

# Getting Started with ModelBuilder

Leah Saunders shows how to use ModelBuilder to create, edit, and run model tools.

<http://video.esri.com/watch/663/getting-started-with-modelbuilder>

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## Video Transcription

**00:01** All right. So, welcome to Getting Started with ModelBuilder.

**00:04** My name is Leah Saunders and I work for Esri.

**00:08** I am a solution engineer out of our Seattle, Washington office, and been with the company for just over...

**00:15** ...10 years, doing all sorts of things, so...

**00:18** But, I always seem to come back to the conference and end up doing something with geoprocessing...

**00:24** ...and ModelBuilder and working in the Spatial Analysis Island.

**00:27** I think that's maybe where my heart is; I'm not sure.

**00:32** So, how many of you are new this year to the conference? First time?

**00:36** Wow, good. I'd would like to kind of check it out and see; hopefully, you're enjoying it and getting lots of information.

**00:43** So, the next 75 minutes, we're going to be sort of talking about ModelBuilder.

**00:48** How to get started, and what you can do with it.

**00:51** And then after, if you, you know, want more information, there's additional sessions...

**00:57** ...and then you can always come down to the Spatial Analysis Island and we have a bunch of ModelBuilder...

**01:01** ...and geoprocessing experts down there so come and hit us up for some more information.

**01:09** So, the agenda for the next little while, while you're here with me, we're going to go over the basics of geoprocessing.

**01:15** What is it?

**01:17** And then we'll get into ModelBuilder itself, how to create some model tools...

**01:21** ...and then a few tips for designing and sharing your model.

**01:25** And I'll have some additional resources at the end, just to kind of get you going once you step out of this room and...

**01:31** ...you know, you're actually going to be start to work with it.

**01:37** So a basic geoprocessing overview.

**01:40** What is geoprocessing?

**01:43** So how many of you, when you hear geoprocessing, think buffers and clips and unions...

**01:47** ...and traditional sort of GIS, geoprocessing tools, right?

**01:52** So, I mean, that's where I come from.

**01:55** But, over the years we've kind of expanded this definition to mean more like a system for managing...

**02:00** ...and manipulating any kind of spatial data, maybe tabular data relating to spatial issues.

**02:07** So, we're able to solve real-world problems, or real-world spatial problems with this, and model our processes...

**02:15** ...and systems and things like that, and then, you know, we generally have a lot of questions...

**02:19** ...and that's why we're doing this stuff.

**02:21** So we want to get results and we can use the geoprocessing sort of environment to do that.

**02:28** So, the geoprocessing language itself is really kind of sitting in tools.

**02:33** So we have many different toolboxes with toolsets and tools, like these specific functions or multiple functions.

**02:41** Here we have your individual tools - Clip tool, Raster Calculator, and so on.

**02:46** Lots of different tools.

**02:47** And you get different tools with extensions, different tools with different levels of ArcGIS Desktop.

**02:55** So that's really our geoprocessing language, is working with these tools themselves.

**03:02** Now, the geoprocessing framework is sort of these different environments that we can use these tools in...

**03:10** ...that we can kind of work in.

**03:11** So you can open up the tool itself and explicitly put in the parameters and click OK and away you go.

**03:18** Or, what we're going to be looking at this afternoon is pulling these tools to create sort of a process in ModelBuilder. Okay.

**03:28** We also have the Python window, so if you're using ArcGIS 10 we added this window so that...

**03:33** ...you can quickly type in Python commands, right?

**03:36** And use the tools in there.

**03:38** You can also take that one step further and go into a scripting environment, right?

**03:42** So you can write more than just one sort of geoprocessing command or tool.

**03:49** Write an entire script to do all of that work.

**03:51** So these four pieces, the tools in ModelBuilder, Python window, and the scripting environment...

**03:57** ...all sort of are what we use in the geoprocessing framework, ok?

**04:01** Or, what we refer to as the framework itself.

**04:06** Finding tools.

**04:07** So you've probably noticed by now I'm working in ArcGIS 10, by these screen shots.

**04:13** So we added a few different things at 10 so that you can actually search for tools.

**04:18** Maybe versions before that you like to go to your ArcToolbox and go find some tools in there.

**04:25** Well, we've added a geoprocessing menu at 10 so that you can get some of the very common tools...

**04:30** ...buffer tools, clip tools, things like that - things that you may use quite often.

**04:36** We also have the Catalog window, and in the Catalog window you can access all of the toolboxes.

**04:42** The system toolboxes, as well as any custom toolboxes that you create.

**04:47** And then the one thing that I really have become very accustomed to using and really enjoy now is the Search window.

**04:56** So the Search window allows you to search for not only tools, but also maps and data...

**05:00** ...by little keywords.

**05:03** So, I'll show you an example of, you know, not just looking for a clip tool by its name...

**05:07** ...but we can also use alternative names or descriptive names when we're searching for tools.

**05:16** On our geoprocessing menu, we do have some geoprocessing options as well.

**05:22** So I kind of put this in the beginning, so that way you'll have an idea of where to get some of this information...

**05:27** ...as you start to use the geoprocessing framework.

**05:31** So, on the geoprocessing options, a couple of important things that I want to point out.

**05:35** One is the ability to overwrite the outputs of operations.

**05:39** So, that's the check box at the very top of the dialog, and this allows you to go ahead and overwrite...

**05:45** ...output to previous geoprocessing operations.

**05:49** The real use of this is, if you have to run a model or a tool multiple times when you're testing things...

**05:56** ...you may not want to go and have to clean it up.

**05:57** You may just want to overwrite and move on, right?

**06:00** So you can go ahead and do that.

**06:01** I definitely recommend logging in geoprocessing operations to a log file.

**06:06** If you call tech support and you have a problem with geoprocessing, and they may ask you, do you have a log file for this?

**06:13** It's really beneficial for you to log your processes as well as to give the tech support or other people...

**06:23** ...supporting you on this.

**06:25** ModelBuilder has specifically one individual option that I'll go over a little later on...

**06:31** ...that has to do connecting pieces in ModelBuilder.

**06:34** Also, you may want to check out the results management options, so you, when you run geoprocessing tools...

**06:40** ...you get these results, and then you can go ahead and decide how long you want to keep those results.

**06:45** Okay, so the default is two weeks, but you can go beyond that, a month, two months, or you can say...

**06:52** ...I only want to keep it for the day. Okay.

**06:55** So, it's up to you how you want to do that.

**06:58** All right, there's a few other little options at the bottom.

**07:00** So definitely go and check out the geoprocessing options on the geoprocessing menu on ArcMap or ArcCatalog.

**07:10** All right, so let's take a look at this.

**07:16** So here I just have a map of Jefferson County in Kentucky, and, a very simple map, but I'm going to go ahead...

**07:26** ...and kind of ignore some of this stuff and just give you the overview of how to find some tools in ArcGIS.

**07:34** So one of the first things I talked about was this geoprocessing menu, and so you can find...

**07:39** ...you know, six of our most common sort of geoprocessing tools, and we also have the ability to get to our...

**07:45** ...geoprocessing options dialog on that drop-down, 'kay.

**07:50** Something else that we can do is open up the Catalog window.

**07:54** So this is a nice little window inside of ArcMap and I can get to all my toolboxes inside this window.

**08:00** All right, so you have system toolboxes and then your custom toolboxes.

**08:04** No search capability here, so you have to know where you're going.

**08:07** So, if I'm going to look for my buffer I need to know that it's in the Proximity toolset, okay?

**08:13** However, if you're not too sure where a tool is, you want to be able to search and you can use...

**08:19** ...the new search window in ArcGIS 10.

**08:22** So, as I said, it takes not only the name of the tool - so if I know it's called clip, I just don't know where it is...

**08:28** ...I can type in Clip and have it go and search, 'kay.

**08:33** But if I'm relatively new to the software and new to GIS, I may not know that it's called Clip, right?

**08:38** I just know that this is a cookie cutter type of function. 'Kay.

**08:42** So, I can actually type in cookie and get the Clip tool.

**08:47** So there's been some intelligence built into this search, to be able to search through the description...

**08:53** ...and other information that's put with the tool, so that way, you know, you can search by common names...

**08:59** ...by things that are a little more descriptive as opposed to just the actual full name in there.

**09:04** So I think this is pretty neat, right?

**09:08** All right, so that's how we can sort of get started with geoprocessing and searching for tools.

**09:17** So, the basis for my demonstration today in that Kentucky map is because I need to solve a problem.

**09:25** I tend to focus a lot on public safety in my region, so this is kind of near and dear to my heart.

**09:32** We have a scenario here where we need to prioritize the schools in the area for emergency shelter planning.

**09:39** We tend to use these tools as our shelters in cases of emergency, because they have larger areas and rooms...

**09:46** ...that we can kind of put people.

**09:47** However, we do have a lot of schools in the area that are in what we could call vulnerable areas.

**09:55** So these vulnerable areas could be within 2,600 feet of the Hazmat route, right?

**10:02** Within 2,600 feet of a hazardous facility, and also within a flood hazard area.

**10:11** Okay, so we have some flooding potential there.

**10:13** So these three items here, I need to make sure that these schools are far enough away from these...

**10:19** ...that they can be used for emergency shelters. Okay.

**10:24** So this is our scenario for today and this is really what we're going to be working on throughout...

**10:28** ...the rest of the workshop, and creating a model to find these potential schools for our shelters.

**10:36** I just wanted to kind of give you an overview of what that looks like.

**10:48** We have four specific tools in here.

**10:49** And, just to give you an idea of the final model okay - so this is what our final model is - there's a few different things.

**10:50** One is to buffer our Hazmat routes.

**10:53** Another is to buffer our hazardous facilities.

**10:56** And then we're going to overlay those two outputs and union them with the flooding areas...

**11:03** ...and that will give us our vulnerable areas within the county.

**11:09** And then I want to go and find all the schools that are not within those vulnerable areas.

**11:14** So, I'm going to use the Erase tool to do that, and then my output is going to be the schools...

**11:18** ...that I could use as potential shelters. Okay?

**11:21** So that's the process that we're going to go through when we go ahead and build the actual model.

**11:26** Okay, and this is essentially what we're going to be looking at later on.

**11:29** But I like to give you an overview of the model first, and then we can start to put all the pieces together, right?

**11:34** And build it from scratch, so that you don't think I'm pulling some smoke and mirrors there when I work through there, right?

**11:42** All right.

**11:45** So getting started with ModelBuilder itself.

**11:49** Why would you want to use ModelBuilder, right?

**11:51** You can go and open up a buffer tool and run it.

**11:54** You can open up the same buffer tool again and run it on some different data.

**11:58** You have the ability to open up all these tools and run them and put a little bit of intelligence into them...

**12:06** ...but there's some distinct advantages of using ModelBuilder.

**12:12** One is, it's a way of encapsulating workflows, right?

**12:15** Making reusable and sharable processes.

**12:19** If you went to the plenary session on Monday you may have seen Lauren Rosenshein...

**12:26** ...doing something with spatial statistics and showing a new 10.1 tool.

**12:30** She created a model and she was able to go and share that model for methodology to somebody in Denver...

**12:36** ...and then he was able to go ahead and reuse that model and apply it to his own data, right?

**12:40** So she did all of this work, why not be able to share that and rerun that?

**12:45** So, that's a sort of a reason why we want to use ModelBuilder - automating and managing workflows.

**12:53** Running a complex succession of processes in one tool.

**12:57** I may have 15 tools that I have to run, and I have to do that once a month. Right.

**13:02** I have to remember, then, the succession of those tools, right?

**13:06** Why not put it into a model, and then have the software kind of do the work for me, right?

**13:11** Write it once, run it as many times as I want to.

**13:16** Another reason is that you can actually go and create a model and then sort of change little things...

**13:22** ...to match what you need to do when you run it the next time.

**13:25** So if I need to add another tool, or I need to change a parameter, you can kind of do that...

**13:30** ...very easily, once you have the base model.

**13:34** And then lastly, being able to have a visual representation of your work. Okay?

**13:39** Again, back to Monday, you know, when Lauren did the spatial statistics, she showed that she created a report...

**13:47** ...and the methodology of how she got the results that she did.

**13:50** And in that report she actually put in the image of the model. Okay.

**13:54** So, a nice graphical way of showing your methodology and what you went through to get...

**13:59** ...the results that you did, all right.

**14:00** So a lot of times people ask us, what did you go through to do that?

**14:04** We have to kind of justify some of our processes there.

**14:10** So before we really get started on ModelBuilder, I need to kind of point out something in ArcGIS...

**14:17** ...and that is the types of toolboxes that you have available to you.

**14:22** One is the system toolboxes.

**14:24** So these are the toolboxes that are installed with the software, right?

**14:27** They are read-only toolboxes.

**14:29** You cannot go and add additional pieces to them.

**14:32** This read only is really a good thing, because this is the stuff that gets installed with the software...

**14:38** ...and you want it to be running all the time, or working for you all the time.

**14:42** So, if we were to give you the ability to mess around with them a little bit, we might give you the potential...

**14:47** ...to mess up those toolboxes, okay?

**14:49** So, the toolboxes that you get to go and play with and add new tools to, and whatever else you want...

**14:56** ...are the custom toolboxes.

**14:58** So these are your user-created toolboxes.

**15:01** They're stored either in a folder as a .tbx file, or inside of a geodatabase.

**15:06** And that can even be an enterprise geodatabase, if you choose.

**15:10** So keep the actual toolbox with your data, or you can kind of put it aside.

**15:17** So why am I telling you this?

**15:19** Well, when we make models, we are making our own new tools, and we need a toolbox to put those models in...

**15:26** ...and that would be our own custom toolbox.

**15:28** So a couple of different ways to start a brand new model - one is to go and click on the ModelBuilder...

**15:34** ...button on the ArcMap standard toolbar.

**15:37** It looks like a little icon that you're seeing on the left side of the slide.

**15:41** So, this opens up a brand new ModelBuilder window, and then you can go and create a model and save that from there.

**15:47** The other way to do this is to go into a custom toolbox, right-click, and choose New Model.

**15:53** That again opens up your ModelBuilder window, and now you can go and start to work on your model, okay?

**16:02** So, the first thing I like to do when I go and create a new model is actually go to the Model Properties...

**16:07** ...and open that up, and start to set up my properties, right?

**16:11** So I create my name, which cannot have spaces, okay.

**16:16** The label, however, is what actually appears in a toolbox, and that can have spaces.

**16:22** But make it nice and descriptive, right?

**16:24** So that if you're looking at it later on and you give this toolbox to somebody, they can see...

**16:29** ...basically by the name what it might do.

**16:32** In addition to that, it's always a good practice to go ahead and put in a description.

**16:37** Put in as much of the description as you possibly can.

**16:41** That's definitely helpful when sharing models.

**16:44** And then the other option towards the bottom of the Model Properties General tab is Relative Paths.

**16:51** So hopefully you're kind of familiar with Relative Paths in map documents, right?

**16:55** So if I open up a map document and I have it on my E drive and I save that, and I save it with Relative Paths...

**17:03** ...somebody else can open it up on a D drive and it won't necessarily break the data.

**17:08** And this is the same for models; models use data and use tools, so they do carry paths...

**17:13** ...around with them for that information.

**17:18** So another thing that I like to go over before we start to actually create a model is the idea of...

**17:25** ...environments and environment settings.

**17:27** So these are sort of default settings that you can have that go with your tools or in your applications...

**17:35** ...such as workspaces - whether it's a scratch workspace or a current workspace that your data's coming from.

**17:42** You can also set up an environment setting for a coordinate system. Okay.

**17:49** So if you usually work in one particular coordinate system, then you can set that up as sort of...

**17:54** ...your default coordinate system, right?

**17:57** It's important to know sort of the hierarchy of how environment settings are distributed.

**18:03** So, at the very top, in number 1 here, we have the application settings.

**18:09** So, these environment settings or defaults are set at the application level.

**18:13** That would be ArcMap or ArcCatalog.

**18:15** Then, any tool that is run within that application, actually inherits those applications settings.

**18:23** However, they can be override.

**18:25** So if you set in ArcMap that your coordinate system is going to be some particular area...

**18:31** ...in the United States, state plain, say I'm in Oregon, but then I need to run a tool...

**18:37** ...that's going to run some data on Washington.

**18:39** I can actually go and open up that tool and override that Oregon setting, in that tool just for that time that I'm running it, okay.

**18:48** That's the same for models.

**18:50** So models themselves have environment settings on them, okay?

**18:55** But then the actual model processes, the tools that are inside ModelBuilder, you can override the model settings with those.

**19:04** So I'll kind of show you what this looks like.

**19:09** All right. Let's go ahead and start to make a model.

**19:14** So what I'm going to do is go ahead and create my own brand new toolbox.

**19:19** So we have tools here, and I'm going to right-click, and say New Toolbox.

**19:27** UC 2011.

**19:29** All right. So there's my brand new toolbox, and I'm going to go ahead and right-click on that say...

**19:35** ...New Model, and now I have a brand new model.

**19:38** So the first thing I would like to do, as I said, is go to the actual model properties.

**19:45** So we can go to the General tab and I'm going to give this a name.

**19:51** All right.

**19:52** Remember, names can't have spaces, but what I am going to do is go ahead...

**19:57** ...and make the label basically the same, just add a space in there, right, make it simple.

**20:02** And I can add a description, model to find possible school shelters.

**20:14** All right.

**20:15** Obviously, if I had more time I'd probably put in more of a description than that.

**20:19** And I'm going to show a relative path, because I may go and give this to somebody else...

**20:22** ...at a neighboring county who might want to run the same sort of analysis.

**20:28** We have some additional tabs here which I'll cover a little later on to the parameters.

**20:33** So what I'm going to do next though is go and look at my environment settings.

**20:37** So these environment settings are on the model settings themselves, right?

**20:42** And I'm going to choose which settings I want to set.

**20:45** So in this case I'm looking at the work space settings, and I'm going to go and grab my current and scratch.

**20:51** Let me set values.

**20:54** And here I have my current workspace and scratch workspace.

**20:57** Now notice they're already filled in.

**21:00** This model has inherited the application settings, so in the actual application I set up to grab my data...

**21:08** ...from the model data .gdb, and to use a scratch .gdb workspace as my scratch workspace.

**21:16** So I'm just going to leave those, because that's ok for my model.

**21:19** If I wanted to overwrite it I would just go ahead and change these values in here.

**21:25** All right.

**21:28** So now we have our vulnerability model; again, it's looking at the label here.

**21:32** And we could go ahead and start to build our actual process.

**21:37** So just to give you a quick review of what we looked at for the model that we're going to be building...

**21:42** ...again, I need to create a couple buffers on my hazardous facilities and my HAZMAT route...

**21:48** ...and then I'm going to go and use a union tool to pull all that, all those hazardous...

**21:52** ...or vulnerable areas together, and then I'm going to go ahead and have the software find the schools...

**21:58** ...that are not inside of those vulnerable areas.

**22:02** So we'll go back in here to ModelBuilder and I'm going to go and start to build.

**22:08** So I can find tools and add tools in a few different ways.

**22:12** If I know where the tools are, what toolboxes, I can go ahead and just find those.

**22:16** Right here on my System tools, system toolbox, and I can go to my analysis and proximity and there's my buffer tool.

**22:26** So I can just drag and drop onto this environment.

**22:29** I also have the ability to go and hit the Add Data or Tool, and go and drag the tool from there, as well.

**22:34** Lots of different options.

**22:36** So then I'm going to fill in the information.

**22:38** And again, I can go and drag and drop data on here.

**22:41** So I can say I want my hazardous facilities on here, and then I can go ahead and use our...

**22:46** ...Connector tool to connect these pieces together.

**22:49** Okay, and these are going to be my input features.

**22:51** Now, the only colored-in oval here is my blue oval and that's my input data.

**22:59** These other pieces of my model, or model elements, are clear because this tool is not ready to run...

**23:06** ...so I need to go in and put in some additional parameters into the buffer tool.

**23:09** So I can open up the buffer tool, set my output feature class, so this is going to be my buffer has facilities...

**23:24** ...hit save, and I can put in my distance.

**23:29** I'm going to put 2,600 feet; and then I can also change some of the optional parameters here.

**23:35** The tool only requires you to put in the required parameters in order to be ready to run.

**23:42** So the Optional are just that; they're optional.

**23:44** You don't have to fill them in, in order to make the tool ready, right?

**23:48** So now I have the buffer tool that's ready to run.

**23:51** Okay, everything's filled in nicely.

**23:53** I can go ahead and change some additional things, so I can rename this to...let's say...Hazardous Facility Buffer.

**24:08** It's always good to put as much information into these models as possible, so that way if you have to share it...

**24:13** ...or you leave your job and you leave behind this information, somebody else can quickly look at it...

**24:18** ...and kind of get an idea of what it does, right?

**24:20** That's important.

**24:22** Right, so we need to add another buffer tool because I need to buffer my Hazmat route.

**24:27** So I'm going to go ahead and search for it, just so you can see how Search works in here again.

**24:33** So we're going to do Buffer, and then we can go and drag and drop from the search onto my ModelBuilder canvas.

**24:42** I have some tools on the toolbar here that allow me to sort of lay out my model, and...

**24:48** ...I can use the auto layout to have it kind of look nice.

**24:52** And then what I'm going to do in this buffer is double-click on it and fill in the information.

**24:56** So I want to now buffer my Hazmat routes, and I want to create an output for those...

**25:02** ...so we're going to do Buffer Hazmat routes.

**25:11** And again I'm going to buffer by 2,600 feet and again I'm just going to dissolve these buffers. Okay.

**25:18** So now you'll see my other buffer tool is ready to run as well.

**25:22** And again, I can go ahead and change some of the graphic-looking information on here.

**25:27** So, we'll say, this is my Hazmat routes buffer.

**25:33** All right.

**25:35** Okay, so far so good. Right?

**25:37** Just added a couple of tools. Okay.

**25:41** So the next thing we want to do is go ahead and add the Union tool, so I'm going ahead and

search.

[25:46](#) I don't necessarily know where that is.

[25:53](#) Okay. So we can go and grab our Union tool, and add this again to our ModelBuilder session here.

[26:01](#) And, what I need to do now is to go in and connect these two outputs to the Union tool...

[26:08](#) ...and grab the flood areas to union, as well.

[26:12](#) So I can use my Connection tool again, and just draw a line and just draw another line.

[26:19](#) You'll notice I get a drop-down box here.

[26:21](#) I'll show you in a few minutes how to get that so that way you can determine if it's an input...

[26:26](#) ...or you know what type of parameter it is that I'm filling in here.

[26:32](#) And then I'm going to go ahead and grab my flooding areas.

[26:37](#) Okay. Put those on there, and connect that as well as an input. Okay.

[26:45](#) Now we can start to see how things are all connecting together.

[26:48](#) Again, the Union fill is not ready to run at this point; I need to go in and fill in some other information.

[26:53](#) It grabs my input for me, so that's great.

[26:56](#) And then I'm just going to go and set my output, and leave all of the rest of the options. Okay.

[27:03](#) So it's always a good thing to validate your models.

[27:06](#) We have a nice little tool here that says Validate entire model, so we can click that...

[27:11](#) ...and what it does is it checks to make sure that everything's connected okay, that I have my inputs...

[27:16](#) ...that you can access so I can see them, that all of my parameters are filled in correctly, and so on.

[27:24](#) It's kind of a nice little way of just checking our tool.

[27:28](#) What is it doing here? I don't know why it's doing that.

[27:32](#) All right. There we go. I'm going to go ahead and rename this to vulnerable areas. And that's my output.

[27:42](#) So. I'm going to go ahead and save this model.

[27:45](#) And what I want to do is add this final output to my display, and I'm having some weird behavior here.

[27:54](#) I don't know if it's my mouse or what.

**27:58** Okay. So let's go ahead and just run this and see what happens.

**28:02** So cross your fingers, hope that everything works ok.

**28:03** ...and you'll actually add that to the display System Run if it's been run.

**28:05** We hit Run.

**28:06** You'll notice as I'm running the tool things start to turn red, and get highlighted, and then...

**28:13** ...as these tools run, they actually get a little drop-down shadow behind them, saying that they've been run already.

**28:20** So, when they turn red that's the tool that's actually being run, and then when they get this drop-down...

**28:26** ...that means that the tool is in an already run state.

**28:30** Okay. So it's already been run.

**28:32** So now what I can do is go ahead and add that to my display. Okay.

**28:39** And there's the result of running those three tools. Okay.

**28:44** So you have a nice little option in ModelBuilder to add things to your display.

**28:50** It's just by checking off Add to display.

**28:53** Now, the nice thing about this too is that the ModelBuilder window actually does talk to the map.

**28:58** So if I forgot to do this before running the model I can go and right click on it and add to display...

**29:06** Or if I turn it off, it's gone again. Okay, kind of neat, right? It all works together. Okay.

**29:14** So I've run three tools.

**29:15** What I'm gonna do is actually go and validate this model so that I can set it backwards to a ready-to-run state, right?

**29:23** So I can run it again.

**29:25** It's ready to go again.

**29:34** Now, before I do that I'm going to go ahead and add that one last tool that I need in here, and that's the Erase tool.

**29:43** ...going to remove them from my results and just give me the schools that are not overlaying those vulnerable areas.

**29:51** So we can go ahead and connect this to our Erase, and this is going to be my actual Erase features...

**30:01** ...and then what I need to do is grab again my schools, and put these on here and then...

**30:07** ...link those up as my inputs.

**30:11** So we'll open up the Erase, and we need an output, and this is going to be my potential school shelters.

**30:17** I'm just going to override that, and then hit Ok.

**30:21** All right.

**30:23** So now I'm going to make sure that this adds to the display at the end, and maybe a quick rename...

**30:31** ...of this, so potential shelters. Okay.

**30:38** And I want to do something else additional, so you notice if you run a tool by default it just kind of...

**30:43** ...gives you whatever symbology it feels like, right?

**30:46** The software chooses something, way back in the day you'd always see brown, it's always some brown colors.

**30:51** Now, who knows?

**30:53** Somebody has some fun with color palettes.

**30:56** But what we can do on this is we can build some sort of intelligence into this actual output, and use a layer file.

**31:04** You know, those LYR files that we have? We've had them around for a few years?

**31:08** We can go and use the symbology from the layer file that exists on disk and apply that symbology to my output.

**31:15** So I don't have to make the extra step once the tool's run to go and symbolize it.

**31:20** The software will actually do it for me.

**31:23** So what we can do is go and... Get into our layers here, and nonvulnerable schools, and now hit Ok.

**31:36** So now what I can do is just go ahead and save this and we will just check to make sure everything's...

**31:41** ...ok and we're going to run this tool.

**31:46** All right, so it's doing a buffer of the Hazmat route, working through the union of the hazardous possible areas...

**31:58** ...and it went into the Erase and away we go.

**32:02** And those are my schools that are left over.

**32:04** So, just so that you believe me, we'll turn on the Hazmat routes, and we'll turn on the hazardous facilities...

**32:12** ...and the flooding hazards.

**32:14** And if I go zoom into an area here.

**32:19** All right. So now you can see all the schools that are left over.

**32:22** Okay. Pretty neat. Good stuff, right?

**32:26** Okay.

**32:27** And we just did that all on the fly, in just a few minutes.

**32:31** So, pretty quick to get going with ModelBuilder.

**32:36** A lot of extra options, but what I'm going to do right now is go back into the slides...

**32:40** ...and then we can get into the extra options and putting in a little more fun into our models.

**32:47** So, I'm going to kind of fly through these slides because we've already discussed this and kind of seen what it is.

**32:54** So the model elements, you have tools and variables and connectors that you have possibly on your actual model.

**33:05** Adding tools and data to the model; you saw me drag and drop, okay.

**33:10** We can also use the Add Data or Tool in the ModelBuilder window to go ahead and add information.

**33:16** So it's pretty easy to get stuff onto that nice drag-and-drop environment.

**33:23** A couple different ways to connect elements - I use the connector tool a few times to go and...

**33:28** ...connect the data to the actual tools.

**33:31** But you can also go and double-click the tool and open it up and fill in all the parameters...

**33:36** ...just like you would if you were to go ahead and open up the tool outside of the model.

**33:40** And it'll go in and connect all the items together and pull data in if it's not on there.

**33:48** You have a couple of different types of little ovals on your model, so you'll see the existing data are the blue ovals...

**33:55** ...so these are the things that I already had in my map or it's sitting on disk and I can go and drag them in.

**34:01** And then on the other side you have the derived data, so this is the data that's going to be output...

**34:06** ...right, and these are the green ovals on the model.

**34:13** So, in terms of the tools and parameters, you have inputs and outputs and then a few other possibilities...

**34:19** ...so in the Buffer tool we also have a distance that we need to fill in.

**34:23** As I said, you only have to fill in the required parameters on a tool in order to get that tool to run, or be ready to run.

**34:31** If you choose to fill in the optional that's entirely up to you, but they will not affect...

**34:36** ...whether or not that tool is ready to run.

**34:40** And just a tip in terms of connecting.

**34:43** Back on the Geoprocessing Options dialog that I showed you a little earlier on, you have an option in sort of...

**34:49** ...the middle of the dialog for ModelBuilder and if you check that off, what happens when you connect...

**34:56** ...your data elements, your little blue ovals to the tools is it will give you that drop-down box that you saw...

**35:04** ...and it'll allow you to determine what that piece that's being connected is going to be used for in the model.

**35:11** So if you're connecting data to a buffer tool, you're probably using it as input features...

**35:19** ...but there are some tools, like the clip tool, that take both an input and a clip, right?

**35:25** So you get the option on the fly very quickly as to whether or not that input data set is going to be...

**35:30** ...the clip data set or the input feature, okay?

**35:35** So a nice little way of quickly going through things, rather than having to open up the dialog for the tool afterwards...

**35:40** ...and checking to make sure everything is ok in there.

**35:45** The model states, if it is...if a model tool and any of the ovals are clear or white, that means they're not ready to run.

**35:55** So if you try and run the model, nothing is going to happen.

**35:59** What you do need to have is a ready-to-run state where everything is filled in and nice and colored...

**36:06** ...and then you can go ahead and run your model.

**36:09** If it has been run you get the drop shadow.

**36:12** If you saw that, I had a drop shadow once I ran some of those tools.

**36:24** And that brings us to the validating here.

**36:26** And then if you want to reset that you can go ahead and validate the model and reset the model to a ready-to-run state.

**36:27** So if you validate and there's success, it'll return a model from has been run to a ready-to-run state.

**36:35** If it's unsuccessful, then certain pieces of the model may be white, right?

**36:40** So they're not ready to run, so you need to go and figure out what the possible problem is.

**36:44** It may be the geodatabase that you were trying to write to doesn't exist, lots of different possibilities there.

**36:50** It's always important to validate your model, especially if you're getting it from somebody.

**36:54** So if you get a model, don't just take it at face value that it's ready to go, right?

**36:58** Just because it looks like it might be ready to go doesn't mean that it necessarily is, okay...

**37:04** ...so definitely use the Validate for that.

**37:10** Now, creating model tools.

**37:11** So we've created a model, we open it up in ModelBuilder and we can go ahead and just hit the little Play button...

**37:18** ...and it runs the model for us, right?

**37:21** Well, all models are essentially tools.

**37:25** They're a tool in the toolbox.

**37:27** They just have a little different icon and they may be a workflow of multiple tools.

**37:34** So, if you've ever received a model or created a model and double-clicked on it in Toolbox and you get this dialog...

**37:41** ...with nothing in it, right?

**37:42** It says, this tool has no parameters? Okay.

**37:45** That means that nothing is built into the model that you need to fill in.

**37:49** You can just hit OK and the model runs, right?

**37:54** However, you can change that and actually go and make a model so that it has parameters that you can fill in on the fly.

**38:01** So if you have Buffer in your model you may want to change the distance, you know.

**38:07** Today I might run it on 2,600 feet tomorrow I might run it on 3,000 feet or 1,000 feet.

**38:12** I don't want to have to go into the model itself, open it all up, find that little parameter in the

buffer tool and change that.

**38:18** I can expose that to a dialog, to a tool dialog, okay?

**38:23** So that's a difference that we're seeing on the screen here.

**38:27** We have one tool on the left-hand side that has absolutely no parameters in it.

**38:32** I don't have to fill in anything, I can just hit OK.

**38:34** The one on the right side, we actually have to fill in some information because they've exposed those pieces...

**38:40** ...of that model to a dialog for me, and I'll show you how to do that.

**38:47** So, if you ever look at a model and you see the little P beside pieces of the model, that's the parameter.

**38:54** It means that this item or element in the model is actually a parameter in that model...

**38:59** ...so when you double-click on it and open up that dialog you're going to see something there...

**39:03** ...that you need to fill in, okay?

**39:05** It is important, too, to watch out because if you create something as a parameter in your model...

**39:12** ...the name that is on that oval or that element is actually going to be the name that's used...

**39:18** ...in the dialog, okay, so we want to make that something descriptive.

**39:22** That's why I was renaming some of those items.

**39:28** You can also go and create variables from actual parameters inside of a tool.

**39:34** So, ModelBuilder will allow you to go and create variables for inputs, right?

**39:39** So, whether that's the distance on a buffer or that's a workspace, or a geodatabase location...

**39:46** ...or a folder that you're going to output your datasets to.

**39:49** So all you need to do is go and right-click on the actual tool.

**39:52** With the Buffer tool I can go right-click on it and make variable from parameters and choose distance...

**39:58** ...or whatever other parameters are in there.

**39:59** And I'll show you how to do that.

**40:05** Let's go ahead and make a model tool.

**40:10** You guys are all very quiet.

**40:13** Hopefully lunch isn't making you fall asleep, or I'm not incredibly boring.

**40:18** All right. So we're back in our vulnerability model here and I'm going to go ahead and actually make a tool out of this.

**40:25** So a few things that I may want to do.

**40:27** I have a buffer of my Hazmat routes.

**40:31** What I can do here is right-click on that tool, make a variable from a parameter.

**40:36** And look, I have all the different sort of possible parameters inside of my tool.

**40:41** So I'm going to actually go and check off Distance here, and you'll notice on my model it makes this little extra element.

**40:49** Okay, that's a variable element.

**40:50** That's a light blue color.

**40:52** And, right now, open that up, and I currently have sort of a default in there set to 2,600 feet.

**41:02** So what I'm going to do is make this a model parameter, now you see the little P beside it.

**41:07** And I can go ahead and rename this, so this is going to be my buffer distance.

**41:13** Okay, so we'll just expand this out a little bit so we can see it.

**41:17** All right. So I save this, and if I go back into my toolbox here, and I double-click on this model, it exposes that as a parameter.

**41:29** So now I can, on the fly, very quickly, go ahead and change that buffer distance.

**41:33** I don't have to go back into the actual model interface every time and do that, right?

**41:38** And notice it took on the name that I have in there, buffer distance.

**41:41** That's what I named the element as.

**41:43** So, a few different options there.

**41:46** You can also go ahead and make output model parameters, okay.

**41:52** So I'm going to check this off as a model parameter, and here I have the little P. Okay.

**41:58** So we'll save that one and I'll show you, again, now I have an additional parameter, okay.

**42:06** My potential shelters and notice it has the output, right?

**42:09** So I call them potential school shelters in my scratch geodatabase.

**42:13** Now the nice thing about this is you want to sort of modify this dialog a little bit.

**42:17** We can go into the properties of this model and go to that Parameters tab that I skipped over at the beginning? 'Kay.

**42:24** So here's the name of those parameters.

**42:27** Maybe I want to go ahead and move these, so I can change this one, the buffer distance down to the bottom.

**42:33** The type, whether it's required or optional.

**42:36** If it is a parameter from a tool, like distance, that's a required parameter in order to run the buffer tool.

**42:43** I can't go and change that in this dialog.

**42:46** Okay, it's going to be required in order to run this tool.

**42:50** So I hit OK, and now if I double-click on it, now you can see that my potential shelters...

**42:55** ...are now at the top and then my buffer distance.

**42:58** So a nice way of making a tool.

**43:00** Something else that was added at ArcGIS 10 is the ability to then go ahead and take that...

**43:05** ...pull it sort of out of the toolbox itself and put it on a toolbar.

**43:11** So I can go and open up my Customize dialog box where I can find all these fun commands...

**43:16** ...that won't fit on toolbars all the time.

**43:19** And I can go to my geoprocessing tools, and I can go ahead and add the tool.

**43:26** So here we have our tools, and my vulnerability model, and then I can go and drag and drop that.

**43:36** All right. I can change some information so if I want, maybe, just the name of it, I can change the name.

**43:43** Let's do text only.

**43:45** Hit Close, and now I can run that tool just from a toolbar.

**43:51** Kind of nice.

**43:52** And you can do that pretty much with all of your geoprocessing tools; scripts, and thinks like that, too.

**43:57** I thought that was kind of fun because, you know, I don't want to have to find it in the toolbox all the time, right.

**44:04** Okay.

**44:08** All right. Some tips for designing and sharing your models.

**44:13** Intermediate data.

**44:15** So, what happens to all that data that gets generated on these little intermediate steps to get

to your final results?

**44:23** So I ran a model with two buffers and a union, and then I have an Erase tool, right?

**44:30** That Erase tool is really going to generate the result that I want.

**44:33** Those buffers and unions, though, that's just some intermediate processing to get to that.

**44:38** I don't necessarily want to keep around that intermediate data, right?

**44:42** It's kind of junk to me.

**44:44** So I may run it, you know, dump it into a scratch workspace, but then I probably have to go and clean that up.

**44:49** Well, ModelBuilder, by default, sets those intermediate pieces to intermediate data. Okay.

**44:57** They do that by default.

**44:58** So that way you kind of can go and clean that up very easily at the end.

**45:04** The final output never gets set to intermediate data, though. Okay.

**45:08** So that's a good thing because in case you forget to turn off that default, at least you'll have your final output, right?

**45:15** You may be screaming at the software because you don't have the intermediate, but that's ok.

**45:19** All right. Couple things about this, though.

**45:23** If you're in the ModelBuilder window, the actual dialog, and working in the model there...

**45:27** ...and then run it from there, the intermediate data does not get automatically deleted.

**45:33** You have to go up to the model menu and explicitly click Delete Intermediate Data, okay?

**45:40** If you run the model as a tool - I double-click on the model and you have intermediate dataset...

**45:47** ...the tool will actually go and clean up the intermediate data on its own after.

**45:53** You don't have to do the additional step.

**45:54** So. The story here is, make sure that you have only the appropriate things that you want to be deleted...

**46:01** ...set as your intermediate data, right?

**46:04** Because maybe I do want all those extra intermediate results, all those little buffers and unions that I do there.

**46:14** So here's some tips for managing that intermediate data.

**46:17** Couple don'ts.

**46:18** Do not write your intermediate data to an SDE geodatabase, an enterprise geodatabase...

**46:25** ...because every time you want to go and delete that, it has to go back out to the enterprise geodatabase to do it.

**46:31** Okay. You may not have permissions to delete stuff in that geodatabase.

**46:35** Right? That's going to cause some problems.

**46:39** Remote data. Do not put it in a really, like in a remote dataset or on a network drive somewhere; trying to set stuff local.

**46:49** Okay, your final result can go out to something that's remote, but try and keep the intermediate stuff local...

**46:54** ...because if you're cleaning it up, it's a lot easier to clean it up locally on your machine...

**46:59** ...rather than having to go and hit an external drive from there.

**47:03** Don't clutter your permanent results database.

**47:06** So, if you have a permanent database and you're trying to write your results to that...

**47:11** ...don't clutter it up with all this intermediate stuff.

**47:13** Put that stuff in a scratch database, right?

**47:17** You have the ability to make these file geodatabases, you know, whatever you want, generally.

**47:23** So why not create a scratch geodatabase that you dump all of your intermediate work in, right?

**47:28** I was just really, really bad back in the days with my shapefile one, shapefile two, shapefile three...

**47:35** ...and they're all in a junk folder and a year later I finally looked at that junk folder.

**47:39** Couldn't figure out if anything was even useful.

**47:43** So, try not to clutter up your workspaces.

**47:47** Okay. So use the scratch.

**47:51** All right. The other new thing you can do here is you can take models that you create and embed them in other models.

**47:58** Okay, so nesting models.

**48:00** The really nice thing about this is that if you have an extremely complex model, right?

**48:06** You're running 20 different tools.

**48:08** You can actually break that model up into smaller pieces and have certain pieces run.

**48:14** So for example, if I take in a bunch of CAD data, and you convert that to a geodatabase...

**48:18** ...and I'm going to run some other processes, I may want to go and have the conversion as its own model...

**48:23** ...and then some other additional processes as a separate model, and pull them altogether into a...

**48:29** ...third sort of overall, this is my tool.

**48:34** So it's really easy to do this.

**48:36** You can do this at any point with any type of model tool that you have, script tools, things like that.

**48:43** And it's also nice if you have to collaborate with a bunch of people and you're individually working on different pieces.

**48:52** Some tips for running models. Running models from ModelBuilder.

**48:57** As I said, intermediate data is not automatically deleted, so you need to go and actually do this on your own.

**49:03** The Add to Display - when you go and right-click on Output, and you say Add to Display, it adds that to the map, okay?

**49:14** No background geoprocessing here.

**49:16** So we have the ability to turn on and off a background geoprocessing.

**49:20** I don't know if many of you've heard of this, but if you have a pretty complex process and you need to run it...

**49:28** ...for a few hours but you don't want it to interrupt what you're doing in ArcMap or ArcCatalog...

**49:33** ...you can run it in the background, and then you'll get a little pop-up at the bottom of your screen telling you...

**49:38** ...that hey, this model ran, and it will give you a check box if it went ok or an x if it went really bad.

**49:44** However, if you're running the actual tool inside the ModelBuilder window it will not run in the background at all.

**49:51** It always runs in the foreground on the screen, okay?

**49:54** If you're running it as a tool the intermediate data is automatically deleted so again...

**49:59** ...make sure that you only have that option set for the actual intermediate pieces that you don't want later on, okay.

**50:00** ...if you have to go and share your models and distribute them; okay.

**50:03** Make sure your layout looks decent.

**50:08** Another sort of trick, when you Add to Display and you're running as a tool, that element...

**50:14** ...that output element that you have, you need to not only check off the Add to Display...

**50:19** ...but you also need to make that output model parameter.

**50:23** It has to have the little P beside it, okay.

**50:26** Then you can double-click on the tool and run it and it'll add to the display for you.

**50:30** So one extra little piece that you need to do there.

**50:33** And then you do have the option to run things in the foreground, okay, or the background if you're running it as a tool.

**50:39** So it's up to you.

**50:43** Definitely design your models to be sharable.

**50:45** Okay, so make them pretty flexible, maybe not as data dependent if you're going to be sharing them.

**50:52** Set environment settings, relative paths, and so on.

**50:55** There is a really good read about tips for distributing models; I recommend reading that...

**51:05** You can also add some additional pieces to your layout.

**51:08** You can add labels on items so to give some more clarity as to what those things are doing.

**51:13** And then, new at 10, we have this item descriptions that were added, kind of like a metadata.

**51:19** You can go and add item descriptions to your models, right?

**51:23** And then also create help documentation.

**51:27** In terms of modifying the layout, you have a lot of different options there to sort of move things around.

**51:32** It does not affect the order that tools run in, right?

**51:36** They'll still run in the order that you have them all connected, even if they're all over the place in terms of your layout, okay.

**51:44** And you have a couple different modes here with your layouts.

**51:47** You can go ahead and have an automatic, so if I click that little blue and green button that we're seeing here...

**51:54** ...it will automatically go and lay out my tools for me.

**51:58** Or I can have a manual mode where I actually determine how everything is going to be laid out.

**52:05** And there are some options for that, so if you go to the diagram properties in the model, you

have options...

**52:11** ...whether you orient them from left to right, right to left, center, whatever you want to do with them.

**52:17** Okay. And this is all for layout; it does not affect how the model actually runs itself.

**52:22** In documenting, 'cause I said you can make labels; you can make some free floating labels if you want.

**52:28** If you're floatin' around, maybe a title, something like that.

**52:31** You can make some element labels.

**52:33** So, if you want to put a little label beside one of the elements in the model to describe things.

**52:40** You can also create labels on connectors, so those little connector lines that you see...

**52:43** ...right, you can make some labels on those as well.

**52:46** This is all really good practice for documenting your model, right?

**52:51** If you're just going to use the model as your own little process that you run you probably don't have to do all of this.

**52:57** But I recommend doing it, you know, just down the road if you have a few minutes...

**53:00** ...just so that if you have to go on vacation or leave your job, at least somebody has something to work with.

**53:07** Another neat thing is you may have seen on my first model that instead of just having...

**53:11** ...little ovals, I have little images, right?

**53:14** Little JPEGs in there.

**53:16** So you can go and change these elements to what we call a picture element, and you can go and choose...

**53:22** ...a JPEG or a GIFF or something like that, and sort of create a little snapshot of maybe what that data looks like.

**53:31** All right. Just to show you really quick, let's go ahead and open up our model.

**53:38** How are we doing for time here?

**53:40** Fifteen minutes, right?

**53:42** All right. So, I can do a few things here if I wanted to go ahead and change this to a picture symbol.

**53:49** And I can go and find...see, there's my junk. I still have a junk folder.

**53:57** All right. So we can go into our...let's see here...I know I did that on my Hazmat route, so I

have a little JPEG, right?

[54:10](#) And then I can go ahead and change the size of that if I want.

[54:13](#) They do lots of things in there.

[54:15](#) I can also create little labels.

[54:18](#) I create a label and go and change the...what's in here; display properties.

[54:32](#) And we can go and change the font and all sorts of things.

[54:37](#) You can create labels on connectors, too, so if I highlight a little connector and do Create a Label...

[54:43](#) ...it'll create a label next to my connector.

[54:45](#) Just nice little ways of sort of documenting.

[54:48](#) And as I said, you can also go ahead and go to the model properties and put in some help information in here as well.

[54:55](#) So you can generate a little help file.

[54:57](#) And you can also give the model some additional descriptive information.

[55:07](#) All right. Learning more.

[55:10](#) So since you've been so quiet, we might actually end it early which means you can probably come up and ask questions.

[55:15](#) ArcGIS Online. Okay.

[55:17](#) So, through the Resource Center you can get to the help very easily.

[55:23](#) You can get to, if you're still working in 9.3 or a previous version there is that help online...

[55:28](#) ...or you can go to the 10 version help.

[55:30](#) I recommend going to the online help as your sort of first location, because the help that comes with the software...

[55:38](#) ...doesn't get updated as often, right?

[55:41](#) It gets updated when you install things like Service Packs and stuff like that.

[55:45](#) The online help is always going to be a little more up to date.

[55:50](#) The Geoprocessing Resource Center.

[55:52](#) If you haven't gone here and you have to do geoprocessing, you have to create scripts, you have to create models...

[55:59](#) ...go to the Geoprocessing Resource Center, and just because I love it and I want to show it to you...

**56:09** We'll go to resources.arcgis.com, scroll down to the bottom and hit the geoprocessing, okay...

**56:17** ...and here's your Geoprocessing Resource Center.

**56:20** So lots of stuff you can find in here.

**56:23** There's presentations that you can get access to.

**56:26** There's a model and script tool gallery.

**56:29** Really neat things in here, okay.

**56:30** I'm learning more and more because I only come here once a year and I get to go and then sit...

**56:34** ...with all the development people and know what they've put up there and they put really fantastic things up there. Okay.

**56:41** You can go and add your stuff to this, too.

**56:43** If you've made a really neat model and you want to share it because you worked so hard on it...

**56:48** ...and you think it'd be useful to other people, you can go and add to this resource center as well.

**56:54** You can also go the Forums directly through here.

**56:56** There's a geoprocessing blog. Okay.

**56:59** So go and check this out.

**57:00** If you do anything else in ArcGIS, if you're part of a sort of a community, you do local government...

**57:06** ...or you do water utilities, the resource center is your friend.

**57:09** The best place to go to get a lot of information very quickly.

**57:16** And no I don't get paid to just plug the Resource Center.

**57:20** I just actually really do love it.

**57:22** All right. So getting more at the conference, okay we're here Wednesday, so I guess that first one is a new point.

**57:30** But Building Tools with ModelBuilder, okay, we had a session this morning and there's going...

**57:33** ...to be another one tomorrow afternoon.

**57:36** That is the Advanced ModelBuilder session, if you want something quick and dirty.

**57:41** It gives you a lot of additional pieces; building actual tools and really building on what I did

this afternoon.

**57:48** And then also come to this Spatial Analysis Showcase.

**57:51** We have a lot of really good people there to help you out and, you know, show you how to build models...

**57:57** ...if you have specific questions on problems that you want to solve.

**58:01** Also, if you just have tools that you want to learn a little more about, definitely come down there.

**58:06** Okay, and we can handle all sorts of questions from all over the place.

**58:10** Couple of other things.

**58:11** Instructor-led training. Okay. We do have a few courses that cover ModelBuilder in little pieces.

**58:17** There's also some live seminars and recordings.

**58:19** There's a free one, I think it's 60 minutes, on building models in ModelBuilder.

**58:25** And then there's a new book that just came out, Getting to Know ArcGIS ModelBuilder.

**58:30** I believe it is down in the Spatial Outlet, so you can go and check it out there.

**58:34** It is your introduction to advanced model building.

**58:38** I think this is the first book that we've actually had that is all about ModelBuilder.

**58:43** Okay. So, I would go and check it out.

**58:45** I haven't really looked at the book too much but I've heard some really good things about it...

**58:49** ...and I met the author yesterday morning; he's wandering around.

**58:53** So, definitely go and check that out if you need some really good resources for ModelBuilder.

**58:58** And before you leave, take down this web address.

**59:03** You want to go to the Esri page, and go to the Session Evals, in order to evaluate this session that I presented today.

**59:12** And that includes me. I am always open to feedback, and also just what you want to see in...

**59:17** ...sessions and whether it was useful.

**59:20** All right. So have a wonderful afternoon and enjoy the rest of your conference.