Document Title: 14541-01 LIT, Underground Cable Crossing		Part # 14541-01	
		Release Date: 8/14/12	
Rev.	Description	Revision By	Date

Production Filename: 14541-01 LIT, Underground Cable Crossing

Path to Working Files: Decadoc\Video Transcriptions\Master\Thermal Properties\14541-01 LIT, Underground Cable Crossing

Dimensions: 8.5 inch wide, 11 inch tall

Material: Paper, 92 Bright White or better, 75g/m² or heavier

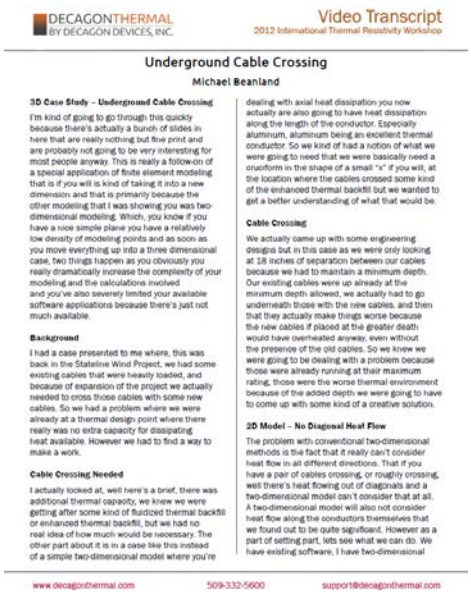
Colors: Color Print on White

Printer: HP Color LaserJet 5550

Finish: None

Adhesive: None

Special Notes: Illustrations are Ref Only ** Not to Scale **



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Video Transcript
2012 International Thermal Resistivity Workshop

Underground Cable Crossing

Michael Beanland

3D Case Study – Underground Cable Crossing

I'm kind of going to go through this quickly because there's actually a bunch of slides in here that are really nothing but fine print and are probably not going to be very interesting for most people anyway. This is really a follow-on of a special application of finite element modeling that is if you will is kind of taking it into a new dimension and that is primarily because the other modeling that I was showing you was two-dimensional modeling. Which, you know if you have a nice simple plane you have a relatively low density of modeling points and as soon as you move everything up into a three dimensional case, two things happen as you obviously you really dramatically increase the complexity of your modeling and the calculations involved and you've also severely limited your available software applications because there's just not much available.

Background

I had a case presented to me where, this was back in the Stateline Wind Project, we had some existing cables that were heavily loaded, and because of expansion of the project we actually needed to cross those cables with some new cables. So we had a problem where we were already at a thermal design point where there really was no extra capacity for dissipating heat available. However we had to find a way to make a work.

Cable Crossing Needed

I actually looked at, well here's a brief, there was additional thermal capacity, we knew we were getting after some kind of fluidized thermal backfill or enhanced thermal backfill, but we had no real idea of how much would be necessary. The other part about it is in a case like this instead of a simple two-dimensional model where you're dealing with axial heat dissipation you now actually are also going to have heat dissipation along the length of the conductor. Especially aluminum, aluminum being an excellent thermal conductor. So we kind of had a notion of what we were going to need that we were basically need a cruciform in the shape of a small "x" if you will, at the location where the cables crossed some kind of the enhanced thermal backfill but we wanted to get a better understanding of what that would be.

Cable Crossing

We actually came up with some engineering designs but in this case as we were only looking at 18 inches of separation between our cables because we had to maintain a minimum depth. Our existing cables were up already at the minimum depth allowed, we actually had to go underneath those with the new cables, and then that they actually make things worse because the new cables if placed at the greater depth would have overheated anyway, even without the presence of the old cables. So we knew we were going to be dealing with a problem because those were already running at their maximum rating, those were the worse thermal environment because of the added depth we were going to have to come up with some kind of a creative solution.

2D Model – No Diagonal Heat Flow

The problem with conventional two-dimensional methods is the fact that it really can't consider heat flow in all different directions. That if you have a pair of cables crossing, or roughly crossing, well there's heat flowing out of diagonals and a two-dimensional model can't consider that at all. A two-dimensional model will also not consider heat flow along the conductors themselves that we found out to be quite significant. However as a part of setting part, lets see what we can do. We have existing software, I have two-dimensional

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