

## BOUNDARY CONDITIONS IN FEM WITH SVOFFICE 2009

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### Introduction

Hi, my name is Murray Fredlund. Welcome to the session How to Assign Boundary Conditions within the *SVOffice 2009 Next Generation* geotechnical software suite.

The concept of a boundary problem is primarily of use in the finite element products (SVFlux, SVSolid, SVAirflow, SVHeat and ChemFlux). It should also be noted that the assigning of boundary conditions is consistent between the products. Because of this we will be using SVFlux as our demonstration product. Once you learn to assign a boundary condition in SVFlux the process is similar in any other piece of software.

### Getting Started

The example used is a typical example of a multicore earthdam (**EarthDams>MultiCoreDam**). Once geometry and material properties have been created, the next step is to apply boundary conditions. As mentioned in other SVOffice tutorials, everything is very visual and object-based within the SVOffice software. If the user double clicks on any shape, the properties of the region are displayed. To get the boundary conditions, one way is to select the desired region (**Model>Boundaries>Boundary Conditions**). This opens the Boundary Conditions dialog. Each point is displayed and is followed by a boundary condition. Boundary conditions in all of our software have been assigned to line segments on the boundary (not node points). Node points can change dynamically through the analysis and the solver may require more mesh along a particular boundary to solve for that boundary condition. Therefore, we apply boundary conditions to line segments around polygon shapes. As you click on each boundary, you will note the boundary is highlighted in the software. In the displayed example, a Head Boundary condition of 55 metres has been applied to the upstream side of the EarthDam. A list of all the types of boundary conditions is located in the Boundary Condition pull down menu. This list changes between every software package and the purpose of this demo is not to go into every boundary condition in detail but to show you how to apply them to a model. The SVTheory and User manuals can supply much more detail on specific applications of specific boundary conditions within the context of certain models.

Alternatively, there is a more graphical way to select a boundary by clicking on a line of the figure and right clicking and assign a boundary condition directly or open the Boundary Conditions dialog. The boundary condition that you selected will be highlighted and you can then change the boundary condition of that line. Boundary conditions are applied starting at a particular node and continue until they are altered or changed. If you apply a condition to a line, it is applied around the entire shape until the shape ends or another boundary condition is defined. If you don't want a boundary condition on a line, you must turn the boundary condition off by selecting **No Boundary Condition**. A continue boundary condition means that the previous boundary condition is continued on that line segment.

### Defining Initial Conditions

Boundary conditions must coincide with initial conditions set up in the model. Problems arise when boundary conditions vary significantly from the original conditions that were set up. This difference causes a massive attempt to change things during the initial time steps of the model and can lead to convergence problems because the model is fighting with itself. In the example provided we show a 55 metre head expression and we've expressed a review boundary condition which will iterate and indicate where the exit point of the water table would naturally be in the system. Defining initial conditions are useful for steady state and transient state models. In transient state models they are required. In steady state models, while they do not influence the result, they provide a good initial guess to precondition the solver aiding in quicker convergence of the model. To define initial conditions select **Model>Initial Conditions>Settings** and then select **Water Table**. Next select the **Draw>Initial Water Table**. Note: the program snaps to the line. A line can be then drawn through the model. The problem is that the line may not coincide with the boundary condition of 55 metres which is roughly the upper water table defined by the boundary condition. This would be an example of a poor set up where the initial boundary conditions are not properly defined.

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