the plug-in units until you actually need them. But I don't propose to have a finished economic analysis of the impact on that.

Robert Loube, FCC

David?

David Gabel, Queens College

One comment. I'd said in my remark that either we should use something like Ben's 85% fill factor, or use the current practices of the industry, but also take into account the revenue from the second lines. Peter Martin pointed out that this 85% fill factor isn't what's typically observed, it isn't engineering practice. I would agree with that, but I'd also point out that when I've looked at telephone company cost studies, they used something that's called the capacity cost method, and they make this very assumption when it comes to competitive services. I don't like it when they do it with competitive services, but they do use an 85% fill factor often for competitive services. And my question is why is it right for competitive services but incorrect for monopoly services?

Robert Loube, FCC

Lisa?

Lisa K. Hanselman, GVNW Inc./Management

I'm going to pass.

Tom Wilson, Washington Utilities and Transportation Commission

I'd like to also mention that the Washington Utilities and Transportation Commission staff in 1994 recommended to the Commission in a tariff filing case, that the Commission require that cost studies be run at objective fill, and the Commission agreed with that. Eighty-five percent was the number that was talked about then. And so cost studies in Washington today are supposed to be run at objective fill levels. Also I would comment that in a recent arbitration between AT&T and GTE, the staff asked that the Hatfield Model be rerun, increasing the fill factors by about 5% in most categories, although not in the lower density zone categories, where those are user changeable inputs. We didn't go as high as 85%. And what we found out was that where the Hatfield Model set at default inputs estimated a cost for GTE at $13.92, with the fill factor changes it dropped it to $13.51.

Robert Loube, FCC

Peter?

Peter Martin, BellSouth

Just to reiterate. Again, if you use a theoretical utilization, say 85% or thereabouts, I think you need to increase your maintenance costs. You at least need to do an in-depth maintenance study to see how maintenance costs vary as utilization levels increase. Because I think it would be considerable. You know, our copper cables, sometimes we do have defective pairs in them. You have to account for that. And when you have a customer go out of service you have to have a way to get him back in, you have to have spare pairs. And the fewer spare pairs you have, obviously the higher your maintenance costs are going to be. So you simply need to consider that maintenance cost and utilization relationship.

Robert Loube, FCC

Thank you. John?

John Schrotenboer, Southwestern Bell Telephone Company

I would reiterate what Pete said. I think that that's an important consideration. I think the other considerations that you have to make, too, are some of the other factors that are going into the design of the cable as to the number of lines per household, the number of businesses, or number of lines per business, and so forth. All of those factors are going to be an important part of what you're going to come up with in terms of how you're going to size the cable using the engineering design

of the fill factor and what your utilization rate is going to be at the end. So all of those need to be factors in the final design or final fill factor, whether it's 50% or 85%.

Robert Loube, FCC

Thank you. Ben, you said you had a couple more points? Quickly.

Ben Johnson, Ben Johnson Associates

Yes, if I can. Just one, the point about market share that came up briefly, just to reiterate a point I made earlier. One of the things that are strengths of our model is that it's been designed to allow you to vary market share of the carrier in a variety of ways. You can vary their market share as to business and residence and so forth. And we've already been doing some studies using that feature, and we have found that in rural areas in particular, the cost to a small carrier with say 25% of the market, such as what AT&T is shooting for, has substantially higher costs unless you start assuming that they have lower labor rates, or if you can assume they have a much more beneficial sharing factor on the structures. Unless you bring in some other change in assumptions, if you just assume they are also paying 50% of each pole and 100% of the trench, and so on, you get higher costs. This fill factor issue relates directly back to that as well, because they've got a real problem. They don't

know what their demand's going to be. So they would tend to deploy fiber because it's more modular.

Robert Loube, FCC

David, you had — ?

David N. Porter, MFS

Just a question, I don't know the answer. I don't know how in the business market environment you're reflecting the difference between the Centrex customer and a PBX customer. If you're assuming that you're building your business outside plant to serve 100 of the customers with central office facilities, it's my expectation that you're overstating the demand by 75%. So at some point in the discussion or perhaps in the documentation that comes with the new models, I'd very much appreciate understanding how you reflect the differences in the business services.

Robert Loube, FCC

Thank you. Being someone with graying hair and young children, I don't know which side I'm going to come out on in this inter-generational debate as to whether or not we should have a higher or lower fill factor right now, but I do know I'm getting hungry, and we've hit 12:00 noon. So, I wish to thank everybody for answering the questions within the time allotted. I guess we don't have any lawyers. (Laughter) And I hope to see

everybody back. I had a request from a state regulator that we reconvene at 1:15. So it's 1:15 is when we're reconvening, and see you then promptly.

(Lunch Break)

Robert Loube, FCC

Could everybody take their seats? Thank you. Welcome to the afternoon session. Again, my name is Bob Loube; I'm with the FCC staff and we are a continuation of the panel on Network Investment. All of our panelists are back, and the audience is mostly back, and so we'll begin with the fourth question. This is: With regard to network investments, what component of the model makes one model superior to the other models? Alternatively, what component of a model should be changed to improve the model? I guess I'll start with Bob Mercer.

Robert Mercer, Hatfield Associates

Okay. I wasn't sure whether to answer this question in generalities or specifically with Hatfield Model versus the others, so I'll do a little bit of both. And speaking in generalities, I guess generally what I think the model criteria is from an investment point of view is (a) the model should include all components of the network necessary to supply the services and elements in question. Second, it should configure and size these components to meet the demand for that set of

services and elements being studied. Third, determine the investment using appropriate costs for network elements. And fourth, present these investments to the critically important expense algorithms in as disaggregrated a fashion as possible so that the appropriate capital and operations treatment can be applied to each category of plant. The Hatfield Model meets all of these criteria with specific reference to including all components of the network. The model alone includes a detailed interoffice transport model. This is consistent with and we think necessary in light of the fact that the universal service definition includes local usage, and therefore you have to have a reasonable model of the interoffice network, and properly sized using traffic engineering principles applied to switches and transport elements so that the traffic is sized appropriately.

And then as another example, I guess, we now more accurately in Release 3 reflect population mixes and density variations. I mentioned them in my opening remarks this morning — identifying the type of households, identifying where there is empty space in a CBG. But then otherwise treating, as the most conservative assumption, treating the remaining situation as being uniformly populated. And our attitude is that that will undoubtedly affect the number and size of cables, and we'll take what it does as far as cables. If that leaves an increase, great, if it doesn't, great as well. But that that's the best you can do by way of accurately modeling the network.

Robert Loube, FCC

Thank you. Jim, do you want to go next?

Jim Dunbar, Sprint

Sure. In terms of the network investment and components that makes any model superior, I think some of the original four criteria that Bob laid out are reasonably accurate. I think you have to make sure that the model in fact puts the right plant to the right people at the service requirements or standards that you expect the model to give. You don't want to turn around and build something or have something that costs services to a customer when all the costs aren't there, where all the standards aren't met. I think it's very important when you look at particularly the question that we're dealing with, with loop plan and some of the associated switching, that it meets all of the normal standards of band width, loop loss, powering requirements, and all of the minimum standard quality service standards that have been written into many service manuals, the NARUC Service Quality Manual, and several of the others that are associated with it. I think very specifically the BCPM does that. It has all of those requirements in it. The questions so far that we've heard on the floor deal primarily with inputs and not with the technical aspects of the model. And the model is certainly open on those inputs to be adjusted if there's controversy on them. But the model itself I think is superior because in fact it meets

all of the full-service quality standards that the Joint Board has asked for.

Robert Loube, FCC

Thank you. Ben?

Ben Johnson, Ben Johnson Associates

Okay. I'm going to interpret this question as an opportunity to point again to some things about the economic cost model that we think are superior to the other two models. Again, bearing in mind they all have strengths and weaknesses. But I do think there's some things we do clearly better. One, with regard to cable, which is a very important and controversial cost, we do a better job of breaking out the labor component separate from the material component. Maybe we've gone too far, but I think we certainly give the user much more ability to control, to verify and to check the reasonableness of the cost of installing, and placing and designing the cable. We give the user very precise control over that, and I think that's the kind of thing that through data request to even small company engineers, you're very quickly going to get feedback as to what is the actual cost to do these activities, much better than you'll ever do by trying to match up different people's blended average number of a whole thousands of different placements, which are the kind of data that BCPM is talking about, where they do a survey. You've blended so many different situations together, it's very hard to

know whether it's accurate or not. Another example is switching cost. We give the user again more control, more items that they can control, to model the switching cost. And frankly, I think our inputs are more realistic than in either of the other two models, particularly at the low end where we have considered the types of small switches that a small company would use, which are also the type of switches that would be the most cost effective for a large company serving a small wire center. So those are the two main areas that I would point to. But in general I think a greater degree of user control has the potential as you get better input data, to give you more accurate, more precise cost estimates than with the other two models that you've got available.

Robert Loube, FCC

Thank you. Start with David Gabel this time.

David Gabel, Queens College

I am going to speak to specifics of the different models, try to do this quickly. First, Ben Johnson's model, say four negative things and a few good things. First, the aerial installation costs are four times as high as the labor time for buried cable. That's not reasonable. Buried, if anything — well, buried takes more than aerial. Secondly, the model ends up giving you lower unit costs for installing cable in central business districts than it would in rural areas because of the

way trenching and conduit is handled when there's a large number of customers. Third, it takes loop length data from BCM Model, but it only takes the average number, so the model loses a lot of detail that's built into the Hatfield and the BCM Model. We lose information about where customers are distributed around the average. Fourth, for the all-copper network, it assumes 26-gauge copper. That's not reasonable for an all-copper network. You have to have other gauges and you have to have load coils.

Good things, Redcom, which is a switch manufactured for small independent telephone companies, that's included in the model, it's not available in the others. The user interface is very easy to work with, and also it's nice to be able to work at the wire center level. BCPM — Glen Brown this morning mentioned about credibility. When I looked at the new model, I was immediately astonished because when I looked at their switching cost results, they are so bad that they call into question what has gone on from BCM2 to BCPM2. The numbers make absolutely no sense. The econometrics is atrocious. So, number one, their switching cost data is real bad. Two, it lacks interexchange facilities. Three, the unit cost for the fiber interface seemed quite high, numbers like I've never seen before. The good part about the model is it's designed to reflect that the cost of installing cable varies based on density and soil type, but still, they'll on that topic, what we're lacking is some good support that they've chosen the right mix for boring cable and trenching, things like that. I've already had two minutes? All

right. Well, all right, I'd just say the Hatfield, the sharing of installation costs is a big problem. Thank you.

Robert Loube, FCC

Lisa?

Lisa K. Hanselman, GVNW Inc./Management

Okay, I'm going to piggyback on what was just said a little bit, and I'm going to give you some specifics that we found in a small market. Again, we took a very small sample of our customer base, about 10%. But I also want to bring forth some information related that NECA provided. NECA did a sampling, a rather large sampling of study areas — to be specific, 1386 study areas — in relationship to — now this is talking about the loop and something that was brought up in that is the number of lines. And some specific data was 10 of those areas were actually over 1,000% different from the actual number. 405 of the areas, or 29%, were greater than 50% different from actual. 774, or 57% of the total study areas, were actually greater than 25% different than the actual number of lines. And significance is, the number of lines of course impacts everything. I mean, it impacts the density calculations, the switch sizing, it impacts everything about the loop.

Okay, second, quickly, I also took a look at the switch costs and I applied the new algorithm. I also have some serious questions about the regression. But we're talking about 50% of

actual costs on the sample companies that I brought with me today. On the transport side, we talk — Benchmark said 3% of transport overall represented. I also measured that against it and I had an average of 21%, with 40% being the high and 7% being the low of actual transport costs on overall investment. So I think there are serious questions on all three aspects represented — switching, loop, and transport.

Robert Loube, FCC

Tom?

Tom Wilson, Washington Utilities and Transportation Commission

Thank you. I think the transparency of the models is by far the most crucial characteristic of the models that we need to have. There has to be an ability to look at the assumptions that underlie and the data that underlie the estimates. And n that regard also, I think as much user changeability of those inputs as possible is real important, too. In Washington, we're going to be focusing in our generic proceeding on the input data to test Dr. Johnson's hypothesis that if you used similar data and inputs, probably the models will come up with fairly similar cost estimates. Another issue related to transparency is it's my understand proprietary concerns about vendor confidentiality of prices have been addressed in some cases, but that's only if parties sign non-disclosure agreements, so that still doesn't

make a model public at that point. And I think, therefore, that transparency of the models is really crucial.

With regard to the second part of the question concerning the most likely component that needs to be changed, I think that switching costs, although they're maybe a smaller portion of the cost pie relative to outside plant costs, are still something that you're hearing the others also saying needs additional work. It appears to me as if actually there has been an effort to fit a single line to what's really two different groups of data, at least. If you look at those lines, there is a lot of variation at the low end of the scale and the smaller wire centers serving just a few people, and it's good to use the smaller switches, such as the Redcom equipment.

Then another area where I think that the models need to consider something is that, first of all, none of the models address flat-rate ports — out of time. I wanted to say that capacity-based cost estimates would be very useful I think.

Robert Loube, FCC

Peter?

Peter Martin, BellSouth

First I guess you need to understand the context of how these costs are going to be used. And incremental costs are used simply to allocate actual cost to smaller areas. And it's not

essential that you be absolutely accurate with this model. However, I think the intent of the Joint Board is to use the model for actually calculating the Universal Service Support, so it is critical that you have a model that accurately calculates cost, and that uses realistic inputs and sound engineering criteria.

Now a few specifics on the models. The BCPM has many positive features. It maps CBGs to serving wire centers. That was the biggest problem with the original BCM as well as the BCM 2, that they didn't do that. It's being refined to cost out grid cells, which will allow it to target cost area effectively. And it's based on sound engineering criteria, properly sized poles, reasonable design of distribution cable facilities and so on. The Ben Johnson Model, realistically at this point it's very hard to analyze it. There is not a lot of detail in the documentation, so it's very difficult to offer an evaluation at this time, but it does appear there are some problems with it. It doesn't seem to break down distribution and feeder cable, for example on utilization, and there are other problems along those lines.

The Hatfield Model, in our opinion, has many problems, and some of them are design errors. For example, the distribution cable is the most obvious example. It appears to leave out the proper amount of cable needed to serve a CBG, and we're not talking by 10% or 15% — by a factor of 5 or 10, possibly. The model doesn't deal sufficiently with difficult terrain, and

that's also a design problem. And then there are many input errors — structure sharing, drop wire investment, the investment I used in other areas, for example, on interfaces and so forth, and poles, greatly understated. There are so many problems with the Hatfield model I just don't see how you could use it at this time in this proceeding.

Robert Loube, FCC

Thank you. John.

John Schrotenboer, Southwestern Bell Telephone Company

Yes, there is a whole litany of problems that you could recite. I guess I'll go back to the one that I talked about before in terms of trying to match the number of lines on a wire center by wire center basis to what's used in the models. There has been some effort to do some better mapping with the CBG correction, the mapping to the own wire center. I understand that that's going to take place in both Hatfield 3 and BCPM. But I think that it needs to go a step further in terms of looking at what is done on a wire center by wire center basis, using the data that the companies can provide to make that whole process better and make the model more viable from the standpoint of providing a more accurate representation of where the lines are, where the customers are, and that I think would translate into better accuracy in terms of how the costs are calculated, what network investments are associated with those particular lines.

In terms of the overall models, both of the models are very, very complex. Both of the models are very, very hard to get through if you try and look at a cell-by-cell description. Hatfield is somewhat more difficult because it has numerous workbooks in the process. The documentation needs to be provided to allow users to be able to go through this in some sort of reasonable manner, in terms of relating worksheets and workbooks to what's going on in the model and some sort of more detailed flowcharting would be extremely helpful in trying to assist the user in making a reasonable assumption about whether or not these models are doing what they purport to say.

Robert Loube, FCC

David?

David N. Porter, MFS

Well, once again, I guess I'm going to be a little bit different. I think we have made a fantastic breakthrough and that any of these models is a quantum step ahead of the methods we've had so far. Having to do traditional cost studies with boxes that we couldn't even argue what was in the cell, that it was proprietary software with proprietary inputs, this is a tremendous step ahead and I'd like us not to lose track of that. There is a lot of debate on individual inputs. I know you've got panels — the next three panels — that will be talking about individual inputs. I think we'll come to closure on that, or at

least we'll know what our disagreements are and we can do a sensitivity analysis and figure out how important it is. That's something we've never had the opportunity to do before. So I think this is a significant step ahead. I'm looking forward to seeing the fantastic improvements in the models. The concerns I came prepared to discuss I understand I don't have to worry about anymore. That's very encouraging. So I would close, I guess, with a request that as you look at the models and evaluate the models, once again, please take a look at the technical parameters that you're expecting the models to satisfy, both on the local loop and in the switch. I mentioned only once briefly but I'd point out again that the concept of requiring a switch to be in every wire center probably overstates the number of switches you'd need with modern design. Assuming that you only have a fiber or a 100% single pair copper alternatives in your loop design overlooks the fact that there are lots of other technologies in the local loop, including plain old subscriber line carrier, that may still be a very viable alternative.

And, finally, I ask you to reconsider requiring the local loop to at least meet the standard of handling a 28,800 modem. If you handle a 28,800 modem, you'll handle ISDN at the same cost. Thank you.

Robert Loube, FCC

Ready?

Robert Mercer, Hatfield Associates

Yes. I guess the main comment that I would address myself to is the one by Peter, a lot of the two — I think of the three engineering improvements that he mentions in CBPM are well-recognized and also coming in the new release of Hatfield. As far as this issue of inputs, if those inputs are wrong, we have consistently said to the LECs, "take what the FCC said in its order in August seriously; the burden of proof is on you, you have all of the data, you have proprietary and non-proprietary data, put that in the record. And if that's in the record and it shows that the inputs are wrong, then we'll change them." Some LECs have put in a new set of inputs, sometimes ludicrously high; one LEC put in a cost of switching of $800-$1,000 a line. But no LEC, to my knowledge, has ever put in a verifiable set of modified inputs. The model is heavily input intensive. It had 400 inputs in the last version; it will have more than that in the new version. So if it's an input issue, we can get the inputs right, provided only that I do think the burden of proof is on the people that possess that data. And in the meantime I would comment that we didn't come out from left field.

Hatfield Associates has long engineering experience and has used quite a team of experts to try to get these numbers right, and will stand by those defaults as best you can estimate them publicly until such time as that kind of exercise is carried out.

Robert Loube, FCC

Thank you. Jim?

Jim Dunbar, Sprint

All right, there are a couple of points that I'd like to address very quickly. One is the user control that Dr. Johnson mentioned. BCPM can be run at any level. You certainly have the control over it. You can run a census block group individually if you choose to, with its own engineering parameters and its own cost inputs. You certainly have the control at any level, including the wire center that he's got in his. I think the other thing in talking about switch costs and some of the other costs that are in there is we made it very clear in our presentations in the initial documentation that the switch data in this version is large company switch data, and not the mix of companies as was in the BCM 2. Yes, there will be a difference in the cost curve, but the logic is there in the current model to fully accept separate size cost curves. There is a cost curve logic for small, for medium, and for large companies, each individually having its own cost curve, as well as small, medium and large levels of expenses, etc., to recognize the small or medium size company concerns.

Robert Loube, FCC

Ben?

Ben Johnson, Ben Johnson Associates

Not a whole lot to say, but I think I would again point out one thing that has been a disadvantage for our model but in some ways will be overcome as people become more familiar with it, which is many of the panelists and certainly many of the people in the audience have not had the time to actually work with the model. I think the more you work with it, the more you'll like it. It's very user friendly. I'm not saying it's as user friendly as it should be, but I think when you compare it to some of the others, you'll find that it's more intuitive, it's easier to start understanding the logic, it has a table of contents, for example, to the algorithms that kind of guide you into the algorithms with buttons to jump you back and forth, just some little features like that do make it a little easier to become familiar with it, which I think becomes important as you're trying to fine-tune the inputs, because if you have a model that's easy to work with, it becomes easier to verify inputs, set up a specific situation, and match it to real data that you have for that situation.

Robert Loube, FCC

Thank you. David?

David Gabel, Queens College

I just want to pursue on this switching number, Jim says that they're using data from big companies. One of the most bizarre results reported in the new documentation is there is no difference in the getting started cost of a remote switching machine and a host switching machine. Now they obtain their data from the switching cost information system, and when that data has been put into the public venue, for example, in 1988 some data from Massachusetts was put into public record, showed the host switch cost $640,000 for start-up, a remote cost $150,000. They are using deterministic data and therefore you should get — and it's deterministic data from (inaudible) model, you get a statistically significant difference between the cost of a host and remote switching machine. They haven't. Their cost per line, they report $225 per line. I have a recent order for a switch from an independent — a small independent telephone company that pays more than a large company. Cost per line, $135 on a host, $81 per line a remote. So I think, you know, it's nice that the BCM2 or the new model is going to be open, but it's the data, everybody is saying we've got to get the data right, and my look at the new model compared to the old model is that data, at my first glance, seems to be a lot worse in the new model.

Robert Loube, FCC

Lisa?

Lisa K. Hanselman, GVNW Inc./Management

I guess I'd just follow up with some comments that were made in the rebuttal that you have all the data, but you don't have all the data. There is an awful lot of data with regard to the small companies that you just don't have because it's not accessible. And I guess I'll just leave it at that.

Robert Loube, FCC

Tom?

Tom Wilson, Washington Utilities and Transportation Commission

Thank you. I'd like to add that with respect to using the model for universal service purposes, I think that it's real important that the same methodology then be used to cost and price unbundled elements. Also, it has come to the staff's attention in Washington in some arbitrations that these models, particularly the Hatfield Model, appear to estimate all of the costs to provide an element, and therefore it's confusing to understand what to do about non-recurring costs in the situation where a customer may not stay on the service long enough to recover those costs. And so that might be taken into account in planning a program.

Robert Loube, FCC

Thank you. Peter?

Peter Martin, BellSouth

Just a quick point. Again, I need to point out that not all of the problems with Hatfield are just in the input. Some of them are in the design parameters, and especially in the way they engineer distribution cable. And also in the way they deal with difficult terrain. And in some of the inputs, they don't need input from the LECs. For example, on the pole size they use, they should look at safety codes and see what kind of clearance is required over streets. And with the 35-foot pole they use, you wouldn't have sufficient clearance over streets. And you don't need input from a LEC or an RBOC to tell you that; you should be able to determine that on your own. So I just think there are a whole lot of things that need to fixed with the Hatfield Model.

Robert Loube, FCC

John?

John Schrotenboer, Southwestern Bell Telephone Company

In terms of the models, there have been a lot of changes that are taking place with the Hatfield and BCPM. I think that it's going to be interesting to see what they come up with when we actually see the models. I would encourage, I guess, that these models be tested in terms of what do they look like against actual cost as a basis for determining whether or not these are in any way, shape or form reasonable. I think that the

comparisons can be made in terms of breaking down costs for investment. There is data available from Universal Service Fund data provided to NECA. There is data that we provided in an October 8 ex parte to the Commission. There is other data that was collected in the Universal Service Fund data request in 1995 that provides a basis for doing these things, and that this data should be used as a basis for determining whether or not these things really are in any way, shape or form reasonable for determining an overall level of cost for universal service.

Robert Loube, FCC

David?

David N. Porter, MFS

I guess that assumes that what you've done is reasonable. And I don't know that I'm willing to concede that, although I suspect if I had to err one way or the other, I'd err to conceding it. But don't put that on the record. (Laughter) Gee, did I just say that? The question of "testing against what" is a critical question, and the benefit that the models give us is assuming you're building a network forward looking, assuming you know where the customers are today. That's a tremendous advantage that the incumbent doesn't have — or didn't have when they built their network. But that's not really the relevant question of what did you know when you did it. The question is what do you know now and what would a well-informed new entrant