

MAINE DEPARTMENT OF TRANSPORTATION
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Indirect And Cumulative Impacts Guidance
J. Scott Lane

Moderator: Our group is pretty subtle. We don't want them to fall asleep. Right? Okay. Everybody's awake? Okay. We're here, as I mentioned, to talk about Indirect and Cumulative Impact Guidance. Scott Lane from the Lewis Berger Group started with that group in January 2003 as a transportation planning manager of their Cary, North Carolina office. Scott has worked in four metropolitan planning organizations -- most recently with the Capital Area Metropolitan Planning Organization in Raleigh, North Carolina.

During his 14 years, Scott has worked on a wide variety of projects, involving land-use forecasting, public outreach, travel demand modeling, corridor studies, financial forecasts, boy...everything! Comprehensive transportation plans and air-quality conformity determinations. Oh -- there's a good one!

Since arriving at Berger, he has conducted training courses in indirect and cumulative impact analyses for the North Carolina Department of Transportation. He is currently the project director for creating a comprehensive guidance for assessing secondary and cumulative impacts for the North Carolina Department of Environment and Natural Resources. He is the principal investigator of an FHWA study examining the emissions benefits of land-use strategies. Scott is a member of the American Institute of Certified Planners, Transportation Research Board, and is the affiliate director of the North Carolina section of the Institute of Transportation Engineers.

Scott is the proud father one daughter and two step-daughters, with his wife, Leigh Lane. Scott and Leigh make their home in Raleigh, where they have lived for the past five years. Please welcome Scott Lane.

Audience: Applause

J. Scott Lane: That introduction was a lot shorter when I wrote it. Thanks! Thanks, everybody, for showing up. I'll try to keep it moving along and topical and everything. I'm kind of afraid to turn my mike on, here. Will we get feedback if I do this?

I wanted to say that the firm's been doing a lot of work with indirect and cumulative impacts. The other person's name up here is Larry [Peseski], who is my boss, and generally a good person. He's in New Jersey and New York offices, and we're down in North Carolina. A lot of the work we've been doing is in North Carolina, so I'm here in front of you today giving this presentation, but a lot of the kudos goes out to Larry [Peseski] and others, as well, with the firm. And of course with NCDOT.

What I hope you will learn -- a background on highways and development -- how this thing actually came about for North Carolina, particularly. The assessment itself, how you do indirect and cumulative -- which we'll define here in a few minutes. The methods and techniques that we work at. And of course, we can't go away without a good case study. That will be in lovely Winston-Salem, North Carolina. That's one that's still going on, and changing and working every time I look at it. We recently put together what I hope is a definitive report, and we'll be out that gate, very soon.

First up. Highways and development. We'll talk a bit about highways -- indirect and cumulative. But before I get too far into this, I do want to say that transit facilities -- rail, particularly, has also been the subject of a lot of work on indirect impacts. A lot of growth in rail stations -- other positive or negative things when a person is talking about it -- it's only been cited in literature. So when I talk about highways, you can substitute your own projects, if you want [that are already] highways.

First I want to give you some background, here. Decentralization. This is a big topic, whether you know it or not. A lot of people are going to move into this country or will be born in this country in the next 20, 30, 40 or 50 years. When you look at a graph like this, you can see already that from 1940 to 1990, unlike the previous 30 years, the density is going way down in the larger cities. That means people are spreading out. Cities are growing geographically and physically to accommodate all these people.

This is interesting, too. I actually have just changed this out for this presentation, because I saw this and it was really kind of neat. How well forecasting really works -- because I do a lot of that in my work. These are the same trend lines, here. One done in 1994, one in 1998, one in 2000 for population of the United States. You can see we're going up quite rapidly over the next 50 years, up to 2050 -- adding around another 200m people in this country. They have to go somewhere. Think about induced growth! These people have to go somewhere, so we have to figure out where they're going to be going.

Interesting, as the trends are going up, even the individual projections themselves are going up. So a projection done just six years later [inaudible] 20m people. So even the projectors are modifying their projections upwards, every so often. We're growing -- and we're growing even faster. Which leads to this picture.

We hear a lot about induced growth. I should define what "induced growth" is for us, in the indirect and cumulative impact field. For me, induced growth is when you put a road or a rail line or whatever it is down in the ground. People find that to be more attractive to live there, because of increasing accessibility or what have you. Induced traffic, which this slide kind of deals with, is quite a bit different. Induced traffic suggests that because you're adding new capacity onto a transportation system, you wouldn't make it otherwise, but now you can afford to do it because the trip is easier, quicker or whatever. There are a lot of people that have talked about induced growth and induced traffic interchangeably, and I want to try to at least stop that today, if I can.

One of the papers that came out just last year by Robert [Steviro] suggested that for every 100 percent of new roadway capacity put down in the ground, 80 percent is absorbed -- either through this latent demand of traffic, or through induced growth. We're talking primarily about the induced growth -- new development -- new offices and homes and things like that. That accounts for about half of what [Sirvello] said. Absorbing all that roadway capacity.

In North Carolina, we had this problem a lot. We'd put a new road down -- either a new capacity or widen the road out -- and in a very short period of time -- sometime the very next day -- the capacity is largely absorbed. So we're actually playing catch-up in a lot of our areas of North Carolina. Which is one of the motivating factors for this work.

One of my many attempts at getting a degree in college was in economics. This is a graph that we showed quite a bit in economics -- pre-macroeconomics. It talks about a very old theory. It just suggests that the closer you are to the city, the more expensive the land gets. The further away you get from the city, the price of land goes down, down, down, down. You finally get to some point down here where your each a rent level -- a so-called bid-rent curve. That's what this is. In other words, you don't really have urban uses, any more. Farming, open space, residential or whatever.

After improvement -- let's say a new highway, just for giggles -- this new curve here appears. In this case, you've got the price tag for land downtown sometimes being depressed, because you have more land available further away from the city. Because you've increased accessibility for people to get back and forth. People are happy and sad on both ends of this curve. Sometimes you get people unhappy down here, because they have a reduced amount of traffic going by their businesses. Sometimes you get people down here that are really happy about it, because they perceive that their land is worth more, and they'll get it developed and it will make more money. People are also unhappy on this end of the curve, because it's already out there. They're foreseeing

many more traffic-type things coming out there to be with them -- and they don't often like that. So you've got people of all kinds -- miserable, happy and all mixed up, all the way through this curve.

This graph says the same thing. This was part of an older presentation, and why don't I just point this out, because I'm not sure I believe that. It talks about how about 7 percent of the total household expenditures are on transportation, and about 30 percent on housing.

Two notes on that. Certainly, [Glaser and Cohn] last year as well, in their paper, suggested that this number's probably much higher for poor people than 7 percent. Housing's kind of static. But the transportation costs for poor folks gets more expensive [inaudible]. Furthermore, for people like even Peter [Calthorpe] -- a book I was rereading on the airplane on the way over here -- was talking about that number being only 20 percent for lower-income people, and that in his words, "Not only can they not afford to live out there at the end of that bid-rent curve, but they can't even afford to drive out there in a lot of cases." So they're really stuck two different ways.

Notice I put a lump here in this curve, out here. What is this? Well, this might be a new office complex, a new shopping mall...lots of things out here that might happen. All of a sudden you get all these lumpy things happening in your nice, neat [equidistant] curve, there. This isn't a similar situation at all. As you go out, you get deviations in this pattern. So I don't want to leave you with this very old, outdated view of the world. It actually is much more complex than that. You get all kinds of things happening out there once you build a new roadway facility, for example.

Of course, this leads to one of the main issues here that we were really talking about -- leapfrog development. You've got a quarry area like Portland, and then all of a sudden they jump out and start building hotels and crazy things like that out near the airport. Then you've got infill in-between the two, with new offices and new residential. This happens quite often. This happens everywhere. I won't even go into that. The first developers are kind of the savvy ones that had the good connections. They build the land. Then the rest of us kind of fall in, behind.

This is that simple model again, in a different way -- blaming everything on transportation. It says, "Make a transportation investment. Lower transportation costs out there at the end of that bid-rent curve. Economic change happens. New people move in." Et cetera, et cetera. The whole thing happens over and over again, because land-use changes, the more people that move out there, and you get more demand for new facilities. Again -- pretty straightforward.

This is a little more complicated, but probably a little more realistic. Accessibility is still out here, and transportation investments. But you have other things, too. Building density, land availability. Land-use controls -- see if they're actually there. Vacancy rates. Consumer preferences. All those things, divided by the cost of construction. There are all kinds of costs associated with that, that I won't get into. That equals where people end up living and developing land, and so forth. Even these things have other things around them. Like regional labor pools, skilled workforces and so on. It's really a pretty complex cycle you go through. It's not that simple -- and I guess that's the message of this slide.

Here it is, actually in practice. This is actually not too far from where Leigh and I live. This is Capital Boulevard, or US1 to non-locals, running north and south, here. Then the mess up here in the upper left-hand corner is the new interchange with I540. This is a case that's interesting, because this happens over and over again, I'm sure. This is a case where there was a shopping mall that's the larger mess in the middle of the screen. It actually had to wait for the development of the road -- this interchange -- to happen. The developers of the mall and the division highway engineers actually communicated back-and-forth to make sure this mall did not open before this interchange was open. So there, you see a very direct kind of working that you don't often see in the real world, of where development and roadway are actually waiting for one another. This is one

from before at Greenfield. This is the mall and the sign in front of it -- "To 540." That again is this thing, right here. This is kind of the real-world way it happens.

This is retail, of course. Different industries look for different things. But many of them enjoy improved access. That's the same thing, showing a more graphical representation of the interchange. We know that land values tend to be higher around these interchanges. That's a comparative case we can make. Anybody can draw that conclusion pretty easily. It certainly happens in our part of the world, and I think it happens here, too.

Something happens as you get a little bit more developed in urban areas. As your transportation system devotes more and more, this effect of having improved accessibility -- first, [inaudible] a little bit. When you first brought a new road into the Greenfield area, things were great. All of a sudden you had a lot of new capacity, a lot of new development potential, and so on. As the network gets more and more evolved, each new "improvement" actually adds less and less to motivation for new developers to go out there, in general. This isn't a continuous thing that happens -- it does sort of taper off, a little bit.

How does this really affect community impact and CIA? [I'm not talking about the other stuff], but not really community, so far. This is a great slide. The pictures we've taken on the right-hand side are from a project we did -- an ICI project, believe it or not. It was from this little-bitty bridge over here that this guy is standing on. The case he talks about is this great big whopping urban expressway [at a loop] facility. Yes. That's very interesting. We did a lot of things with it. But really, the real world is this guy on the bridge, right here. Many of our projects are not these big, whopper headline projects. They are these little guys, right here in the corner. That's the more interesting topic in some ways, than the big projects.

This guy's out here in [Roberson] County. You never heard of [Roberson] County before and you probably won't hear of it ever again. So here it is. [Roberson] County. It's a little bridge that's going to be replaced and widened, and I'm sure made safer. Whatever it is they do to them.

This is a sign that's posted here that talks about consumption of bass and blackfish -- crappy, I think, is what we used to call that. "Should be limited to no more than two meals per person per month." This makes me nervous. Two meals? And this sign is from the Washington Post on August 4th. Just this month. This article, right here.

It says, "You shouldn't be eating fish if you're pregnant, more than twice a week, and if you're less than 3 years of age." Mercury, although it's a very interesting element -- liquid metal and all that stuff -- I'm not sure it's [inaudible] but I'm not pregnant or 2 years old. I'm also not sure I should be eating fish, either.

Anyway, this guy's down here, and he's got a little minnow bucket. This is the ubiquitous fishing bucket. You only have this bucket for one reason. If I carry minnows in that bucket, which you have to buy or [inaudible] catch them, goodness knows -- it's a pain in the butt. So you catch your fish with the minnows, because that's the best bait you can use. Our fish like minnows, but I'm not sure about Maine fish. North Carolina fish like minnows.

So when you're done at the end of the day, you put your fish in that bucket and go home. This guy's not going to catch and release. He's catching these fish to eat these fish. Why is he catching those fish? To eat those fish. Even though the sign's right here, nailed to that tree, probably right in front of him. He's supplementing his income. There's no doubt about it.

Here's where it happens. Here's where mercury emissions -- 30 percent, I think we counted one day for profile power plants, and a bunch more from other kinds of developments. Those industries -- here's the effect. Here's the cumulative impact. Here's the indirect impact of what's going on. The presentation will allow numbers and

all of those techniques and have more words as the conference goes on. But this is what happens; this is why you're doing it.

What is it? Why do you do it? Why do you do it? NEPA requires it. NEPA did not require this, actually. The Council on Environmental Quality, when they did the regulations in 1978 -- they required it in the regulations. And they defined it. Which we'll do right now.

Indirect effects. Those are the effects that are removed from your project -- road, bus, rail or whatever it is, removed from any time respects. So it could happen 20 years from now -- the effect -- or it could happen two hours away. So it's a little bit further away in time and distance; but it's still significant.

Cumulative effects. A little bit different, but about the same thing. Cumulative effects are those effects that individually aren't that big of a deal. But in the aggregate, they're a big deal. They're significant. An important aspect of cumulative effects -- actually, two things I'll tell you about -- the project that you look at for cumulative effects could be the same as your project. So since this [inaudible] looking at -- maybe looking more at development in the office part -- water and public sewer facility... It could be from a private source, as well. So when you're doing your cumulative impact assessment, this isn't just roads. It's also everything else around it that could be a cumulative impact. That gives people no end to the grief with our DOT -- but it's nevertheless the case.

The sad thing to note about cumulative impacts is that even though we pay a lot of attention to indirect impacts, many -- like 95-plus percent of the court cases that have been released -- have dealt with cumulative impacts, not indirect impacts. So you'd better do a good job with cumulative impacts.

Other laws required. [With aquatic] -- the Clean Water Act certainly talks about it. CAMA -- Coastal Area Management Act. We have coastal areas in our state. Our general statutes define secondary and cumulative impacts [Leichtner and Jones] statutes set the minimum criteria. It's right there.

The courts require it. Third bullet. They're [inaudible] no one noticed it because [inaudible]. This is a big factor in North Carolina, I guarantee you. Because we started getting sued over our failure to look at indirect and cumulative impacts. Different projects have different impacts, so you have to do an analysis.

Then in [inaudible] like for the people I told you of before already today at the conference -- it makes sense. Long before people were looking at this subject, and talked about indirect and cumulative impacts, we were talking about economic development. We were talking about whether it's good or bad for my community. Those are indirect and cumulative effects.

Next few slides, we'll go over some sources besides the [inaudible] that we've produced. You may want to look at these to supplement your own library. NCHRP Reports 403 and 466, and the URL's right here on the bottom. If you can't read that, come up to me later, and you can copy anything down from my presentation. CAQ. We talked about them, already. They released some very good guidance on cumulative effects in 1997. FHWA. Most recently, particularly their 2003 q-and-a piece that was [most significant] for them. That wasn't too long ago.

This is the whole list of states that have guidance. Florida, Maryland, Wisconsin, California, Oregon. I believe Illinois is also doing something. I think New Jersey might be doing something. I think a lot of people are doing something. This is the whole list. So feel free to add your own mental people that are doing guidance.

Of course, North Carolina's at the bottom, and this is the one we'll be talking about the most. The guidance we're talking about the most is the Department of Transportation Guidance. But I should also mention that we

have recently completed draft guidance for the Department of the Environment. I think this might be the first that I've heard of comprehensive guidance being done for the Department of the Environment.

It also speaks highly for the work of the [NC] DOT -- the Department of the Environment also wanted to use us -- which I think is amazing. These two agencies don't always get along together, believe it or not. We're also doing it for the environment.

This big long URL is actually where the guidance is located on the DOT website. If you don't feel like writing that down, I've got some CD-ROMs that I will replenish out on the table, today. They look like this. I'll put those on the table for you, and you can grab one of those.

This is how it happened, kind of sort of. In the 1980s and 1990s and really even in the 1970s, with a project I can think of -- NCDOT got more and more criticism for different quarters. Particularly the water quality people in charge of producing permits, and things like that, for stream quality and wetland quality -- about our lack of attention to indirect and cumulative impacts.

In DOT-land, they decided to do an [inaudible] agreement with the Department of the Environment. That was a real landmark kind of happening. This is how people asked me, "How'd you get that to happen? Why does the division of water quality and [inaudible] actually pay attention to what you do, as DOT?" Well, it's because we went to them right at the very beginning, as a stakeholder kind of interview process, and asked them what they thought about it. They thought they should enter into this agreement. Whatever came out of that guidance, they would adhere to. And they have. They've benefited from it very greatly. We've also done additional guidance on 401 integration with the guidance last year. So they've continued to benefit from this agreement they formed with DOT. That was just integral.

DOT went through a thing in DC a couple months ago. NCDOT [fell into place and they called out our number distinctly]. They said, "We can't get them to do anything." Well, the first step is, you've got to sit down with them, before you even talk about how to do it. You've got to get them to agree to a process. One just keeled over, that day.

The end shot of this was an 8-step process. Four less than Alcoholics Anonymous. So if you do this enough, you'll probably end up there, too. The first five steps are really kind of lumped together. That's why you have a line across here. [inaudible] boundary, the timeline in which you want to go forward and backward with your inventory of impact. Another of the features is kind of a shorthand for things like various endangered critters in little communities, and whatever else you might find. The impact-causing activities of the project.

Step 5 is really that's really the [focal] point of the whole thing. That's where you decide if your project is rating out impacts in time and space that there receptors you've already identified in your catalogue here can receive. You may have endangered animals -- critters in certain environments -- but if your project really isn't doing anything to threaten the environment, you really don't have good reason to do a detailed assessment down here.

Much of the talk on the case that you're going to be talking about is on more advanced techniques. But really, the more we do these -- and we've done quite a few of them now -- we're finding that the top 5 here can get you a long way if you do a good job of it. Many things don't need a detailed, quantitative, number-crunching kind of analysis. A good qualitative analysis in our opinion and in the guidance's opinion, is just as good as a good quantitative analysis. Both have assumptions. Both make mistakes a hundred times. That's one thing we like about our guidance. We don't discount talking to people and being qualitative in our methods, and being unqualitative in our metrics.

Prescreening. At some point, our friends at the Department of the Environment said we were trying to do this a little bit too often. I think DOT kind of felt the same way, frankly. We now have an upfront kind of step, apart

from the 8 steps. It talks about prescreening. Are you making a measurable change in roadway capacity? That gives people a greater than 5-minute advantage in travel time. Is this a major facility, or something even like a major arterial -- or something even high, like a freeway? And the project purpose. This still happens, quite often, in our state with road projects. I'm sure yours, too, where road projects are being done in large part to facilitate economic growth. Well, bam! That's induced growth. That's an impact, right there.

When we talk about the rate and path of organization, well, much of our state is growing very rapidly, but other parts of our state are not growing very rapidly. So induced growth, we're talking about as being a big factor, no matter how many roadways you put down there. It's still going to be a pretty backwater kind of place. That does happen.

Methods. We got past Step 5, and we actually had some indirect and cumulative effects that we want to try to analyze. This is the part where people just kind of fall all over themselves. Imperative case analysis. What's a good example? We have a lot of little towns in North Carolina on the coast. Occasionally we want to build a road there, for whatever perverse reason. People in those communities will either favor or disfavor the project. One way to look of this project and explain it in real-world terms is to draw conclusions from other places. This is very common. People do it all the time, whether they admit it or not. They're doing it all the time.

One thing people often screw up, though, when they get into this being their job doing this -- they forget to look at the differences between communities. They may have the same population, same growth rate, but... One community's more of a tourist trap and the other one is more of a residential, summer home kind of thing. There are some differences. [Do look at] the differences in doing the analysis? Don't be afraid. Just do it. There are all these differences in all these comparative cases, and that's fine.

So, there you are, writing. Kind of like comparative [inaudible], kind of. But you're getting people to help you write different scenarios. If X happens, then Y might happen. How quantitative was that? If X happens, there's a 40 percent probability Y will happen. You can see that actually happening sometimes with some of these more detailed, [inaudible] morning exercises. Again, a great way of getting people involved. People understand this.

Visioning. People love pictures. What are those pictures? One way to get across things about development patterns and densities and what's an R40 and an R20? What the heck is that? They might not know what those things are, but they might know about risk. That's very low-density. That's part of [inaudible] R40. I'm not sure what that is. Maybe agricultural. That might be an R20 -- that's probably less than an R20 -- probably an R4. Urban density might be a CBD or a mixed-use kind of development. People understand this when you talk to them. They don't understand what a mixed-use development is. They don't know what an R40 or R10 is -- so showing pictures often helps. We try to do that a lot.

Visioning for the advanced. You see these fancy things with four -- airport noise contours are very common. Everybody does these little visualization things, now. Even walk-thus like this one for the World Trade Center. That was actually something I think we did for the World Trade Center. One of the proposals we put out there for rehabbing the World Trade Center after the 9/11 attack.

And then this one -- we did this house just for the heck of it. We knew that cell phone towers were a continuing problem for [Diener]. People had asked us to look at that in our guidance we prepared for them. We did some 30 minutes. We pretended there was a cell phone tower down here. This is a "before" picture, here. We asked this GIS thingy to show us where you could see the cell phone tower from. Everything in snow-white is where you can see that tower. So you can see that tower from here and here and here. You enter in things like the height of the observer and the height of the vegetation and stuff. I swear to you, it takes about 30 minutes to do something that's actually pretty reasonable.

If you have an historic feature out here that you want to protect, to make sure you don't cell phone it up, you can actually look at something like this and do it pretty quickly. It's not a big deal, any more. That's the big message, I guess. These things aren't a big deal, any more. They used to be. They're not so big, any more.

More methods. More people kinds of methods. Delphi technique is the Webster's definition, which I hate, of an expert panel. That's kind of varying for Delphi, in my mind, because you actually get people from the Division of Water Quality and other places that kind of "help you" make decisions. It could be from business interests or it could be from just people out there in the real world.

Okay. Strap yourselves in. We're getting quantitative. We'll be gentle, though, at the end. Trend extrapolation. Everybody does this, too, in their own minds. They think about their past experiences and project that forward to the future. That's all trend extrapolation is. There are three different kinds we're going to talk about. Essentially seemingly innocuous little things can lead you to disaster, and here's how it can happen.

Graph 1. We've got a nice straight line. Here are our data points from 1910 all the way up to about 1990, or so. We're projecting those out to 2000. Then we go on. This line fits pretty good. Of course if you didn't add statistics like a little bit of R^2 value of 0.92 -- particularly in market kind of behavioral situation -- that's outstanding. That means that line is [planning] 92 percent of the variation of these points. That's really good.

Problem. In 2000, short [inaudible] population was 700,000 people. So according to this line, in 2020 should be 700,000 people. Whoops. That's all right. We'll try it again. [inaudible] What's the [inaudible] now? Oh, my goodness. You'll never say that ever again. Take a good look. Take a peek. Okay. Now we're saying that in 2020, the population of Charlotte Mifflinburg will be about 1,050,000. Something like that? I don't know. Something like that. Big problem with that. And talking to the people in Charlotte Mifflinburg, they said there's no way you can continue the economic trends that produce these two dots out there. So that's also wrong. That's very wrong.

So what do you do? Many things exhibit an [acentotic] kind of growth pattern. We start kind of slow, get fast, fast, fast, fast, and then something happens. You run out of the juice you had in the beginning or in the middle, and you eventually taper off. This is a much better curve to show Mifflinburg.

One reason you know this is a better curve is you're talking to people in Charlotte Mifflinburg County. You don't know it from the paper. You don't know it from up here. You've got to talk to them. So just talk to them. That's how trends can lead you astray.

Kind of an add-on to that. Build-out and caring capacity analysis. If we built up as much as we possibly could, on every piece of land we've got, it'd be this. We have this much more impervious service. We'd have this many more gaps. What else? Well, that's great to have that. Nothing wrong with having that.

One of the things we do for NCDOT is kind of review consultants' work and kind of provide [constant]. There's one that every time comes back. It's just one thing that they use, and it's this -- the build-up scenario. When people read that, they think that's what's going to happen. Well, no, that's going to be worst-case what will happen. That [peg's going to end the spectrum]. They keep sending the same comment back, and they keep on, and the next project will see it and it'll be right there again. So don't just use this. But it's neat to have it, and it's good to show people the worst that can happen. But don't rely upon that all by itself.

In fact, don't rely on any of these all by themselves. Always use more than one method to triangulate the results with both qualitative and quantitative. That's the [major theme of the talk].

Rates and ratings. People love rates and ratings. Low, medium, high -- all that kind of stuff. A great thing about this, if you can do it, is to get people out there in the real world to help you provide a rating. How

important is public water and sewer to development? How important will the new road be? How important is market perception? Your rating can actually be something measurable in the real world, and validated by people that live in these areas.

Methods. Okay. We're getting a little bit heavier. Heavier-looking. Heavy-knuckled. Progression analysis. Kind of like the curves we saw a minute ago. Basically, a statistical way of kind of measuring the change on one variable, based upon many others. This is as bad as it gets. We've bottomed out -- so don't worry. It'll get better from here.

If you want to know how many people are in a certain area, you can look at things like [Travel Time or New Road. Or Healthy New Road]. The amount of land you have available. Water and sewer. Crime rate and other things you might want to add on there. [inaudible] or whatever you want to do. Then how to figure out from all these things what the change in population or employment might be. This is called a [gravity] model, and it's been around a very long time. It's used most often now with travel and demand models. You'll see this kind of formulation up here. Here it is.

Good old Isaac Newton started this whole mess. We have him to thank for it.

There are two things old Isaac said that influenced planetary bodies. One was the distance between them, and one was how big they were -- how much attraction they had for each other. The same thing, theoretically, goes for places. If I want to go between Portland and Boston, this theory says I'll probably go to Boston, because there's more opportunity in Boston than in Portland. I don't know about that -- I like Portland better. Here it is in the real world. You come up with a black marker [inaudible]. You have a beautiful Circle City, and a new project's going to be developed, here.

Next picture over, without the development, this could be the number of employees. These shadings could be employment density or people density or whatever. Then with the project, you've got things happening. These two cells right here are a lot more dense than when we got the project. They've got more things going on.

Well when you [get this out of the way], it's pretty simple from there. You get the idea where we're headed with this idea. You put in low-income communities or natural habitat or whatever it is, and you're right on top of the groove. You kind of get a feel for what's going to go on there.

We've done this. We did it for Winston-Salem. There's nothing wrong with this, but people tend to rely upon these numbers thing way too much. A lot of assumptions are going on, here. You don't see them, but it doesn't mean they're not there. They are there. If you ask me which one's better -- this or a good talking to with many of the people who live in that area -- I think Circle City's served by both, pretty well.

To try to do that, I guess...integrate this technical part with the land-use modeling part, they've come up with these things called land use and transportation models. Trying to predict where people will go. The travel demand part of it is shown right here. This is the shading -- it's kind of hard to see that -- but it's the old four-step model. You generate trips. You put trips out in space where they're going to go. You decide how they're going to get there. Bus, bike, car or whatever. You assign them to a network, and you feed the congested times back into the distribution, again. You run back around, over and over and over again. Finally, everybody gets where they're going in the best possible time. Everybody's rational about it.

The people have cited a lack of... There were many problems with this. Some of the problems cited with this were that the feedback... Sure, you'd get the trip generation. I'm making it easier for people to get around, so there are going to be more trips made. If it were harder, there might be fewer trips being made. An even bigger problem was when people decided to forget all that stuff. You'd have to get all way back around through here and say, "Well, your land-use data might even change." If your transportation system sucks, your business will

be going in there. That happens in the real world. But many travel-demand models -- I'd say just about all of them except for a handful -- all look at this one very limited kind of feedback -- not the big one.

To address that little problem, this was shown to you actually a couple of years ago, I think -- in Wisconsin. Was it Chris Sinclair who actually did the presentation? Yes. The man, himself. And Hannah was there, too. From Renaissance Planning Group. He showed this thing to you. [various] models. I did a lot of this, because I used to work for MPOs, and we thought about this a lot. "Should we be doing this? Should we not be doing this?"

They're very data-hungry, and they like a lot of data. They like to maintain a lot of data, and they're very difficult to keep up. It's kind of black-boxy. You feed this stuff in and it comes out. What happens in-between, no one really knows.

The thing I like about the core-plan model that Renaissance Planning Group did, and I'm probably stealing someone else's stuff here, but it's okay -- is that you really have to have involvement of people to get the numbers into this thing. It looks at what people are saying about their community. They're using building-blocks for existing developments they understand. They put them into a spreadsheet or GIS and you get the data back out of the backend, still. But it's calibrated kind of automatically by what people are thinking about what the community should or might or will look like.

The probably I think about [inaudible] we'll get into, I guess, is as soon as things happen -- things will get torn apart just as easily as things that are a lot less technical... number-crunching... will get torn apart. They don't necessarily make people believe what you're saying any more than if you didn't have it. So just because you're doing this work, don't necessarily think people will fall at your feet and worship you -- the techno-geek that you are -- because you have a land-use model. That is not the way it always works.

Step 7 of our guidance in the 8 steps you saw a few minutes ago, talks about evaluating results. What is that? You've got all this technical stuff. You've done all your interviews. You've done Delphi. You've done Strings, Ribbons, Twigs, Branches, Feathers or whatever you're doing. You've done all that stuff. Now you've got it in your hand. Well, there is some level of error in that report. Now, whether you say what level of error that report is, it's up to you. You may hand it in, being the good consultants you are, and not talk about the error or the assumptions you made. That's bad. You know about the error that might be in there -- the assumptions.

Sensitivity-testing. This goes to our case that you'll see here in a minute. We looked at this beltway project, which is actually two projects. If you just focus on the beltway of the city itself, it's delayed decreases because you're adding the capacity you get from other... [You want to go easier]. Delay goes down. As delay goes down, the number of trips being made goes up 200,000 more trips. Wow! Or VMT... Vehicle Miles of Travel. Excuse me. It sounds like a lot, but that ain't much. In a city like Winston-Salem, that's less than 0.5 percent -- probably 0.25 percent. If they were TIP projects -- you know, all the Transportation Improvement Program projects, you'd get this pink curve. If you add both the beltway and all the TIP projects, you get the yellow curve. So you can see, as you go up, the delay functions.

This is kind of telling people, "This isn't adding anything to your final number." Okay? This doesn't do that. What this tells people is, "This is a range of a kind of effect." This isn't telling you that it's a different number from the one I said a few pages ago in the report. This is saying, "What if we did this, this, and this?" It gives some sort of a range of sensitivity to go by.

But we spend a lot of time trying to polish those numbers that go into those models. Let's face it. At some point, you're polishing something that's probably not worth your polish. So what you're trying to do here is say, "Look. We know there's error, and here it is. Here's the error." We should spend much more time, in my opinion, doing this, rather than trying to get that input to be picture-perfect, when we all know that no matter

what you do, it'll never be just perfect. When you're done with it, people will move and they change. Homeowner use has grown. Who knows.

So, CIA. Here we go. How do you do this with indirect and cumulative impacts? People can help in a lot of ways. They can help set boundaries -- physical, spatial boundaries. Conformed boundaries. They can help you do the analysis in some ways. Rates and ratings. They can help give you rates. They can validate things for you. They can certainly identify mitigation options for you. The input... Is the input good? Is the output reasonable?

The techniques, we went over, here. Most of it. We didn't go over contingent valuation, which is sort of a controversial technique used a lot in different places, trying to figure out if a park wasn't in a place, how much would you miss it in monetary terms. That kind of thing. I'm not doing that. [inaudible] They just started doing that.

As I mentioned, [inaudible] here that we did recently -- we just finished a good draft of it I think, for Winston-Salem Northern Beltway. We chose this as a case, I guess, because it really examines a lot of different things. Again, you're not trying to use one tool or one technique. You're using many techniques to try to triangulate a result or an answer or a response. This one certainly does that. We tried a lot of different things with it.

Gravity model. Sensitivity analysis. Expert interviews. We did one with cumulative impacts, trying to get down to the nitty-gritty level. Comparing several different scenarios, going to the East side of the route, West side of the route. A lot of things were going on here with this analysis.

[tape turn]

[One side of the area is the entire county]. Changes to the entire county might include new people migrating into the county because of the new facility. Maybe. People moving from one side of the county to the other. Traffic or resident-wise. Of course, the direct-impact areas are the 17-or-so interchanges around the beltline. We all know -- we just said a few minutes ago, anyway -- that interchanges tend to change the value of the area around them. That might induce some more development on the interchanges. So we looked at all of these areas, all the way around.

One kind of cool thing about Forsythe County is that it has a growth management plan. They stay cool, because most of that hasn't happened very often. Green area should stay green and basically unoccupied. The built-up area's in yellow, and the transitional area's in light green, over here. So that was something we thought about pretty hard as we were looking at it. See, the beltline is basically inside the yellow area. There are a few places out here are kind of slipping out, and it's supposed to be undeveloped. That was certainly one way that we drew attention to these two interchanges, here.

We looked at low-income, minority communities as part of our mapping. This is pretty traditional kind of stuff, now. Thanks to extensive data and GIS. The gravity model -- the big one that [inaudible] saw a minute ago -- is better-explained probably by a map like this. Areas that might be losing population or employment are shown in blue. Areas that might be gaining it, because of the entire beltway shown here in white, are shown in red. Pretty simple. [inaudible] to get there, but it's pretty simple.

Some help for you -- you can use the Internet for this. We targeted several people that wanted to give us a response. What if we put an interchange here? What do you think of this interchange's potential for growth, looking at the project? This sort of displayed it. The size of the pie shows the kind of rating from 1-10 that people thought the potential was for development. This little part over here on Bay Mountain Road was pretty small, compared to University Parkway. You can follow that. Also, you can see that by shading of this tan area, you get half the pie -- they thought that actual potential with the beltway was that much bigger than

without it. So it kind of did two things at once -- it showed the pie as a potential, and the [inaudible] in hand showed the potential due to the new roadway coming in. So you see both at the same time. [inaudible]

One thing I would say about these evaluation matrixes -- everybody uses them. Nothing wrong with it. Low, medium, high. Make sure you tell people how you got the low, medium, high. What were the specific things that made it low versus medium versus high?

Cumulative effects. This is just ugly. He's got to go in there and figure out the things you've already looked at. Look at those areas you thought might be potentially higher-growth areas because of the project. Do a very detailed kind of assessment on the ground, and through aerial photography, of what's going on. I think we're seeing some of the historical communities down here. I live near Bethania -- I don't know. And [string] features, and so on. It's just a matter of inventorying each as an individual areas that you might be higher-growth. There's nothing pretty about it, but it's just an inventory, really.

Then you get to the part where you want to manage the impacts. Well, if you have impacts, you want to find a way to manage them. The key thing here is that it's not just DOT's fault. It's got to happen with local communities. It's going to happen with private agencies and non-profits. Everybody can play a part, here.

System planning. Forsythe County's kind of advanced in some ways for North Carolina. They actually do talk about these kinds of things. Vehicle miles of travel, impacts of jobs, housing and balance. Other companies have planning tools and kind of look at these different system performance measures. It's kind of cool. But DOT can do things, too. Certainly the design, [the environment], and things like that can help mitigate some of these impacts during construction and afterward.

Again, the community -- excess controls, context [inaudible] design. I think you all have heard about that, before. Growth-management techniques. We talked about Forsythe County already having a growth-management plan, but they could also look at transfer development rights, for example -- to help preserve the more rural parts of their county and keep them rural.

That other thing [inaudible]. This can be done with planning conservancies and things like that. Development fees. There are lots -- there's a menu of things you can look at to mitigate these impacts. I'm happy to say that people in Forsythe County are paying attention to this. They're actually doing some very good planning for the interchanges, even before they get there.

More?

In a summary...here we go. These are kind of key things we found as we do these projects. Probably foremost among those when technically robust is standpoint. You've got to look at the problem from multiple angles. Don't use one tool. Don't use the hammer to drive in the screw. We tried looking at it from different ways, using different techniques. Talking to people and learning the numbers. There are things that you do, in the complexity that you get into -- the money you spend will depend a lot upon the complexity, the controversial nature of the project or whatever. Those kinds of things will influence how much you'll get into these kinds of indirect and cumulative effects -- and of course the area and the project, itself.

Reasonable scenarios. People think that because of this indirect and cumulative stuff, it can get all pie-in-the-sky. Well, yes. Some of it is that way. But the scenarios have to be kind of reasonable. You have to explain why you think something's going to happen. It can't just be any strange combination of circumstances. It has to be a "reasonable, foreseeable," circumstance.

Mitigation has a lot of partners. DOT was very afraid of those at the beginning, because they were training them to do all the land-use planning for the state, and they didn't want to do that. Locals don't want to do that,

either. Mitigation has made progress in local government and land conservancies and chambers of commerce -- lots of partners.

To follow one -- maybe the most important one for this conference -- is both qualitative and quantitative methods. You've got to have both. Just because it doesn't have a number attached to it that's got 12 decimal places doesn't mean it's any worse off than one that does. Both tools and techniques make lots of assumptions and are biased. That's okay. But again -- Step 7 -- note those biases. Test those biases. Probe them a little bit.

Einstein said that, "Nothing that really counts can be measured, and nothing that can be measured really counts." That's something you need to keep in mind. People just count things to be counting them, sometimes. He also said this, and I think this is true. I think that we've got to put ourselves in a situation where we can [flip part of the facility] and put the blinders on and we've done it for a long time. Based on a case law that we're seeing now nationally and internationally, that day is coming rapidly to an end. We're seeing a lot of interest in this topic about indirect and cumulative effects on communities; on natural environments. So in order to address those, you can't keep doing the same thing over and over again. Who was it that said the definition of insanity is doing the same thing over and over again? Well, we don't need to go there. We can do it a different way. It can be done, but it's not progressive. We don't have lot of growth management laws on the books. We're just as economic, Wal-Mart-hungry as the next guy. But DOTs can engage in this and be fully successful. Ultimately, it's got to come to a system-wide perspective. But until that day comes for us and others, this isn't a bad way to go about it.

Moderator: Thank you.

J. Scott Lane: Okay.

Audience: [applause]

Moderator: Questions? We have about 10 minutes before we'll start the next [inaudible] at a quarter of.

[session ends]