expectation if you designed local loops to meet an 18 kilofoot copper maximum limit using 26- and 24-gauge copper, that you would have a design that would also support ISDN. I think a design that, as I think I understood Dr. Mercer's comment for his long loop design, to include load coils and coarser gauge copper is not an appropriate forward-looking design. I concede that the design that I would suggest would require more fiber in the long distribution. I think that's precisely the method that the rural telephone companies are using today and I think that method should be included in my — stop, thank you.

Robert Loube, FCC

Thank you. David?

David Gabel, Queens College

First, just adding on what was just said about the rural standards set by Congress, Congress explicitly limited that to the RUS companies, did not extend it to all companies. And absent explicit legislation, I'd be — advise caution on the Joint Board to do something that wasn't done intentionally by Congress. Congress did not require one megabit transmission throughout the United States. Secondly, when I look at where these models stand right now, what's still missing from them is any effort to model when does it made economic sense to use fiber or copper. Instead it's most explicitly done in the BCM Model that fiber is used when the customer's located more than

18 kilofeet from the central office. That choice is made because that is what's required for ISDN. So the network design built into, say, something like BCM is done so that — with just installation of the appropriate line cards, ISDN type service can be installed.

Well, what's the cost impact of designing a local loop so everything's ready there other than the ISDN cards? Well, in the BCM Model, the least expensive type of digital electronics has an additional cost of $50,000. That's for the AFC cabinet and electronics getting started costs. So, what's taking place in these models by designing the loops so that they can provide ISDN-type service is you have a big increase in the investment per customer in rural areas. Does it make sense to do that? Well, that's a cost benefit analysis and it seems to be that Congress did not explicitly require that kind of standard for the rest of the nation. So I think some caution should be exercised in building into a model standards that are not required by Congress and are quite costly to implement.

Robert Loube, FCC

Lisa?

Lisa K. Hanselman, GVNW Inc./Management

Okay, our interpretation of the question generally resulted in the answer that yes, the models in general do position us well to move into the future. It represents integrated digital loop

carrier, a crossing network that extends deep into the loop. We have to look at fiber pushed deep into the loop. As was stated before, we have price considerations that make fiber favorable. We have service requirements that make fiber favorable. And even though universal service as defined today doesn't require some of those future services, it's essential that we position ourselves to move that way. Certainly, there are less sophisticated designs that could be deployed that would meet the requirement of meeting basic voice grade service. But I don't think most of us would be satisfied with those today. Those requirements that we used to deploy, today our voice grade and what we put over voice grade circuits are different. We have fax machines, Internet. The data requirements for a voice grade circuit carrying data requires a much cleaner circuit.

Successful completion of the call or voice or data across this is expected by people today. Although broad band and ISDN are not really commonplace today, there are definite trends moving in that direction, and video is closely following on the heels of ISDN. The network must be positioned to meet the physical and the technical demands of those services, even though they are not required by universal service now. Our expectations would not be met if we didn't position ourselves that way. Network investment in these models must reflect the positioning of the network to move forward into the future.

Robert Loube, FCC

Thank you. Tom?

Tom Wilson, Washington Utilities and Transportation Commission

First of all, I'd like to say that I think that the Joint Board made a good decision in defining "universal service" to be voice grade service, and not counting ISDN. I think that, for one thing, it's possible that in the future there may or may not be huge demands for ISDN. There may be additional new technologies out here coming along that will change the nature of the demand for high cap services to end users. Secondly, I think that I do have some doubts still remaining in my mind as to whether we can accept the representations of all of the modelers or not, that all of the costs are properly accounted for in their models. Specifically, I'm thinking of the BCPM model which I understand relies on a survey of SCIS results generated by a survey of LECs to come up with switching costs. And I have no idea whether the cost of the AFC and other electronics at the central office are in that result or not, and I'd look forward to a response to that.

Also, I would add that I think that's a good thing if the models are capable of estimating ISDN costs separately, and so that should be part of it to also allow the models to account for the economies of scope and scale, if there are any, by offering ISDN as well as voice grade.

Robert Loube, FCC

Thank you. Peter?

Peter Martin, BellSouth

Okay. There seems to be general consensus that, at least along the model builders, that none of the models include more investment than is required to provide universal service, basically, a narrow band voice grade network. The models could understate universal service investment if they included more advanced services for economies of scale purposes, when those services might be provisioned in a different way, maybe over a different fiber-copper mix. Regarding the Hatfield Model, I think it does leave out or understate investment in numerous areas, and Jim Dunbar touched on some of those. In the area of distribution cable design, it flat out leaves out sufficient cable to adequately design the network. And then in the area of inputs, it greatly understates the amount of investment required to provide service, for example, the drop wire. It has an input of $40 and we've actually found in BellSouth that it's closer to $200 when you look at aerial and buried drops and what's the proper mix of those. The Hatfield Model greatly understates investment there. Regarding the sharing of structure, the Hatfield Model makes an assumption that two-thirds of structure cost will be assigned to other purposes. For example, when you are looking at trenching costs, that's just not a realistic assumption. Power generally comes in first; they have to be

there so the builders can get power to build the homes. Telephone comes in later, pretty close to when the first home is going to be occupied. And then cable TV often times waits until there are several homes occupied on the block, and then they go and place their facilities at that point. So they're not placing their facilities at the same time. It's not realistic to assume they'll be able to share the structure as Hatfield assumes.

And one other thing is on poles, Hatfield uses 35-foot poles. That would provide insufficient clearance over roads when you are sharing between telephone and electric cables. And again, this is just an inconsistency in the model that needs to be accounted for. Thank you.

Robert Loube, FCC

We'll start with the rebuttal I guess in the same order in which people addressed the question, if you do have a rebuttal.

Robert Mercer, Hatfield Associates

Yes, I do. I'm not going to address the last comments at all because they have nothing to do with the ISDN question. Needless to say, we could talk for hours about what's right or wrong about the Hatfield Model and we could defend what we've done. But I would like to comment. I believe, and I think Dr. Gabel captured it right, if you really look at the differences between BCPM and Hatfield Model and their new version, and I think it's important to focus on the new version if we start

talking about defects and models. I would argue I could have a lot longer list than the couple of items that Jim Dunbar mentioned. But if we look at the new models, one of the astounding differences between the two is you will see much more extensive fiber deployment, much deeper in the network, in the BCPM, at least on the surface, examining the pictures they drew. That's not there for voice. You don't need it that close to the customers for voice. Therefore, while you might argue that you've left the investment out in the sense of line cards and the like, as Dr. Gabel said, that doesn't mean that you haven't deployed extra investment to support services like ISDN. I want to emphasize there's certainly nothing wrong, and in fact it's appropriate, for a telephone company to deploy a network. But it's a question of what's being charged to universal service.

Robert Loube, FCC

Thank you. Jim, I guess you're next.

Jim Dunbar, Sprint

All right, the point that I'd like to make deals with the ISDN and the fact that the BCPM overbuilds. I would counter that very strongly. The 18 kilofeet or the breakpoint that's in there is not a service decision. It is not a decision made to support ISDN and future networks. It's an economic decision. When you consider the loading, the additional costs that has to go along with the copper, and the additional maintenance that's required,

and all the costs associated with copper placement versus fiber placement, it is an economic decision. And that's why there's a flexible breakpoint in there, because that economic decision is different for different companies.

Robert Loube, FCC

Thank you. Ben?

Ben Johnson, Ben Johnson Associates

I think the approach we followed in our model is what you'd want to do, which is what Dr. Gabel is suggesting. There are two variables currently available, that are infinitely variable, that you can optimize and find exactly what is the minimum cost configuration, if that's your criteria. Or, you can set up a criteria, which I think is more appropriate, such as the one we did for the illustrative study, which takes into account minimizing costs, but overdeploys fiber with a view towards the additional revenues that would be available from other services. You just have to understand that that has happened, that you have more fiber in there than might be necessary for simply cost minimizing. Because you also want to maximize revenues, in order to run a company properly. But to separate out the cost of basic voice grade service, trying to separate that, disentangle it, all you have to do is run a study in which you're minimizing the cost, and determine how much fiber minimizes cost. And I think all the models are capable of doing it to some degree. Ours is

probably a little bit more convenient and gives you an infinite range of choices as to the breakpoint. It does not have to be discrete every 3,000 feet.

Robert Loube, FCC

John?

John Schrotenboer, Southwestern Bell Telephone Company

I think that in terms of provision of the length of fiber versus the length of copper in any one individual loop, that that should be based on sound engineering principles with an eye towards the economic deployment of that fiber. I don't think that you should deploy fiber to provide services for, or at least in this particular model or universal service, in terms of providing services beyond what's required for voice grade services. Certainly I don't think that it would be appropriate to provide capabilities for 1.5 megabit service to all of these customers. I think you're talking about way too much cost associated with that particular provision. The engineering assumptions that are used in BCPM and BCM and Hatfield or any other proxy model should be based on engineering and economic principles in terms of cost tradeoffs.

David Porter, MFS

I find it intriguing when we consider that the technology requirements of the rural utility service should be applied to

the island of Guam and not to the island of Manhattan. I think we have an interesting misperception in the needs of the public. Second, I'd point out that my understanding of loop design suggests that you can do ISDN, you can do ADSL, and HDSL, on a properly designed, shorter than 18 kilofoot copper loop. And that a longer than 18 kilofoot copper loop doesn't meet the current forward-looking design standard for a voice grade service. So that the difference that we're talking about between an ISDN designed loop and a voice grade designed loop is the cards and the electronics that you add to the loop, which I'm not asserting should be part of the universal service model. But the copper distribution facility is the same for both, and should be included. Thank you.

Robert Loube, FCC

Thank you. David?

David Gabel, Queens College

I agree with David Porter and just about what everybody has said here that prospectively, telephone companies are using this 18 kilofoot as a demarcation point between fiber and copper. But I seriously disagree with Jim Dunbar's suggestion that it reflects cost minimization. First, there is nothing in the BCPM model to suggest that any optimization has been done to find that 18 kilofeet is cheaper. Secondly, when states have used the model, or other parties have used the model, varied the crossover

point, they found that cost savings were obtained by using longer crossover point. Third, is just even if you hadn't done that exercise and you just think about real rural areas, you're still going to need to trench or bury the fiber cable. So where are the big cost savings, when as I've said before, the minimal electronic investment is an incremental $40,000. So there has to be a lot of maintenance savings on that fiber cable relative to copper to justify $40,000 electronic investment.

Robert Loube, FCC

Lisa?

Lisa K. Hanselman, GVNW Inc./Management

Well, moving from the cable industry back to the telecommunications industry, I guess I'm a little sensitive to the idea of gold plating. But I guess I still go back — and coming from an engineering perspective, we do need to position ourselves. And if you really want to get down to it, when you look at these models, you're practically going to engineer it, you're going to consider all of what was said. You're going to look at HDSL and ADSL and you're going to look at all different kinds of options to provide the services. And none of these models really — I mean, if you get down to it — practically take a look at and do an actual cost study, come up with a analysis that one technology is better than the other. You can't do it in the model. It's a theoretical approach, you've got to

start somewhere, and you're not going to be able to capture the technological differences, I don't think, in this structure of a model.

Robert Loube, FCC

Thank you. Tom?

Tom Wilson, Washington Utilities and Transportation Commission

I'll pass.

Robert Loube, FCC

Peter?

Peter Martin, BellSouth

Just very quickly, I'll point out the last part of the question does say "if the models fail to include all of the investments required for the provision of universal service, what investments are missing?" So while Mr. Mercer might find it uncomfortable to address some of these issues, I think the Joint Board staff has a responsibility to address these issues, because it very definitely does impact the investment required to provide universal service.

Robert Loube, FCC

Thank you. Seeing how everybody actually held to the time, does anybody want another minute? (Laughter) I was in shock here. Okay. Well, then we'll go on to the next question. The distribution network design is affected by 1) the assumption of a uniform distribution of households within most CBGs; 2) alternative installation practices with regard to difficult terrain conditions; and 3) the number of cable legs within each CBG. Of these three features, which one generates the greatest error in the modeling process, and how would you correct this error? Jim, do you want to go first on this one?

Jim Dunbar, Sprint

Okay. If I look at all three of them, all three of the answers, or the assumptions that are in there affect the cost. If I was to pick of those three, which one was most significant or created the greatest error, I believe it's certainly the number of cables within each CBG. That's indicative of incorrect engineering, and the fact that you cannot get the facilities to the customers. Overbuilding or oversizing to something that is too short still doesn't account for the cost of getting there. I think it's a serious omission, it's indicative of units that are missing, and it reflects certainly improper engineering to go along with the economics that are there. If you don't have all of the units that you require a plant in place, you are not going to have the service provided. Therefore, if the cost that you

reflect has missing units or inadequate units, you flat have not reflected sufficient cost to provide the service. And I think that's a significant error that happens in the model. Certainly in that case.

Robert Loube, FCC

And how might you correct that?

Jim Dunbar, Sprint

Well, I think at this point, from the standpoint of the correction of the model, it's got to reflect a correct engineering. It's got to have plant that goes — of proper size and proper condition and proper engineering to get physically to the customer location, each and every customer location in each and every area, whether it's census blocks, census block group, wire center, whatever, you have to make it reach the customer.

Robert Loube, FCC

Thank you. Ben, do you want to go second?

Ben Johnson, Ben Johnson Associates

Sure. I'm not sure I would pick any of these three as probably the area where the greatest difficulty of modeling and the greatest error occurs. Within the three, I'd be hard-pressed to pick one. I would say probably — well, first let me say I

think the notion of designing a network around a CBG is introducing error to the modeling process of the other two models, and it's unfortunate. I think as we move towards better and better ability to map where the customers are and get down to census blocks, we're going to want to abandon this whole notion of using the census block group, which is merely a statistical artifact, as the basis for deciding how many cable legs and where to deploy the equipment. So I think that is slightly different than what you are asking, but in essence, Item 3, as it relates to the fact that these other models are built around a CBG.

I would also suggest that as to the installation practices, if we're going to focus on debates over input values, the area where I'm not completely comfortable with our input values, nor am I completely comfortable with either of the other two models, are some of the time requirements or the labor requirements for installing plant. We just don't have good enough data to really know. We know that there's a wide array. It can cost $5 a linear foot to trench, and it can costs 60 cents, depending on the nature of the dirt and the nature of the conditions. And the latest version from the BCPM folks, they're trying to deal with that, at least show what they're assuming, but they have some very strange assumptions. They assume that even in a very low-density area, 10% of the time they're drilling under asphalt or concrete. And that just doesn't seem likely to me along a lonely road where there's only one customer every half mile or so, that you'd have to drill under asphalt or concrete 10% of the time, 10% of the linear footage. But that's the kind of factor

that can cause such wide array in the data. When we get samples back of what did it cost you to trench, or what did it cost you to install poles, we don't have good enough data to sort that out. That's one of the areas I think more work is needed.

Robert Loube, FCC

Thank you. Bob?

Robert Mercer, Hatfield Associates

First of all, I guess I would suggest that the question shouldn't prejudge the effect of these parameters by causing them errors as much as by increasing uncertainty in the model. And the models do have a problem with dealing with the uncertainties of population location. Having said that, I think that factors number 1 and 3, which is the uniform distribution and the number of cables, are very closely linked. And together they're more important than the terrain factors, which I think to some extent have been a little bit overblown in the debate. While not minimizing the importance, I think they're overblown and are less important than the other two taken together. And what I mean by saying the other two are together, for instance, if you have all the population concentrated in one place, you can clearly serve that population with fewer cables than if the population is uniformly distributed. And therefore that's my linkage between the three. Hatfield Model, really three, departs substantially from this assumption of — for any assumption of uniform density,

in at least three different ways. One is it detects the presence of high-rise buildings and serves them with risers instead of regular distribution cable. Second, it finds multi-tenant living units and takes advantage of the greater concentration of people in terms of their smaller effective lot size. And third, it detects empty space and the lower density CBGs and then treats the rest of the population as clustered in the occupied area. And beyond that, however, it assumes uniform population distribution because that's the most conservatively high assumption. It's always going to be more efficient to serve an area if the population is clustered than if it's spread out. So you take advantage of what you know from your available data sources, and then other than that, I think it's appropriate to say within what you know, or beyond what you know, then you have to assume uniformity as the most conservatively high assumption you could make.

Robert Loube, FCC

Okay. Why don't we start on this side for the comments. Peter, do you want to start?

Peter Martin, BellSouth

All three of these factors influence cost. The first one, uniform distribution of households can result in an overstatement of costs in very rural areas. And the BCPM did basically fix this problem when they changed, and only looked at area within

500 feet of roads. And I think the Hatfield Model is supposed to incorporate something along those lines in its new version. I think in suburban and urban areas, the assumption of uniform distribution is reasonable. The alternative installation practices for difficult terrain conditions is a big factor. And Mr. Mercer said it was overblown. Well in Florida, we have the threat of hurricanes, so overblown is probably appropriate. There's a lot of coral rock in south Florida, and it's very expensive to bury cable. And yet because of the threat of hurricanes, aerial plan is a very risky proposition. So we're looking for a model that really does try to incorporate what is the cost of burying in difficult terrain. And the BCPM does seem to do a better job of that. Hatfield just adds 20% and assumes you can go around the problem. Well, that's not realistic in a lot of areas.

The last one was basically distribution of cable legs. And there, that's a very big factor. The BCPM has a rather detailed methodology. Hatfield assumes square CBGs and the number of cable legs varies. And I understand they're going to fix some of this. But just as an example of how it can impact cost, we asked MCI for an example of the CBG just to see how the distribution cable came out. And they gave us a CBG in Forsyth County, Georgia. They said it was one of the CBGs they looked at to validate their model. And basically when you run all the calculations, you come up with 14.37 miles of distribution cable in this CBG. Well, we mapped it out, and there's 150 miles of roads in that CBG, and the roads generally have homes along that

require service. So again, they're greatly understating investment in cable length in many CBGs. And it's a huge factor, and probably the biggest of these three.

Robert Loube, FCC

Thank you. Tom?

Tom Wilson, Washington Utilities and Transportation Commission

Well, I think that the assumption concerning uniform distribution of the households within the CBG is the greatest concern. I think that the models do need to adjust to this problem. I like the idea of going to smaller units of observation, such as the grids or the cells. I also like the idea of assuming that households are along the roads, and don't count the empty space. In Washington State, for example, there are several exchanges where, particularly in the mountainous areas — and one of my peers from the State of Maine has shown me a little map that illustrates this real well — there's places where the households are simply all in one spot, and the CBG appears to be a large geographic area, and it would be wrong to distribute the households across the whole area. With regard to the alternative installation practices, I think that Dr. Johnson made a real good point, that it's important to separate the outputs from the modeling assumptions. And it's entirely possible, I think, that if that's done correctly, then you can look at the inputs rather than the outputs. And that's where the

work needs to be done. That's what we're going to be doing in a generic costing proceeding in Washington. I especially like the idea of specific labor rates per wire center, which could perhaps take effect — take account of the problems discussed about the hurricanes or other weather problems. Also there's a question in my mind about the subject matter expert opinions about the percent of time spent at each activity. And that ought to be pretty specific, too. With regard to the legs per CBG issue, U S West tried to show in an arbitration in Washington how badly Hatfield did on that. And the only thing I can comment on is, it needs to be done real carefully. Look at that issue very carefully.

Robert Loube, FCC

Lisa?

Lisa K. Hanselman, GVNW Inc./Management

Okay. I guess I was not only concerned with the amount of error, but also with some aspects of the models which would give us the greatest opportunity to correct or to improve the models. With regard to the assumption of the uniform distribution, I know that the BCM has taken strides to improve that with the employment of the road network, but it really wasn't clear just what the financial impact and benefit was. I really couldn't visibly see that. The Hatfield, on the other hand, and I know it's not fair because I haven't seen the new model, but in the

previous model I didn't see that it was addressed at all. And in fact, I guess concerning the small company environment, I guess I don't want to us focused so much on just census blocks or census block groups or grids because I'm thinking that the differences across the nation, there are so many differences that I think you're going to see a combination that's appropriate. Maybe in some areas a census block is appropriate and others maybe a census block group and so forth. And certainly with regard to the small environment, none of them may be appropriate at all. Maybe it's going to require a whole different set of assumptions there.

Second, with regard to the terrain, there is so much known about what it takes to plow cable in different areas. We ought to be able to do a very good job there of being able to represent the cost. Although I'm not quite sure how the factors were derived for the BCM, I am certainly a little more comfortable with those weighted factors than I am with the Hatfield which says that if we run into difficulties, we'll extend the cable by a certain percentage. Finally, under the number of cable legs in the CBG, the CBG represent — I think that also is the greatest opportunity. We modeled about 10% of our client base, and we found the loop investment to be off so significantly from embedded cost that it just to me has to reflect a lot more than the comparison of future looking to embedded cost. In about 12 out of the 13 cases, it overstated the cost by 149%, the benchmark. We couldn't model it with the Hatfield because it's not — it simply doesn't work for small companies at this point.

Robert Loube, FCC

Thank you. David?

David Gabel, Queens College

Okay. First on the issue of the distribution of customers. Initially, the Benchmark Cost Model Version 1 deployed customers uniformly in rural areas over the CBG. I'm going to focus on rural areas because that's the focus, I think, of this activity right now. How do we get the correct contribution towards the universal service fund? Well, in the second stage of BCM 2, they moved to having customers uniformly distributed over CBGs, to uniformly distributed over roads. That was a big improvement for rural areas, reduced the cost estimates. The question is, are houses truly universally uniformly distributed along roads? I'm not so sure that is the case. I don't know what is the right answer, I'm just suggesting now moving towards well, what should we be doing about this. Well, ideally what we would do is as opposed to just making some kind of gross assumption is do what is done regularly in loop studies, and that is go out and collect sample data which tells us what is the typical length of loops in rural areas. I think that is our ideal source of data. Absent the ability or the time to do that, we could look at things such as where are carrier serving areas interfaces located. That could give us some indication of where there are population centers. Turning to the second issue which is the installation cost, I share the concern that has already been expressed that in

the BCM model that while the cost of an activity such as boring cable or trenching may be correct, the mix may not be correct. To the extent that I've been able to compare it to actual installation costs, I find that the mix assumed in the model biases the cost estimate upwards. We need to find a more appropriate way of getting the mix right and I think there's a good way of doing that, and that is turning to publicly available data through RUS, which is the old REA. Turning to the Hatfield Model on installation costs, I don't agree with the 20% adder. I think that we need to have more of the kind of detail that's built into the BCM. Neither do I like the sharing of the structure cost, the trenching. It just doesn't seem like a reasonable assumption to me.

Robert Loube, FCC

Thank you. David?

David Porter, MFS

Thank you. I find it a little bit interesting that we're commenting on three models that we haven't seen. So the critiques, as several of the model sponsors have pointed out, are a little bit misplaced, or may be misplaced. I read the second question as being just a trifle broader and so I will trifle for one of my minutes, and then get to the specific questions for the other one. I think the greatest error in the modeling is that we've got the wrong designs, the wrong engineering design on the

local loop, which I've already expressed and the wrong switching design. I understand the simplification that was required to assume you use existing wire centers as collection points. That does not mean that you have to use the existing wire centers as switching points. So the concept of using, particularly in the rural environment, remote switch modules homed on a central host, I think should be explored. I recognize that we have to keep the investment separate by carrier, and that provides some limitation to us, but I'd urge that to be considered.

The third major error, I think is one that is very addressable and may have been addressed in some of the new models, and that is simply that the census block groups are in substantial ways misallocated or misassigned because they are based on the airline distance to the closest wire center, not to the serving wire center. And you can see the effect of that right here in Washington, D.C. In the wire center we're sitting in, this wire center is shaped like a hot dog. I'm sure there's a technical explanation for that, but it's long and thin. And the census blocks that are at either end are actually closer to other wire centers then they are to the wire center they're served in. That's an error that can be corrected if you choose to use census block groups by simply asking the incumbents "what census blocks do you serve?"

Now, to the three issues that you specifically raise in the question, the assumption of uniform distribution, I think there have been several different methods of addressing that, and I

look forward to seeing the new models. The alternative installation practices is something that causes me great concern, and we'll talk about that later in the two days when we talk about the specific input factors. Thanks.

Robert Loube, FCC

Thank you. John?

John Schrotenboer, Southwestern Bell Telephone Company

I looked at this in a broader perspective, also, and in terms of the basic idea of using CBGs. This has been a concern of ours for a long time. In terms that, number one, the CBGs have been assigned to wire centers based on the closest distance. We have also had some investigation that has looked at a comparison of the actual number of lines in a wire center, for all of our five states, versus what results the Hatfield Models or the BCM2 result. In each of those cases, we found that the number of lines that have been associated with a wire center are significantly different than what we look at from an actual standpoint. And I think that that has reinforced our concern over whether or not, number one, the CBGs are being assigned in the correct way. When you assign a CBG, the models assign all of the households, not just a portion of them, if only a portion of that area is bounded by the wire center boundary. So I think that there is the errors that are introduced by the number of lines, and the overall structure of using CBGs may be a problem