 divided into 4 potential "distribution quadrants," with the "cross hairs" being at
5 the road-centroid of the ultimate grid. Subfeeder then extends into each ultimate
6 grid to the road-centroid of the ultimate grid. In low-density areas, this is where
7 the DLC is located. Horizontal and vertical connecting cable extend from the
8 DLC to each *populated* distribution quadrant of the ultimate grid. The connecting
9 cable terminates at the road-centroid of each populated distribution quadrant.

10
11 Q. HOW IS THE AMOUNT OF BRANCH AND BACKBONE CABLE
12 DISTANCE NEEDED TO SERVE THE CUSTOMERS IN EACH POPULATED
13 DISTRIBUTION QUADRANT DETERMINED?

14 A. This is determined with the aid of another modeling tool. An area equal in size to
15 1,000' times the amount of road mileage within a populated distribution quadrant
16 is conceptualized. This area is assumed to be a square consisting of equal sized
17 customer lots. Branch and backbone cable is then "laid" to serve each lot.

18
19 Q. HAVE YOU APPLIED THE MST REALITY TEST TO BCPM IN FLORIDA?

20 A. Yes, I have. I performed a test on BCPM 3.1 for BellSouth's service territory in
21 Florida. The relevant unit of analysis in BCPM 3.1 is the Carrier Serving Area or
22 "ultimate grid." The MST is computed for each ultimate grid based on the
23 assumption that customer locations are evenly distributed along roads.

24
25 Q. HOW SHOULD THE TERM "DISTRIBUTION" BE USED TO ANALYZE

1 BCPM'S DISTRIBUTION NETWORK USING THE MST TEST?

2 A. The issue is whether BCPM is estimating enough cable distance to connect
 3 customers to each other *and* to the network. Hence, "distribution" cable should
 4 include all cable on the customer's side of the subfeeder termination point in the
 5 serving area, i.e., ultimate grid. This distance includes branch, backbone, drop,
 6 and connecting cable distance. For the purpose of the MST test, connecting cable
 7 is always defined as "distribution" cable regardless of the location of the FDI.

8
 9 Q. WHAT ARE YOUR FINDINGS FOR BCPM?

10 A. The findings are presented in Table 10.

11
 12 **Table 10. BCPM 3.1 Distribution Route Distance Understatement:**
 13 **Default Drop Lengths BellSouth Florida**

14 Data for Only Grids That Are Short

DZ	BCPM Dist Route Feet Shortage	MST for Short Grids	% Short	Number of Grids Short	Number of Grids in DZ	Number of Grids Short in DZ (%)
< 5	1,138,087	5,387,477	21.09%	256	806	31.76%
5 - 20	621,726	3,991,302	15.58%	106	703	15.08%
20 - 100	349,609	770,058	45.40%	22	751	2.93%
100 - 200	82,343	205,984	39.98%	8	536	1.49%
200 - 650	86,867	177,997	48.80%	12	1,931	0.62%
650 - 850	18,399	19,563	94.05%	4	836	0.48%
850 - 2,550	109,886	224,708	48.90%	16	4,975	0.32%
2,550 - 5,000	9,634	35,370	27.24%	4	1,223	0.33%
5,000 - 10,000	26,507	26,507	100.00%	1	40	2.50%
> 10,000	12,958	12,958	100.00%	1	5	20.00%

2,454,018 10,851,924 22.61% 430 11,806 3.84%

1

2 In Table 10, the data are for the ultimate grids for which the MST distance
3 exceeds the amount of distribution cable estimated by the model (i.e., "short"
4 grids). In addition, BCPM 3.1 does not use the 5 - 20 and 20 - 100 density zones
5 but considers only the aggregate 5 - 100 density zone. To provide greater detail
6 for low-density areas, we provide data for these two subcategories.

7

8 Q. WHAT DOES TABLE 10 SHOW?

9 A. In the areas of interest for universal service, i.e., the *two* lowest density zones, the
10 data in Table 10 show that BCPM 3.1 does not estimate enough distribution
11 distance to connect customers in their estimated locations in 24% of its ultimate
12 grids. Considering the entire BellSouth Florida service territory, BCPM's
13 estimated distribution distance falls short of the MST distance in 4% of the
14 ultimate grids. The total "shortage" is at least 2.5 million feet or 465 miles of
15 distribution distance.

16

17 Q. WHAT IS YOUR OVERALL ASSESSMENT OF BCPM'S DISTRIBUTION
18 DISTANCE ESTIMATION PROCESS?

19 A. The results indicate that BCPM is much more internally consistent than HAI 5.0a.
20 That is, BCPM more effectively estimates a minimum required distribution
21 distance (i.e., the MST distance) to connect customers in the locations estimated
22 by the model.

23

24 Q. CAN ONE COMPARE THE BCPM MST RESULTS WITH THOSE OF THE

1 HAI MODEL MST TEST?

2 A. Yes, but it is important that one keep in mind what the MST test represents. The
3 test is a test of a model's internal consistency, in other words, whether the
4 respective model does what it purports to do, assuming that one accepts its
5 particular modeling assumptions.

6
7 With respect to the HAI model, the test addresses whether the HAI model
8 estimates the minimum amount of cable distance, via the rectangular *main*
9 *clusters*, to connect customers in the locations identified by the model, i.e., in the
10 corresponding PNR *main clusters*.

11
12 With respect to BCPM, the test addresses whether BCPM estimates the minimum
13 amount of cable distance, via the road-reduced areas and connecting cable
14 configuration, to connect customers in the locations identified by the model, i.e.,
15 in the microgrids that comprise an ultimate grid.

16
17 Hence, the conclusion one can make is that BCPM is more internally consistent
18 than HAI 5.0a. That is, BCPM is much more likely to estimate the minimum
19 amount of distribution distance needed to connect customers in *its* serving areas,
20 i.e., ultimate grids, than is HAI 5.0a to connect customers in *its* serving areas i.e.,
21 main PNR polygon clusters.

22
23 Q. DO THE RELATIVE RESULTS OF THE TWO MODELS' MST TESTS
24 CHANGE IF THE DEFINITION OF A "SERVING AREA" IN THE HAI
25 MODEL IS EXPANDED TO INCLUDE THE ASSOCIATED OUTLIER

1 CLUSTERS?

2 A. Not substantially. Table 11 presents the results of the HAI MST test, in the same
 3 format as Tables 9 and 10, for HAI serving areas defined in this manner. As
 4 Table 11 indicates, the addition of the outlier clusters reduces by 0.89 million feet
 5 (169 miles or 9%) the total shortage for BellSouth's Florida territory. In the
 6 lowest density zone, < 5 lines per square mile, the share of "serving areas" that
 7 are short declines from 87% to 76%. The comparable figure for BCPM 3.1 (from
 8 Table 10) is 32%. Including outliers improves the HAI model's showing in this
 9 test because the T1 road cable distance between the outliers is estimated assuming
 10 rectangular routing while the MST is the straight-line distance.

11 **Table 11. HAI 5.0a Distribution Route Distance Understatement:**
 12 **Default Drop Lengths, Expanded Serving Area Definition,**
BellSouth Florida

13 Data for Only Serving Areas That Are Short

DZ	HAI SA Dist Route Feet Shortage	MST for Short SA	% Short	Number of SA Short	Number of SA in DZ	Number of SA Short in DZ (%)
< 5	2,314,677	6,789,656	34.09%	120	157	76.43%
5 - 20	4,016,334	15,756,075	25.49%	256	396	64.65%
20 - 100	1,697,531	6,980,288	24.32%	138	415	33.25%
100 - 200	295,974	1,360,514	21.75%	30	227	13.22%
200 - 650	187,645	740,964	25.32%	32	604	5.30%
650 - 850	19,973	137,864	14.49%	6	216	2.78%
850 - 2,550	250,752	1,380,601	18.16%	48	1,491	3.22%
2,550 - 5,000	80,714	661,603	12.20%	31	1,376	2.25%
5,000 - 10,000	35,185	291,621	12.06%	24	832	2.88%
> 10,000	64,757	176,762	36.64%	16	234	6.84%
	8,963,523	34,275,948	26.15%	701	5,948	11.79%

14
 15 **VIII. SUMMARY**
 16

1 Q. PLEASE SUMMARIZE THE MAIN POINTS OF YOUR REBUTTAL
2 TESTIMONY.

3 A. There are three points I wish to emphasize that pertain respectively to the Hatfield
4 models' customer location, customer aggregation, and provision of distribution
5 plant.

6
7 First, the rate of successful address-geocoding in the rural areas of Florida is very
8 low. In fact, not a single location could be geocoded in 25 wire centers in Florida.
9 HAI 5.0a relies on an estimation process for those locations that cannot be
10 address-geocoded. Due to the limited ability to address-geocode customers in
11 rural areas, HAI 5.0a's customer location methodology is reduced essentially to
12 placing customers along the perimeter of Census Blocks.

13
14 The proponents of the HAI model have not provided any quantitative analysis of
15 the predictive accuracy of the geocode-surrogate methodology relative to actual,
16 real-world customer locations. In comparison, it has been demonstrated in this
17 testimony that BCPM yields a reasonably accurate depiction of the distribution of
18 customers across the randomly chosen Yankeetown wire center.

19
20 Second, the degree to which a model uses address-geocoding needs to be
21 determined. For example the address-geocoded and surrogate locations are used
22 only to define the perimeter of the PNR polygon clusters in the HAI preprocessing
23 stage. Once these clusters are formed, the customer latitude and longitude
24 information is discarded. This information never enters the Access database used
25 by HAI 5.0a.

1
2 Third, a key validation test is whether the models estimate enough distribution
3 cable distance to at least connect customers, as the crow flies, in the locations
4 identified by the models.

5
6 Once customers have been located and aggregated into serving areas, HAI 5.0a
7 and BCPM use different modeling tools in the estimation of the distribution
8 distance needed to connect customers to each other and to the network. The focus
9 should not be on the assumptions behind these tools but on the estimated
10 distances that result from the application of these tools. Specifically, the focus
11 should be on whether the models estimate enough distribution cable distance to
12 connect customers in the locations identified by the models. In the case of HAI
13 5.0a, these are the geocoded and surrogate locations within the PNR polygon
14 clusters. In the case of BCPM 3.1, these are the microgrids within the ultimate
15 grids.

16
17 The minimum spanning tree (MST) test, offered in my testimony, is a test of a
18 model's internal consistency in this regard, i.e., whether it does what its purports
19 to do based upon its own modeling assumptions. When applied to HAI 5.0a and
20 BCPM 3.1, the test indicates that the HAI 5.0 contains a substantial shortfall. In
21 the lowest density zone, the model's estimated distribution distance (including
22 drop and connecting cable) is less than its MST distance in 87% of its main
23 clusters. For the same density zone, BCPM 3.1's estimated distribution distance
24 (including drop and connecting cable) is less than its MST distance in
25 substantially fewer ultimate grids. Overall, the HAI 5.0a shortfall totals at least

1 1,866 miles while that of BCPM totals at least 465 miles.

2

3 Q. DOES THIS CONCLUDE YOUR TESTIMONY?

4 A. Yes.

1 analysis and modeling. I served as an economist with the Utah Division of Public
2 Utilities where I directed the Division's analysis of telecommunications loop
3 costing models. As an economist with the Utah Office of Energy, I analyzed a
4 wide range of resource, energy, and electric utility issues.

5
6 I have a Ph.D. in economics from the University of Oregon; I have served as an
7 assistant professor at three universities; and, I am currently an adjunct professor in
8 the MBA program at Westminster College of Salt Lake City. I have authored or
9 co-authored 17 academic papers as well as numerous reports. I have attached my
10 curriculum vitae as Exhibit KDD-1.

11
12 Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

13 A. The purpose of my testimony is to respond to the second issue specified by the
14 Florida Public Service Commission regarding "the appropriate cost proxy model
15 to determine the total forward-looking cost of providing basic local
16 telecommunications service pursuant to Section 364.025(4)(b)." My testimony
17 describes several key features of the model that BellSouth is proposing the
18 Commission use to determine the cost of universal service in BellSouth's Florida
19 territory: the Benchmark Cost Proxy Model version 3.1 (BCPM 3.1). The task the
20 Commission faces is to determine if BCPM 3.1 can arrive at a reasonable estimate
21 of the forward-looking cost of universal service. In this regard, the Commission's
22 attention should be focused on three aspects of a cost proxy model: (1) how does
23 the model locate customers and how does it aggregate customers into telephone
24 service areas; (2) the engineering criteria that influence the design of the wireline
25 network "built" by the model; and, (3) the values for the literally hundreds of

1 user-adjustable inputs used by the model. Dr. Bowman's testimony addresses
2 item (2); Ms. Caldwell of BellSouth addresses item (3) in her testimony. My
3 testimony focuses on item (1). Specifically, I describe the key features of BCPM
4 3.1 pertaining to its customer location and customer aggregation methodologies.
5

6 Q. WHAT ARE YOUR PRIMARY FINDINGS AND CONCLUSIONS?

7 A. All cost proxy models that seek to arrive at a reasonable estimate of a
8 geographically disaggregated cost of basic local service face a fundamental
9 challenge. This challenge is to locate customers at the sub-Census Block level.
10 The U.S. Census reports housing unit counts at the Census Block level. However,
11 since Census Blocks can be quite large in the rural, low-density areas, areas of
12 particular interest in the universal service arena, further locating customers within
13 these potentially large areas is important. The exact spatial location, i.e., latitude
14 and longitude, of every potential telephone customer is not known. Hence,
15 BCPM uses an alternative methodology to geocoding. BCPM's customer location
16 methodology is based on the plausible assumption that customers tend to live on
17 or near a road. This assumption facilitates the use of a geographically
18 comprehensive road-network database provided by the U.S. Bureau of the Census.

19
20 In low-density areas, BCPM allocates Census Block level data across a Census
21 Block based on the amount of livable road mileage that occurs in each section of
22 the Census Block. The fundamental unit of analysis used by BCPM is called a
23 "microgrid," an area roughly the size of 4 by 3 typical city blocks. Each Census
24 Block is overlaid with a "fishing net" of these rectangular microgrid's. If a
25 particular microgrid has 10 % of the livable road mileage within its borders, then

1 10 % of the Census Block housing units are allocated to this microgrid. The end
2 result is a statistical distribution of customer locations. In other words, the
3 methodology yields the likely (*estimated*) location of customers.

4
5 Once customer locations are estimated in this manner, telephone serving areas are
6 formed by aggregating contiguous microgrids into larger areas. This aggregation
7 is governed by engineering network design criteria. The resulting serving areas,
8 or "ultimate grids," are also geographically comprehensive and rectangular in
9 shape. In the rural, low-density areas, the ultimate grids are typically
10 approximately 6 square miles in size. Some ultimate grids may be unpopulated,
11 to which BCPM does not "build" plant.

12
13 Once the serving areas are determined, BCPM then divides each ultimate grid into
14 quadrants. A modeling tool referred to as the "road-reduced area" is used to
15 estimate the amount of branch, backbone, and drop cable needed to serve each
16 populated quadrant. The amount of cable required to connect the road-centroid of
17 the ultimate grid, where the sub-feeder terminates, with the road-centroid of each
18 populated quadrant is also estimated.

19
20 In sum, the BCPM road-based methodology addresses the issue of how to
21 estimate customer locations when a complete set of data on exact customer
22 locations, i.e., latitudes and longitudes, does not exist. In addition, the
23 methodology used to aggregate these estimated locations into serving areas is
24 consistent with standard engineering design principles, as discussed by Dr.
25 Bowman, and is logically consistent. The estimated customer locations are

1 preserved spatially throughout the aggregation process. There is no
2 transformation of grids from one shape to another other than simply aggregating,
3 where appropriate, contiguous rectangles into a larger geographic area, that
4 corresponds to serving area. Moreover, customer locations are never moved.
5 Hence, the methodology used by BCPM facilitates its estimation of a reasonable
6 forward-looking cost of basic local service in Florida.

7
8 Q. HOW IS YOUR TESTIMONY ORGANIZED?

9 A. *Section II.* of my testimony provides a general description of a cost proxy model,
10 including key assumptions made by cost proxy models. *Section III.* provides an
11 overview of BCPM 3.1's customer location and aggregation algorithms.

12
13 Q. ARE THERE EXHIBITS TO YOUR TESTIMONY?

14 A. Yes. The following is a list of the exhibits that accompany my testimony:

15
16 KDD-1 Qualifications

17 KDD-2 Census Blocks in the Bunnell Wire Center, FL

18
19 Q. PLEASE BRIEFLY DESCRIBE THE HISTORY OF THE BCPM.

20 A. Two models, the Benchmark Cost Model 2 (BCM2) and the Cost Proxy Model
21 (CPM), are the direct predecessors of the BCPM. BCM2 was developed in a joint
22 effort by Sprint Corporation and U S WEST and was filed with the FCC on July
23 3, 1996, for consideration in CC Docket 96-45 (Federal-State Joint Board on
24 Universal Service). Pacific Telesis and INDETEC International developed the
25 CPM, which was filed with the FCC at the same time. The California Public

1 Utilities Commission in its universal service cost proceeding accepted the CPM.

2
3 The BCPM was initially designed to incorporate the best attributes of two models,
4 BCM2 and the CPM, and to add capabilities that did not exist in either of the
5 earlier models. *INDETEC* International was retained to aid in the development of
6 the BCPM as well.

7
8 **II. GENERAL DESCRIPTION OF A COST PROXY MODEL**

9
10 **Q. PLEASE DESCRIBE THE CHARACTERISTICS TYPICAL OF A COST**
11 **PROXY MODEL.**

12 **A.** The term "cost proxy model" has emerged only recently in the
13 telecommunications industry. There is, therefore, no precise definition of "cost
14 proxy model" in economics. In industry usage, the term has come to mean a
15 mechanism used to estimate the forward-looking economic cost of universal
16 service or unbundled elements. A cost proxy model for use in the universal
17 service arena is generally considered to have the following characteristics: (1) it
18 relies largely upon public information that is available nationwide; (2) many of its
19 key inputs can be modified; (3) its complexity does not preclude its application
20 nationwide; and, (4) it is generic enough so that it can estimate the forward-
21 looking cost of any company that chooses to be a universal service provider.

22
23 **Q. WHAT IS FORWARD-LOOKING ECONOMIC COST?**

24 **A.** Forward-looking cost represents the economic cost an efficient provider of
25 universal service would likely incur to serve the area in question, in this case,

1 BellSouth's Florida service territory. This cost is forward-looking in the sense
2 that it reflects the economic cost that would be incurred today if the wireline
3 network were rebuilt entirely. Hence, it relies on current market prices and
4 current, but proven, technology.

5
6 Q. HOW DOES A COST PROXY MODEL ARRIVE AT AN ESTIMATE OF THE
7 COST OF BASIC LOCAL SERVICE?

8 A. Conceptually, there are four steps in the estimation process. The first step is the
9 design of a new wireline telephone network to serve customers in their current
10 locations from central offices also in their current locations. This requires that
11 customers be spatially located, that customers be aggregated into telephone
12 serving areas, and that a feeder/sub-feeder network be designed to serve these
13 groupings of customers in an efficient manner, yet still adhere to the requirements
14 of the 1996 Telecommunications Act and of the Florida Commission.

15
16 The second step is the estimation of the investment needed to actually build such
17 a network from scratch. Such diverse items as the cost of poles, the investment
18 multiplier required when "difficult terrain" is encountered, and the cost of digital
19 switches are taken into account.

20
21 The third step is the application of factors, such as the rate-of-return, to the
22 estimated investment to yield the annual capital cost.

23
24 Finally, the fourth step is the estimation of the recurring costs, i.e. expenses,
25 associated with the operation of such a network.

1

2 Q. WHAT ARE SOME OF THE KEY ASSUMPTIONS MADE BY COST PROXY
3 MODELS?

4 R. One key assumption concerns the determination of customer locations. The
5 challenge faced by the cost proxy models is the spatial location of customers at
6 the sub-Census Block level. This is especially important in rural, low-density
7 areas where Census Blocks tend to be very large. Since information on the exact
8 latitude and longitude of customer locations is sparse for rural, low-density areas,
9 customer locations must be estimated. Hence the methodology used by the
10 models to estimate customer locations is important.

11

12 Another key assumption is the models' definition of "customer." In terms of
13 residential customers there are three possibilities: housing units, households, and
14 households who currently have telephones. Which definition is used depends on
15 the model developers' interpretation of what the FCC meant when it stated in
16 Criteria 6 of paragraph 250 of the FCC Universal Service Order, "The cost study
17 or model must estimate the cost of providing service for all businesses and
18 *households* within a geographic region." (italics added). Did the FCC mean
19 housing units that are currently occupied, which is the U.S. Census definition of
20 households? Did they mean all inhabitable structures (housing units)? Or did
21 they mean only households with current phone service? Which definition is used
22 affects the amount of plant "built" by the model, affects the economies of scale,
23 and, hence, affects the estimated cost of basic local service.

24

25 Another key assumption is the engineering criteria that govern the aggregation of

1 customers into serving areas and the design of the feeder/sub-feeder network
2 needed to serve these areas. These criteria are important for they affect whether
3 the network is capable of providing access to advanced services in both urban and
4 rural areas, as required by the 1996 Telecommunications Act, Section 254. Items
5 of design interest are the maximum length of copper loop beyond the digital loop
6 carrier (DLC) and the maximum number of lines per DLC.

7
8 A third key assumption, actually set of assumptions, are the values for the
9 hundreds of user-adjustable inputs. The user is allowed to specify values for a
10 wide range of items that can affect the model's estimated cost. For example, the
11 user can specify values for a wide range of items such as the cost of drop wire, the
12 cost of 200 pair cable, the activity-share of "cut and replace sod" in the
13 underground placement of cable in the 5 to 100 line per square mile density zone,
14 the cost of money, and the recurring cost of buried cable maintenance, to name
15 just a few.

16
17 Q. WITH RESPECT TO CUSTOMER LOCATION, WHY IS THE ACCURACY
18 OF A COST PROXY MODEL'S ABILITY TO LOCATE CUSTOMERS
19 IMPORTANT?

20 A. It is important that a cost proxy model locates customers with a reasonably high
21 level of accuracy because the size of the universal service fund and the
22 appropriate targeting of eligible recipients depend upon the degree of accuracy
23 with which customers are located. The more accurately customers are located,
24 the greater the accuracy in cost estimation across geographic areas. Thus, it is
25 essential that an evaluation of a cost proxy model include not only an assessment

1 of the relative accuracy of the cost proxy models in locating customers but also of
2 how these customers are then aggregated into telephone serving areas.

3
4 Q. AT WHAT LEVEL OF GEOGRAPHIC DETAIL SHOULD THE
5 CALCULATION BE PERFORMED?

6 A. Because costs vary substantially across geographic areas, the calculation should
7 be done with as much geographic specificity as possible, such as at the level of a
8 grid cell or a census block group or, at a minimum, a wire center. Traditional
9 Incumbent Local Exchange Carrier (ILEC) forward-looking economic cost studies
10 will be difficult or impossible to apply because they were generally designed to
11 reflect the costs for much broader geographic areas.

12
13 **III. BCPM 3.1'S CUSTOMER LOCATION AND AGGREGATION**
14 **ALGORITHMS**

15
16 **A. Some Basics**

17
18 Q. WHAT FUNDAMENTAL CHALLENGE DO COST PROXY MODELS FACE?

19 A. Cost proxy models that seek to estimate cost at geographically disaggregated
20 levels must locate customers with a reasonable degree of accuracy. The smallest
21 geographic unit for which U.S. Census data are available is the Census Block.
22 However, in the rural, low-density areas Census Blocks can be very large.

23
24 Q. WOULD YOU BRIEFLY EXPLAIN THE DISTINCTION BETWEEN
25 "CENSUS BLOCK GROUPS" AND "CENSUS BLOCKS"?

1 A. The U.S. Bureau of the Census has devised a tiered geographic reference system.
2 Starting at the state level, states are disaggregated into counties, which are further
3 disaggregated into census tracts. Census tracts usually have between 2,500 and
4 8,000 persons. They were originally designed to be homogenous with respect to
5 population characteristics and do not cross county boundaries. On average, there
6 are 28 Census Tracts in a county.

7
8 Census tracts are further disaggregated into Census Block Groups. A Census
9 Block Group is a collection of Census Blocks generally containing between 250
10 and 550 housing units, with an ideal size of 400 housing units. On average, there
11 are three Census Block Groups in a Census Tract.

12
13 The finest level of geography, for which Census data are provided, such as
14 housing units, is the Census Block. The U.S. Bureau of the Census defines
15 Census Blocks as "small areas bounded on all sides by visible features such as
16 streets, roads, streams, and railroad tracks, and by invisible boundaries such as
17 city, town, township, and county limits, property lines, and short, imaginary
18 extensions of streets and roads." On average, there are 31 Census Blocks in a
19 Census Block Group.

20
21 Q. HOW LARGE CAN CENSUS BLOCKS BE?

22 A. In urban areas, Census Blocks are fairly small. For example, in a downtown area
23 they tend to be 0.005 square miles in size. In a typical suburban area they tend to
24 be in the 0.5 to 1.0 square mile range. In rural areas, Census Blocks tend to be
25 much larger. Census Blocks as large as 60 square miles are not uncommon, with

20 square miles being more typical.

Q. HOW LARGE ARE CENSUS BLOCKS IN FLORIDA?

A. Table 1 shows U.S. Census Block data for Florida by density zone. The maximum size populated Census Block in Florida is 544 square miles. In the two lowest density zones, zero to 20 housing units per square mile, populated Census Blocks constitute approximately 5.3 % of the total populated Census Blocks and span 69 % of the total populated land area in Florida. In Florida, there are 98,285 unpopulated Census Blocks. A cost proxy model's customer location methodology for placing customers within a Census Block is much more critical in these rural, low-density areas.

Table 1. Florida Populated Census Blocks

Density (HU/sqmi)	CB Size (sqmi)		CB Counts		1995 Housing Units		CB Area	
	Maximum	Minimum	Number	%	Number	%	SQMI	%
< 5	543.62	0.20	3,965	1.81%	24,768	0.37%	16,322.10	43.79%
5 - 19	85.03	.05	7,721	3.52%	99,163	1.48%	9,401.10	25.22%
20 - 99	39.72	0.01	15,881	7.23%	267,125	3.96%	5,997.15	16.09%
100 - 199	23.62	0.01	11,003	5.02%	201,539	3.00%	1,428.38	3.83%
200 - 649	5.694	0.002	29,477	13.44%	669,637	9.99%	1,801.51	4.83%
650 - 849	3.37	0.001	10,362	4.72%	227,811	3.39%	371.27	1.00%
850 - 2549	3.25	0.0004	77,296	35.24%	2,060,259	30.57%	1,330.87	3.57%
2550 - 4999	0.97	0.0002	44,509	20.90%	1,529,693	22.81%	453.83	1.22%
5000 - 9999	0.41	0.0001	13,275	6.05%	622,800	12.27%	122.88	0.33%
> 10000	0.31	0.0000006	5,851	2.67%	814,858	12.15%	45.08	0.12%
Total	692.85	0	219,320		6,707,653		37,274.17	

Visually, the challenge faced by a cost proxy model is shown in Exhibit KDD-2. KDD-2 shows the Census Blocks in BellSouth's Bunnell wire center in Flagler County, Florida. The wire center is 18.7 miles wide (East-West) and 14.1 miles

1 long (North-South). In the more rural portions of the wire center (western
2 portion) the Census Blocks are much larger. The yellow-shaded Census Block in
3 Exhibit KDD-2 is 74.7 square miles in size and is 8.1 miles wide (East-West) and
4 10.6 miles long (North-South). U.S. Census data indicate that there are 164
5 housing units located in this Census Block. The challenge faced by a cost proxy
6 model is locating these 164 customers with reasonable accuracy within the 75
7 square mile area of this Census Block.

8
9 Q. WHAT LEVEL OF GEOGRAPHIC DISAGGREGATION DOES BCPM 3.1
10 USE?

11 A. BCPM 3.1 uses the Census Block as the starting point for its customer location
12 methodology. BCPM 3.1 utilizes 1990 Census Bureau housing unit data that have
13 been updated based upon 1995 Census statistics regarding population growth by
14 county. BCPM 3.1 also uses business line data obtained from PNR and
15 Associates (PNR) to assign businesses to Census Blocks. The U.S. Bureau of the
16 Census provides housing unit counts at the Census Block level.

17
18 The Census Block data is then allocated among a large number of small
19 geographic units within a Census Block called microgrids.

20
21 Q. WHY DOES BCPM 3.1 REJECT THE USE OF CENSUS BLOCK GROUP
22 DATA AS THE RELEVANT GEOGRAPHIC UNIT FOR LOCATING
23 CUSTOMERS AND DESIGNING A NETWORK?

24 A. Census Block Groups, while of similar population size, tend to be very large and
25 irregular in shape in rural, low-density areas. This leads to three problems. First,

1 such large areas make it difficult to reflect actual underlying population location
2 and population dispersion. Second, large Census Block Groups make it difficult
3 to aggregate accurately Census Block Groups to higher levels of geography, such
4 as wire centers. Consequently, using Census Block Groups to assign customers to
5 the appropriate wire center and the appropriate serving incumbent local exchange
6 carrier is problematic. Third, large irregular shaped Census Block Groups may
7 not readily correspond to meaningful telephone plant design areas.
8

9 Q. HOW DOES BCPM 3.1 DEFINE A RESIDENTIAL "CUSTOMER" IN TERMS
10 OF THE CENSUS DATA?

11 A. BCPM 3.1 defines a residential customer based on the U.S. Census designation of
12 housing units. Recall that housing units consist of both occupied and unoccupied
13 inhabitable structures, as opposed to households that consist of only occupied
14 inhabitable structures. The difference is important because BCPM 3.1 builds a
15 network to serve housing units. The developers of BCPM 3.1 believe that a sound
16 and proper cost model should reflect the costs to provide service to all housing
17 units, currently occupied or unoccupied. Because of its obligation to provide
18 timely service to customers, an ILEC must place facilities to serve all housing
19 units, not just those units that are occupied at one point in time. Any particular
20 housing unit is likely to be occupied at some points in time, and unoccupied at
21 other points in time. To assume otherwise requires costly new installation to serve
22 a previously unoccupied housing unit.
23

24 Q. WHAT IF THE COMMISSION DEEMED THAT IT IS MORE APPROPRIATE
25 FOR BCPM TO "BUILD" ONLY TO HOUSEHOLDS?

1 A. Although the assumption that a residential customer is a housing unit is integral to
2 the base BCPM 3.1 model, a module does exist that would allow the model to
3 "build" only to households if this is what the Commission deems is reasonable. In
4 addition (or alternatively), there is a "wireless cap" on loop investment. This cap
5 says that if the investment for any given loop exceeds a user-defined amount, that
6 loop cost would be capped at that amount assuming that in reality either some
7 other, less costly technology would be used or the customer would share in the
8 cost of installing the loop. This prevents the model from estimating too much
9 investment for housing units that are far removed from the central office.
10

11 Q. WHAT DATA DOES BCPM 3.1 USE TO ESTABLISH WIRE CENTER
12 BOUNDARIES?

13 A. BCPM 3.1 uses wire center boundaries provided by Business Location Research
14 (BLR).
15

16 Q. HOW DOES BCPM 3.1 ENSURE THAT CUSTOMERS ARE ASSIGNED TO
17 THE APPROPRIATE WIRE CENTER?

18 A. BCPM 3.1 ensures that customers are assigned to the appropriate wire center by
19 utilizing Census Block data. Those customers located in Census Blocks that fall
20 within the BLR wire center boundary are assigned to that wire center.
21

22 B. **Customer Location**
23

24 Q. WHAT KEY ASSUMPTION DOES BCPM 3.1 MAKE REGARDING THE
25 LOCATION OF CUSTOMERS WITHIN CENSUS BLOCKS?

1 A. BCPM 3.1 assumes that customers are located on or near roads and uses detailed
2 road-mileage information to allocate U.S. Census housing units counts within
3 Census Blocks. BCPM 3.1 attains greater precision than that obtained using
4 Census Block information alone, by using road data for both interior and
5 perimeter roads to place customers within the Census Block. The end result is a
6 statistical distribution of customer locations. In other words, the process yields
7 the *likely* (estimated) location of customers within a wire center.

8
9 Q. HOW DOES BCPM 3.1 ESTIMATE CUSTOMER LOCATIONS WITHIN A
10 CENSUS BLOCK?

11 A. The BCPM 3.1 customer location algorithm begins by partitioning the area of a
12 wire center into "microgrids," roughly 1,500 feet by 1,700 feet in size (i.e.,
13 roughly 1/10th of a square mile or 4 x 3 city blocks). Thus, each Census Block
14 within the serving wire center is overlaid with microgrids (unless the entire
15 Census Block falls within a single microgrid). In the rural areas of the wire
16 center, the allocation of customer locations is based on the road network, the
17 location of which is known in every Census Block. Census Block housing units
18 are apportioned to microgrids based on the share of the Census Block's road
19 mileage that occurs in a given microgrid.

20
21 In fact, there are actually two methodologies for allocating housing units to
22 microgrids used in BCPM 3.1. For Census Blocks greater than 0.25 square miles
23 in area, relative road lengths are used. For small Census Blocks, housing units are
24 apportioned based on the land area of the microgrid relative to the Census Block's
25 total area. Since large Census Blocks characterize rural areas, the road

1 methodology applies to rural areas.

2

3 Q. WHAT IS THE SOURCE OF THE ROAD DATA USED TO ALLOCATE
4 CUSTOMERS TO THE MICROGRIDS?

5 A. The 1994 U.S. Census Topologically Integrated Geographic Encoding (TIGER)
6 files form the foundation for the road database. The 1994 TIGER files use the
7 NAD27 datum unit, which corresponds to the datum unit used in the BLR wire
8 center boundaries data. This is important for ensuring that the BCPM customer
9 location process, which is based on locations of roads, is consistent with the
10 boundaries of wire centers. The BCPM developers made a determination as to
11 which of the TIGER road types people are likely to live and work along. This
12 subset of the TIGER data was then used in the customer allocation process.

13

14 Q. WHAT TYPES OF ROADS WERE INCLUDED AND WHICH TYPES OF
15 ROADS WERE EXCLUDED?

16 A. Examples of an included road type are a neighborhood street and state highway.
17 Examples of road types that were excluded are four-wheel drive dirt roads, access
18 ramps, limited access highways, and any road type that is in a tunnel or is an
19 underpass.

20

21 Q. IS THERE ANY EMPIRICAL EVIDENCE TO SUPPORT THE ASSUMPTION
22 THAT CUSTOMERS TEND TO BE LOCATED ALONG ROADS?

23 A. Yes. Causal observation suggests that this is true. In addition, if one examines
24 the relationship between the number of housing units in a Census Block and the
25 total road miles in a Census Block, one will find a reasonably high correlation.

1 Table 2 presents the correlation between housing units and road mileage for
2 Florida, Kentucky, and Mississippi for four density zones less than 200 housing
3 units per square mile.

4 **Table 2. Census Block Road Mile - Housing Unit Correlation**

Density Zone	Florida	Kentucky	Mississippi
0 - 5	0.69	0.78	0.68
5 - 20	0.66	0.86	0.81
20 - 100	0.87	0.93	0.87
100 - 200	0.91	0.93	0.92

5
6 The correlation is always positive, and indicates a strong association between
7 housing unit locations and road miles. A measure of correlation ranges between --
8 1 and +1. Values that approach either extreme indicate a strong association, either
9 directly (positively) or inversely (negatively).

10
11 It should be noted that the road miles used in this analysis are the road miles used
12 in the BCPM customer allocation process. In addition, the analysis is suggestive
13 as the correlation is between aggregate measures of location and roads. It is not a
14 correlation between actual location coordinates, i.e., latitude and longitude, and
15 road segment coordinates. A full set of the former would negate this discussion
16 entirely as no estimation of customer location would be needed.

17
18 **C. Customer Aggregation**

19
20 **Q. HOW ARE THE ESTIMATED CUSTOMER LOCATIONS AGGREGATED**
21 **INTO TELEPHONE SERVING AREAS?**

1 A. Contiguous microgrids (along with the estimated locations within each microgrid)
2 are aggregated into telephone engineering Carrier Service Areas (CSAs)
3 according to engineering design criteria. A CSA is referred to as an "ultimate
4 grid." The maximum size of an ultimate grid is usually approximately 12,000 feet
5 by 14,000 feet, (roughly 6 square miles) to comport with engineering guidelines.
6 Although the BCPM ultimate grids are geographically comprehensive, many can
7 be unpopulated. If an ultimate grid is unpopulated, then no plant is "built" to
8 serve the grid.

9
10 Q. ONCE "ULTIMATE GRIDS" ARE FORMED, HOW ARE CUSTOMER
11 LOCATIONS TREATED WITHIN THE ULTIMATE GRID?

12 A. BCPM 3.1 does not assume that customers are uniformly distributed within each
13 ultimate grid. Rather, customers are located within the ultimate grid based on the
14 microgrid to which they were originally allocated based on road mileage. Each
15 ultimate grid is divided into four distribution quadrants. The latitude and
16 longitude coordinates of the distribution quadrants are determined by first
17 establishing the road centroid, i.e. weighted average of the road coordinates, of the
18 ultimate grid. The quadrants are centered on this road centroid. If a distribution
19 quadrant does not contain any roads, that distribution quadrant is simply treated as
20 an empty distribution quadrant. Hence, road information is used to further locate
21 customers within the ultimate grids.

22
23 Q. HOW LARGE ARE THESE DISTRIBUTION QUADRANTS?

24 A. The maximum size ultimate grid is typically 12,000 by 14,000 feet or roughly, 6
25 square miles. If we assume that the road centroid of such an ultimate grid falls at

1 the geographic centroid, i.e. geographic center, then each distribution quadrant
2 will be roughly 1.5 square miles in size. Each distribution quadrant in this case
3 will be comprised of 4 contiguous microgrids.
4

5 Q. HOW DOES BCPM 3.1 ESTIMATE THE AMOUNT OF PLANT NEEDED TO
6 SERVE THE ESTIMATED CUSTOMER LOCATIONS IN EACH OF THE
7 POPULATED DISTRIBUTION QUADRANTS?

8 A. BCPM uses a tool called the "road-reduced area" to estimate the amount of
9 branch, drop, and backbone cable needed to serve the estimated customer
10 locations within each populated distribution quadrant. The exact methodology is
11 described in the BCPM Release 3.1 Model Methodology. Each populated
12 distribution quadrant must then be connected to the road-centroid of the ultimate
13 grid at which point the sub-feeder terminates (in low-density grids, this will also
14 be the location of the DLC). The determination of the length of these "connecting
15 cables" is also described in detail in the BCPM 3.1 Model Methodology.
16

17 It is important to make clear that BCPM does not locate customers within the
18 road-reduced areas. Estimated customer locations reside in the microgrids and are
19 not "moved" to the road-reduced areas. Rather, the road reduced area is used as a
20 tool to estimate the amount of cable needed to serve the estimated customer
21 locations that reside within the microgrids in the populated distribution quads.
22

23 Q. DOES THIS CONCLUDE YOUR TESTIMONY?

24 A. Yes.
25

1 Q (By Mr. Carver) Dr. Duffy-Deno, could you
2 summarize your testimony, please?

3 A I would be happy to. The purpose of my
4 testimony is to convey to the Commission why BCPM
5 should be used to estimate the cost of basic local
6 service in Florida, and the focus of my testimony is
7 on two elements of the model; one, customer location
8 and, two, plant estimation.

9 The conclusions of my analysis are as
10 follows: First, BCPM accurately depicts the
11 distribution of customers across a wire center that we
12 looked at here in Florida. That was the Yankeetown
13 wire center.

14 And, secondly, the model is generally
15 internally consistent with respect to the amount of
16 plant estimated to serve the customers in the
17 locations identified by the model.

18 Hence, BCPM likely yields an accurate
19 estimate of the forward-looking cost of basic local
20 service here in Florida.

21 And what I would like to do for the rest of
22 my summary statement is to focus on those two
23 conclusions and describe how I arrived at them.

24 First, some brief background. High cost to
25 serve areas are largely in the rural, low density

1 areas of the state; and I have a graphic I'd like to
2 put up just to exemplify I that. This graphic is a
3 graphical representation of data that is found in
4 Table 1 of my direct testimony.

5 The focus of this graphic is simply on the
6 amount of green space that you see. There are two
7 shades of green, a lighter green and a darker green;
8 and all of the green together show you the amount of
9 land area, populated land area, in the state that is
10 in the less than 20 housing units per square mile
11 density zone.

12 So in my mind, this is the extent of the
13 universal service issue here in Florida. High cost
14 areas will tend to be concentrated in this portion of
15 the state and, as you can see, it's a fairly large
16 portion; and if you look at the data in Table 1 of my
17 direct testimony, you'll see that the figure is
18 roughly 70% of the populated land area falls within
19 this density zone.

20 Second background point: The majority of
21 the basic local service cost is due to the loop. I
22 don't think we have an argument there. Roughly 70 to
23 75% of the cost of basic local service is attributable
24 to the connection between the customer and the central
25 office.

1 So how a model locates customers and then
2 how it estimates plant to serve these customers
3 directly affects the cost of the loop and, hence,
4 affects the cost estimated by the model, the cost of
5 basic local service.

6 In terms of estimating the cost of the loop,
7 the model goes through essentially four steps. Let me
8 briefly state what these are. First; the model
9 estimates customer locations. Second; the model
10 aggregates these estimated locations into serving
11 areas. Third; the model estimates the amount of cable
12 needed to serve or connect customers within these
13 serving areas. And, four; the model estimates the
14 amount of feeder cable needed to serve the serving
15 areas from the central office. Four central
16 components of how the model estimates the cost of the
17 loop.

18 My analysis focuses on customer location and
19 the amount of cable needed to serve customers within
20 the serving areas identified by the model.

21 Let's look first at customer location. Why
22 is it important? If we don't get customer location
23 accurate, then we can't estimate the proper amount of
24 cable to serve customers.

25 Before the Commission are two competing

1 customer location estimation methodologies. BCPM uses
2 roads. Customers are assumed to reside along roads.
3 Census block housing units are distributed throughout
4 a census block based on the road distribution within
5 that census block.

6 The Hatfield model uses two estimation
7 processes. It uses address geocoding, and it uses a
8 census block boundary placement when an address cannot
9 be successfully geocoded.

10 We must emphasize that there's no database
11 in existence, to my knowledge, that identifies the
12 actual spacial location of housing and business
13 structures in the state or anywhere in the country.
14 So both methodologies are essentially estimating
15 customer locations.

16 Now, we can debate all day the assumptions
17 behind these estimation methodologies, and I'm sure we
18 will today. But I wanted to bring the Commission's
19 focus to what is the real test of a customer location
20 methodology, and that the test is how well does the
21 methodology predict. Simple as that.

22 If it predicts well, then we can look at the
23 assumptions and see, okay, that assumption was a good
24 one; but if it predicts poorly, then we especially
25 need to go to those assumptions and find out which one

1 is the one that's causing the inaccuracy.

2 But I think we ought to focus first on
3 predictions and then on assumptions later. So how
4 well does BCPM predict? What we did is we went to --
5 we randomly selected a wire center here in Florida,
6 the Yankeetown wire center, and we obtained through
7 satellite imagery the locations, actual locations, of
8 houses in that wire center.

9 And let me put up another graphic that
10 you'll find in my rebuttal testimony. What this
11 graphic shows is the Yankeetown wire center. It shows
12 the -- by the yellow dots the actual locations of
13 houses identified through the satellite imagery, and
14 it also shows concentric rings emanating from the
15 central office.

16 And what we did is we said how many actual
17 locations occur within each ring and how many
18 locations are predicted by BCPM. The idea is to see
19 whether or not BCPM yields an accurate depiction of
20 the distribution of customers as you move away from
21 the central office. And when we did that we find
22 that, indeed, BCPM does a very good job of that.

23 And if I can put up another graphic that is
24 also found in my rebuttal testimony. (Pause) This
25 graphic shows that distribution. The blue line is the

1 distribution of the actual houses in that wire center
2 as we move away from the central office, and the red
3 line is the number of housing units predicted by BCPM,
4 again as we move away from the central office. As you
5 can see, a very, very close correspondence. Based on
6 this benchmark, BCPM does an excellent job of
7 predicting the distribution of customers in that wire
8 center.

9 How does the Hatfield model customer
10 location methodology predict? We don't know. A
11 definitive answer requires unfettered access to the
12 geocoded and surrogate points.

13 So far AT&T has refused us access to those
14 points. And this is simply more than taking a visit,
15 a very brief visit, to PNR. This requires getting the
16 database in house so that we can look at it on our own
17 computers at our own time to determine whether or not
18 the customer location methodology yields a similar
19 type prediction.

20 What do we know about the Hatfield customer
21 location methodology? We don't know how well it
22 predicts. What do we know? Well, it is an estimation
23 process, and in the rural areas it's probably a fairly
24 poor estimation process, because those locations, or
25 those addresses, that cannot be spacially located or

1 estimated are assumed to be distributed on census
2 block boundaries.

3 And, finally, the surrogate placement on
4 census block boundaries does not necessarily yield the
5 maximum dispersion of customers. We have to remember
6 that the model does not use census blocks. It uses
7 census blocks as a starting point, but the fundamental
8 unit in the Hatfield model in terms of customer
9 clustering is the irregular polygon clusters formed by
10 PNR, and these span multiple census blocks, possibly,
11 and once that -- you consider that, and you consider
12 two census blocks that are side by side uniformly
13 distributing customers on the perimeter of the census
14 blocks could yield an unnatural cluster on the
15 boundary on that sense -- on that common boundary
16 between those two census blocks. And in that sense
17 that would not be a conservative placement.

18 Also, another reason is even if it was true
19 that boundary placement yields a conservative or a
20 maximum dispersion of customers, it's not necessarily
21 true that the PNR placement does so.

22 By changing the surrogate placement, you can
23 change the size and shape of the PNR polygon cluster.
24 To me, that says that simply saying uniform placement
25 maximizes dispersion is not necessarily true, because

1 it also requires that the PNR placement adhere to that
2 same -- that criterion; and there's no guarantee that
3 it does.

4 Okay. Customer location: We've got
5 customers estimated, and we've determined their
6 estimated locations. The next step is to determine
7 amount of cable to serve those customers. Again, why
8 is this important? Even if we've accurately located
9 customers, it doesn't guarantee that we estimate
10 enough cable to serve them. I mean, that's another
11 step in the process that we've got to go through.

12 The test that I performed to determine
13 whether the models are doing this has been referred to
14 as the Minimum Spanning Tree Test, and it sounds a lot
15 more complicated than it is. What it is is simply
16 let's estimate the minimum amount of cable needed to
17 simply connect customers in their serving areas and
18 compare that minimum connecting distance, minimum
19 crow-fly distance, with the amount of cable estimated
20 by the model.

21 So it's a reality check on the model, and I
22 refer to it as an internal consistency test. Does the
23 model estimate enough cable to simply connect
24 customers in the locations identified by the model,
25 not in their actual locations, but in the locations

1 identified by the model; and that is in a -- a
2 completely valid test. And when we apply that test to
3 both models, we get stark differences in the results.

4 First of all, BCPM. How well does BCPM
5 perform? It could do better, I'll be the first to
6 admit. We do come up short. We come up short in 24%
7 of the serving areas. That is, the estimated cable is
8 short of the minimum spanning tree distance in 24% of
9 the serving areas. I'm not happy with that. I don't
10 think the sponsors are happy with that, and the
11 sponsors are certainly willing to work with the
12 Commission to fix that. So there is room for
13 improvement.

14 In all fairness, we should apply that same
15 test to both models, and we have. So how well does
16 the Hatfield model perform? Well, it turns out they
17 perform -- it performs much worse. Remember, 24% of
18 the BCPM serving areas are short. Hatfield, the
19 comparable number is 68%, and this is for BellSouth
20 serving area.

21 So what that means is that in 68% of the
22 Hatfield serving areas, the model is not estimating
23 enough cable to simply connect customers in the
24 underlying serving areas. Conclusion is that BCPM is
25 much more internally consistent.

1 So in conclusion, to yield an accurate
2 estimate of the cost to serve rural, low density
3 customers, a model must do two things. It must locate
4 customers accurately, and it must estimate enough
5 cable to serve customers in these estimated locations.
6 And as I've just explained, BCPM excels on both
7 counts.

8 The Hatfield model, in contrast, has not
9 demonstrated any superiority in customer location and
10 does much worse than BCPM in its test of internal
11 consistency. Hence, the Commission should adopt BCPM.

12 By choosing BCPM, the Commission will obtain
13 an accurate estimate of the forward-looking cost of
14 basic service particularly in the low density areas,
15 because that's really the areas that we want to focus
16 on. It would also ensure an appropriately sized and
17 targeted universal service fund. We need to find
18 those particular areas that are indeed high cost.
19 And, finally, by doing so will ensure that Florida
20 residents have access to basic local service at
21 affordable rates.

22 Thank you for your attention.

23 MR. CARVER: Does this conclude your
24 summary?

25 WITNESS DUFFY-DENO: It does.

1 MR. CARVER: The witness is available for
2 cross.

3 MR. COX: Chairman Johnson, before we get to
4 cross-examination, Staff thinks it would be
5 appropriate to mark as an exhibit the deposition
6 transcript and late-filed deposition exhibits of
7 Dr. Duffy-Deno. It's identified as KDD-3, and I
8 believe those are all available as of this morning.

9 CHAIRMAN JOHNSON: It will be identified
10 as 48.

11 MR. COX: Yes.

12 (Exhibit 48 marked for identification.)

13 CHAIRMAN JOHNSON: Is that it?

14 MR. COX: Yes. Thank you.

15 MR. FONS: Sprint-Florida has no questions.

16 CROSS EXAMINATION

17 BY MR. LAMOUREUX:

18 Q Good morning, Dr. Duffy-Deno. My name is Jim
19 Lamoureux. I represent AT&T.

20 A It's nice to see you again, Mr. Lamoureux.

21 Q I'm happy that we're talking about
22 microgrids and macrogrids at 10:30 rather than 6:30
23 last night.

24 A Do you think it will make more sense?

25 Q I hope so. Do you agree that a proxy model

1 for calculating universal service costs should
2 calculate forward-looking costs?

3 A As a general principle, yes.

4 Q You say at Page 6 of your direct testimony
5 that forward-looking costs represent the economic cost
6 an efficient provider of universal service would
7 likely occur to serve an area in question; in this
8 case, BellSouth's Florida service territory?

9 A I say that, yes.

10 Q So I presume from that statement you agree,
11 then, that the Commission should identify the costs an
12 efficient provider in a given service territory in
13 Florida would incur and not the cost that a particular
14 company has incurred or will occur; is that correct?

15 A That's correct.

16 Q In terms of customer location, the issue of
17 customer location is critical to the calculation of
18 universal service fund costs, correct?

19 A I would agree with that.

20 Q And by customer location, you mean the
21 identification of the spacial location that is the
22 longitude and latitude of customers; correct?

23 A Yeah. Customer location is the spacial
24 estimation of a housing and/or business structure,
25 yes.

1 Q And by spacial location, we mean
2 identification of longitude and latitude?

3 A Generally that's our coordinate system. I
4 liken it to putting a pin in a map.

5 Q And when you use the term "locating
6 customers," you refer to spacial locations of those
7 customers; correct?

8 A Yes, I do.

9 Q At Page 9 of your direct testimony you say
10 it is important that a cost proxy model locates
11 customers with a reasonably high level of accuracy
12 because the size of the universal service fund -- I'm
13 sorry -- of the universal fund and the appropriate
14 targeting of eligible recipients depends upon the
15 degree of accuracy with which customers are located.

16 MR. CARVER: Could we have a line reference
17 for that, please?

18 MR. LAMOUREUX: Were you able to find that
19 reference in your testimony, Dr. Duffy-Deno?

20 WITNESS DUFFY-DENO: I have. It's Line 20.

21 MR. CARVER: Thank you.

22 Q (By Mr. Lamoureux) What do you mean by the
23 appropriate targeting of eligible recipients depends
24 upon the degree of accuracy with which customers are
25 located?

1 A By that statement, I mean that we have been
2 able to identify high cost to serve areas.

3 Q So by targeting eligible recipients, you
4 mean targeting areas?

5 A Targeting -- yes, yes; not particular
6 people, subsets of people, but areas of high cost.

7 Q And when you talk about the accuracy with
8 which customers are located, you're referring there
9 only to the areas in which customers are located?

10 A No. I'm referring to the spacial
11 location -- or the accuracy of the spacial location of
12 housing and business structures, which is synonymous
13 with customers.

14 Q Okay. Do you agree that it is important to
15 calculate costs with as much geographic specificity as
16 possible?

17 A Yes. If we're to appropriately identify
18 high cost areas, then we need to incorporate into our
19 models as much specificity -- it's too early to even
20 pronounce that word -- with as much focus as possible.
21 And BCPM does so by starting with a very, very small
22 area called a microgrid, which is about a 10th of a
23 square mile; and by targeting -- or by starting with
24 such small areas, the model then is able to come up
25 with a very good idea as to where the high cost areas

1 are in the state.

2 Q Okay. Now, with respect to the Hatfield
3 model, all customers in the Hatfield model, both the
4 geocoded locations and the surrogate locations, are
5 assigned a precise spacial location in the form of a
6 longitude and latitude; correct?

7 A That's correct, whether it's accurate or
8 not. It's an estimate, but they are assigned a
9 latitude and longitude.

10 Q And that's for each customer?

11 A That is for each customer, yes.

12 Q BCPM, however, does not identify or
13 calculate the spacial locations of any individual
14 customers, does it?

15 A I disagree. BCPM starts, remember, with a
16 census block. And the idea is, given that we've got,
17 say, 100 housing units in a census block, where within
18 that census block are these housing units located.

19 We start with a microgrid net that is
20 overlaid on this census block where these microgrids
21 are a 10th of a square mile in size. And we look at
22 the roads within that census block, and we assign
23 customers, those 100 customers, to each of these
24 microgrids within that census block based on the
25 relative road mileage.

1 So if a particular microgrid has 10% of the
2 roads, then it is assigned 10% of the housing units.
3 Those microgrids have a spacial orientation. So, yes,
4 BCPM spacially locates customers to those microgrids.

5 Q Now, you define the --

6 **COMMISSIONER DEASON:** Excuse me just a
7 second. What about the phenomenon that if you have a
8 main road and then there's a smaller road connecting
9 to the main road, that there's a likelihood that
10 you're going to have more households closer to the
11 main road than at the end of the secondary road? Do
12 you understand?

13 **WITNESS DUFFY-DENO:** I understand.

14 **COMMISSIONER DEASON:** That's not a problem?

15 **WITNESS DUFFY-DENO:** The way the model works
16 now is that first a determination is made as to what
17 type of roads people are likely to live and work
18 along, and then that subset is used in the assignment
19 of customers within the census block. Now, all roads
20 within that subset are treated equally.

21 So in your example the model would not
22 distinguish between a main road and secondary road.
23 Those roads would all be considered the same, and
24 essentially there would be an even distribution, if
25 you will. The model doesn't actually do this, but for

1 talking purposes, the model would simply evenly
2 distribute it along those roads.

3 Now, that is a refinement that going forward
4 I certainly would want to look into in terms of
5 improving BCPM, because there is information on road
6 types. For example, we can look at state highways
7 versus a neighborhood street, and, clearly, more
8 people live on neighborhood streets than state roads,
9 state highways.

10 But that is a refinement, and it's a
11 refinement that we can do, but currently BCPM does not
12 do that for you.

13 Q (By Mr. Lamoureux) You defined the phrase
14 for me earlier, "spacial location," as assigning a
15 longitude and latitude.

16 A That's correct.

17 Q BCPM does not spacially locate any
18 individual customers, does it?

19 A No, I disagree. You can argue that BCPM,
20 because a microgrid has a spacial orientation, that if
21 you allocate, say, 10 housing units to that microgrid,
22 those 10 housing units have a spacial orientation.
23 They're within that 1/10th of a square mile area.

24 Now, for talking purposes, if you want to
25 pin me down to a coordinate, let's use the road

1 centroid of that microgrid as the latitude and
2 longitude for all 10 of those housing units.

3 Q BCPM itself does not assign a longitude and
4 latitude for any of those individual 10 customers in
5 that microgrid, does it?

6 A Well, I think we're starting to split hairs
7 as to what we mean by "assign".

8 Q As Mr. Carver asked Mr. Wood to do
9 yesterday, if you could begin with a yes or no, that
10 would help me out.

11

- - - - -

12 (Transcript continues in sequence in
13 Volume 9.)

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Page 876

BEFORE THE
FLORIDA PUBLIC SERVICE COMMISSION

In the Matter of

DOCKET NO. 880696-79

Determination of the cost of
basic local telecommunications
service, pursuant to
Section 364.025,
Florida Statutes.

VOLUME 8

Pages 876 through 1006

PROCEEDINGS: HEARING

BEFORE: CHAIRMAN JULIA L. JOHNSON
COMMISSIONER J. TERRY DEASON
COMMISSIONER SUSAN F. CLARK
COMMISSIONER JOE GARCIA
COMMISSIONER E. LEON JACOBS, JR.

DATE: Monday, October 13, 1998

TIME: Commenced at 9:10 a.m.

PLACE: Betty Easley Conference Center
Room 148
4075 Esplanada Way
Tallahassee, FloridaREPORTED BY: H. RUTHIE POTAMI, CSR, RPR
Official Commission Reporter

APPEARANCES:

(As heretofore noted.)

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