Designing the Smart Network

On day two of the 2010 GeoDesign Summit, Andy Bennett of Telvent says that GIS is the starting point for advanced telecommunication network design.

http://video.esri.com/watch/122/designing-the-smart-network

Video Transcription

00:01 Yeah, I just want to take a few minutes to talk about GeoDesign in the context of the way a distribution utility...

00:06 ...specifically electric utilities, actually operate.

00:09 So probably the first question is, you know, Why do we need to do design at a utility?

00:15 You guys probably look out, front yard, you see a pole; doesn't look like it changes all that often.

00:20 But the network, the distribution network, the electrical network that brings us electricity to our homes...

00:26 ...is...is...is one that is pretty dynamic, and it changes fairly constantly.

00:30 And there's some obvious changes, right? We have new subdivision designs, new homes that come into our communities...

00:36 ...then, of course, we have these new challenges with the ever-increasing need for more power, right?

00:42 And so we have capacity issues, and those capacity issues dictate design as well.

00:47 And then utilities go through a lot of seasonal change so...

00:51 ...they're always redesigning their systems to shift electrical load to areas that need more power.

00:58 And then, of course, one of the most obvious reasons for design and the continued nature of design...

01:04 ...is because we have electric outages, right?

01:05 There's storms, poles get knocked down; we've all experienced this.

01:09 And so all those things really necessitate the need for geodatabase and...and... and GeoDesign within a distribution utility.

01:18 So I guess just a...a couple of the goals and the ways a utility thinks about this.

01:22 And the first thing is that all the design that most...most utilities are doing on their

distribution systems...

01:29 ...are based on the fundamental concept of using the GIS.

01:33 Mainly because that GIS is already where all their assets are stored, right? That's the as-built nature of the network.

01:41 But there's a lot of other reasons why utilities find this very attractive, right?

01:45 They're always looking for ways to streamline that design process and to reduce that backlog.

01:51 You can imagine if you have thousands and thousands and thousands of designs taking place on your network...

01:56 ... every year, right, that if you don't have a very streamlined process...

02:00 ... to get those things posted and into your as-built state, then that could cause a lot of problems.

02:05 That could cause problems with the nature of the network being out of date and things of that nature.

02:11 But there's a lot of other reasons why utilities do this as well.

02:14 There's certainly the problem of aging workforce; a lot of folks are leaving the utility industry.

02:20 That's leaving an industry that really has still the continued problem of designing...

02:25 ...but not necessarily having the engineering prowess and experience to do that.

02:30 So that sort of necessitates the idea of more and more design folks to help with that.

02:35 So just real briefly, a little bit about the anatomy of a design.

02:39 This is not always the way a utility thinks about it, but...but frequently is.

02:43 Really at the top level, we think about a work request or a work package.

02:48 That's the concept of all the work we're going to do to get a certain job done.

02:53 And then within a work request, we may have many designs, right? So that's kind of a many-to-one ratio.

02:59 You may want to do a design that's an underground design and then also do the design that's overhead...

03:05 ...and maybe compare and contrast those two designs for things like cost.

03:09 Every design has at least one estimate, right, one cost estimate associated with it.

03:15 And then many designers will use these...this concept of a work location.

03:19 And...and that's really just a place within my design, a logical place...

03:22 ...where I may drop off equipment or associate equipment as I start to think about how I parse

up that design.

03:29 Then this last concept is these designs are really comprised of something that we call compatible units or assemblies.

03:37 So if you think about the...the...the pole for instance; might be a pole...

03:40 ...there might be some, you know, brackets and side arms and things on that pole.

03:44 So all those materials, those...the...the pole and the nuts and the bolts and that sort of stuff.

03:49 In addition to that, the labor associated with putting that pole in the ground.

03:54 All that stuff gets formed into this concept of a compatible unit.

03:58 So as a utility designer is doing a design, and they're laying out the electrical infrastructure...

04:04 ...they're not just placing features; they're placing compatible units, they're building up labor, they're building up cost.

04:08 They're building up the concept of the entire job.

04:11 So just real briefly on the...this...this concept of the anatomy.

04:15 We think about those things like those work locations. Those are some numbered work locations...

04:19 ...and then a list of the compatible units that will be associated with those work locations.

04:23 And then always in a design, the design standards are sort of captured.

04:27 And on this design, this is a pretty simple one here, you can see the...

04:32 ...the symbology here showing that this entire conductor is going to be replaced or upgraded.

04:37 Everything green is going to be new.

04:40 And the symbology really helps dictate...

04:43 ...and let people know the difference between what's existing infrastructure versus what's new.

04:48 And then, of course, there's a lot of detail on construction notes.

04:50 I know we don't generally think of electrical engineers as being the most artistic type people but...

04:56 ...you...you'd be surprised at just the wealth of information that people put into these...these drawings.

05:02 So just a little bit more on the workflow, because the workflow aspect of design is really one of the most important parts.

05:10 A sketch is the final product, but how that design moves through its life cycle is pretty critical.

05:16 So this is just a very simple workflow, right?

05:17 This is the idea that a designer may create a design; they'll send out a work packet to a construction crew.

05:23 That construction crew will build it; we'll get back some as-built information.

05:27 The complexity of those designs can get more varied.

05:30 You think about how that design might...

05:32 ...traverse and move through from the time it gets sketched to the time it actually gets built.

05:39 There might be many, many iterations of folks that want to look at that design to validate the electrical standards...

05:46 ...to make sure that the design is...is sound.

05:48 And so there's all sorts of different workflows that are associated with that.

05:51 This is a real workflow from a fairly large distribution utility. It's not unusual.

05:57 At the end of the day, it...it looks really complex; it probably is pretty complex.

06:01 That...that's a reflection, I think, of just the amount of collaboration that goes on within a utility.

06:08 One person doesn't build a design and then go out, put up those poles or dig those trenches.

06:14 That...there's many, many, many people that are involved in that process...

06:17 ...both to oversee the financial requirements, the electrical requirements, the safety requirements.

06:22 And so these type of design processes can get very, very, very involved as you can see.

06:28 So the complexity of the designs, of course, varies immensely too. This is a very simple design.

06:34 This is maybe the idea of a three-pole extension, maybe of a new residential house. Someone has to put up those poles.

06:40 They may do some structural analysis of the poles and make sure that they...they can sustain that.

06:45 And then there's much more complex type designs, right?

06:47 This is the idea of an underground design where you might even need some idea of the manhole diagrams...

06:54 ...what's going on in the manholes, where a conductor's coming in.

06:57 And often designers will put all sorts of information about the trenching detail.

07:01 That becomes critical as you're dealing with many, many, many different types of utilities.

07:05 You don't want to dig into an electrical utility or a fiber utility or something of that nature.

07:11 So one of the other concepts that we have within design that's...that's...that's pretty important...

07:16 ...is the idea that these people aren't doing this in isolation.

07:19 There might be hundreds or thousands of designs going on within an organization at any given time.

07:24 This is probably a little hard to see, but this is...this yellow area denotes a...a one-person design...

07:29 ...and this green area is someone else's design.

07:31 And you can see that they're both tapping off of the same facility.

07:36 And that idea of...of...of people multiediting needing to communicate is pretty principal to the overall concept.

07:43 These designs also may go on for years and years.

07:46 This is a highway widening project where you might be moving some conductor.

07:49 And that means that different areas of them may become energized at different points in time.

07:55 So now you have this concept within your design philosophy of partial posting...

07:59 ...of taking some portions of your design as they become energized and making them available to the as-built view.

08:04 Okay. So last slide. I just...the...the...

08:07 Probably the most interesting aspect of design within a utility and how it relates to...to modeling...

08:14 ...and some of the things that we're seeing is this idea of design optimization, which has been talked about quite a bit today.

08:19 But within a utility, the way they perceive that is that if they've got, for instance, a subdivision...

08:25 ...and they really want to optimize that design.

08:27 Because what happens frequently, designers will overbuild.

08:31 They could use a...a 25 kVA transformer, but it's easier just to throw out a 50 kVA transformer and bring more power.

08:38 But that's not exactly the most efficient or economical way of doing that.

08:41 So now what we...we are seeing a lot in our industry, of course, is that...

08:45 ...this idea of optimization where you take the parcels and...

08:49 ...and the system, the GIS, figures out what the front lot is and what the rear lot is.

08:54 You put information in about load and capacity and that sort of nature, and the design actually gets built for you by the GIS.

09:01 And now you have this highly optimized design.

09:04 Now this will vary tremendously based on what you're trying to optimize on. 00:09:08

09:11 So I think the interesting part about this, and as we're looking forward...

09:14 ...one of the things that utilities don't necessarily take into account with optimization today...

09:19 ...is the wealth of all that other rich data that's out there; the...the subsurface environment...

09:23 ...things like soils have a...an enormous effect on the cost of a design.

09:28 Things like looking at the aesthetics and the 3D aspects of where conductors are going and where those crossings are.

09:34 That's all critical.

09:35 And as we think about design optimization in a utility context, that certainly seems to be the direction that we are going.

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