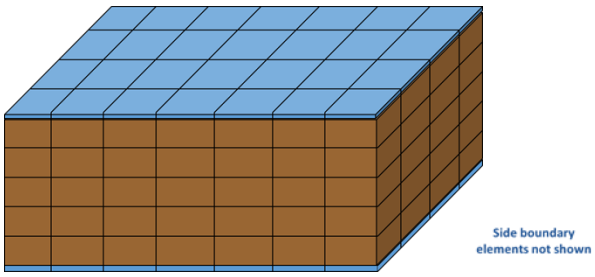
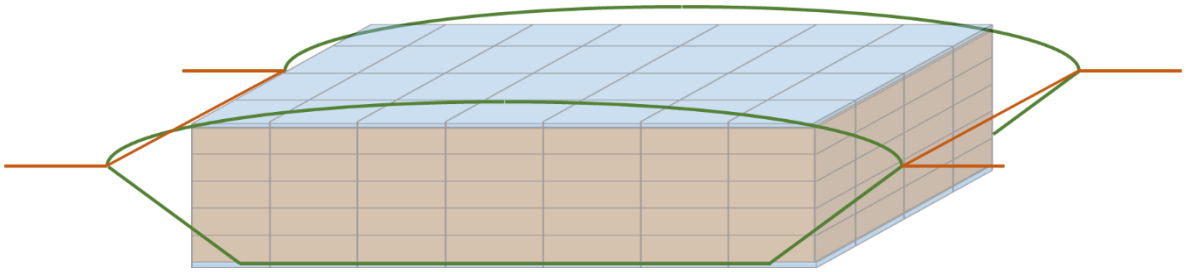
Fast Track to Using LDAT

How to build and run an LDAT landfill process model

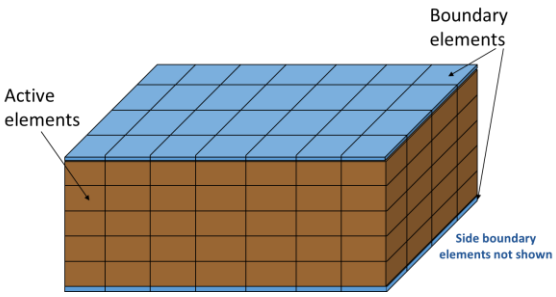
Model structure – the 'elements'



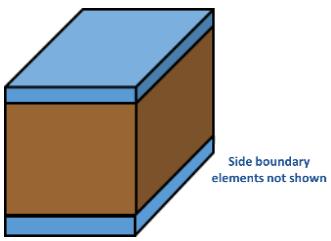
An LDAT model is an assembly of rectangular waste elements.



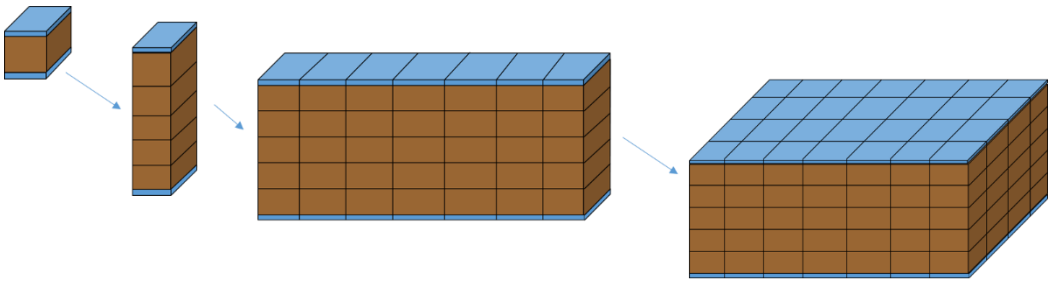
The rectangular assembly forms a geometrically approximate representation of a landfill.



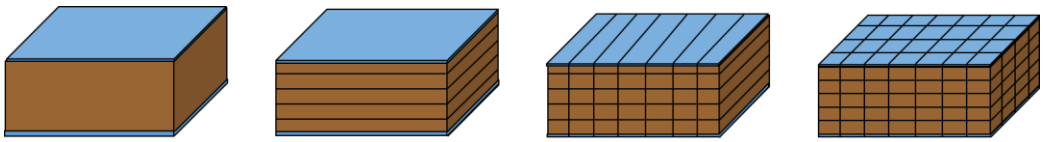
The outer layer of elements form the boundary of the waste inside the landfill. These elements are called boundary elements. The elements inside the boundary representing the waste are called the active elements.



Constructing the geometry of an LDAT model starts with a basic single active element wrapped with 6 boundary elements. This is a 'default' read only model provided by the modelling system.



The single active element model can be grown vertically to construct a vertical stack of elements. Or be grown horizontally to construct 2D and 3D arrays of elements.



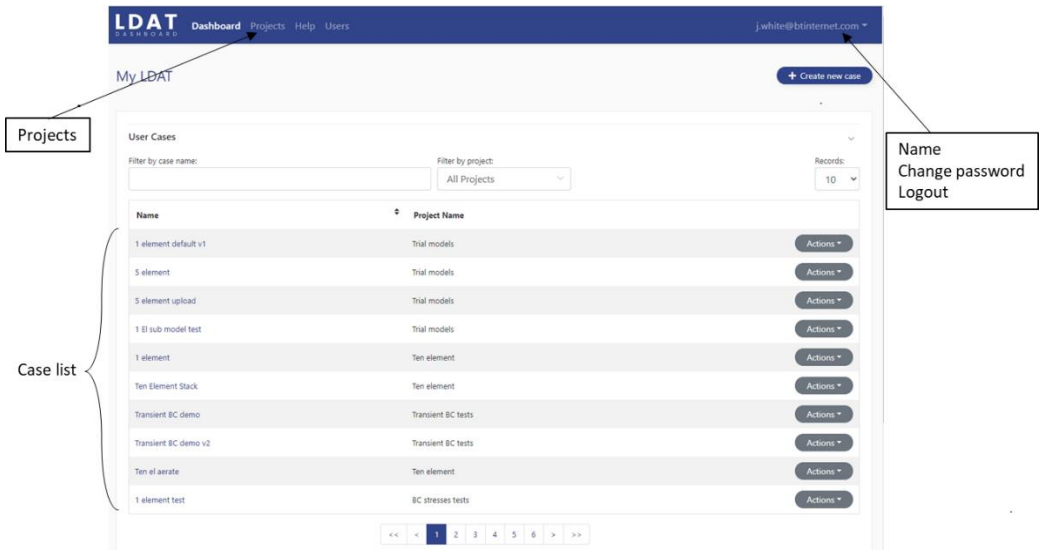
By changing the dimensions of the elements all of these model configurations may be adjusted geometrically to represent the same volume of space but with different numbers of elements.

Increasing the number of elements and the dimensionality of the element array, will increase the accuracy with which the model represents a landfill. However it will also increase the computation time and the associated processing costs. More often than not a simple stack model will prove to be an adequate compromise.

Run your first model

After you log in, the LDAT Dashboard page will be displayed. Note the dropdown with your user-name (e-mail address), Change password, and Logout options, in the top right hand corner. The main component in the Dashboard page is a table that lists Cases (or instances of Ldat models).

The Cases are grouped under the headings User Cases, Default Cases and Running Cases.

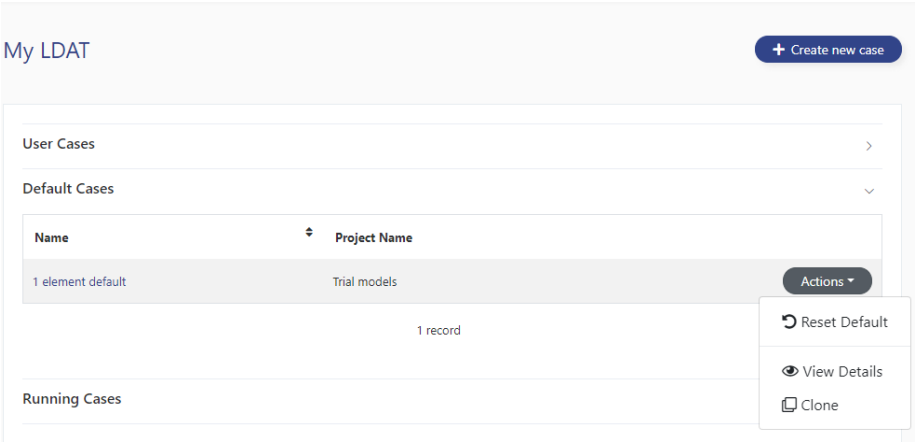


To start with you will have no User Cases, so you will need to create one by copying one of the Default Cases into your User Cases list. Before doing this create a Project to keep it in. A Project is the name given to a group of Cases and helps to organise your collection of models.

Click on Projects in the main menu bar, and then on Create new project. Enter a name such as 'Trial models' and click the Save changes button. Then return to the Dashboard.

Now click on Default Cases to open the list, and then click on Clone in the Actions drop down for the Single Element Example. Enter a 'New Case Name' in the text box such as 'My Single Element Example'. Select your Project name from the drop down and click on the Clone button.

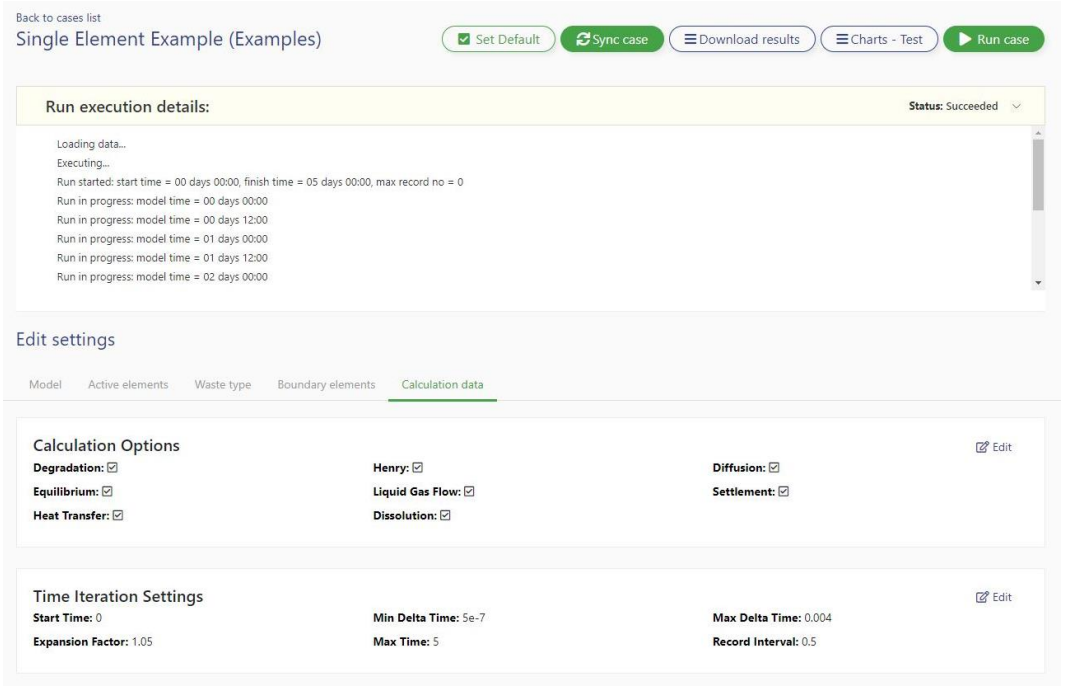
Your 'My Single Element Example' Case will appear in the User Cases list with the 'Trial Models' Project Name alongside.



The single element default model is the base model from which all models are derived. Now you have it under your control you can edit it to change its properties including the number and size of the elements. The default model is set up to represent a cubic metre of waste in a container. The container is open at the top and leachate can drain out of the waste into the lower boundary.

The initial conditions are set up with 90% leachate saturation.

Clicking on the name of the Case will take you to the area where you can Edit the Case and Run it. Ignoring the Editor for the time being Click on the Run button to run the Case.



Progress details of the calculation will appear in the Run execution panel after a short time.

Whilst running the Case, the model results are collected in a Table called ‘MergedResults’. You can click on the 'Download results' button to download a Table in the form of a .csv (comma separated variable) text file, which can be read by Excel. The results are the model parameter values for every element in the model at every record time specified by the Calculation time settings.

The model parameters are the primary variables which are the direct stress applied to the solid phase of the waste, and the gas and liquid pressures, together with every significant chemical compound mass in each of the phases: gas, liquid, degradable solid, bacteria and inert solids. Some derived secondary variables are also supplied and include dry density, gas and liquid permeability, pH, leachate saturation, heat generation and so on.

Guidance on how to use Excel to analyse and plot the ‘MergeResults’ data is contained in the following pdf and Excel files: **Using a Results Template.pdf** and **MergedResults csv file Header definitions.xlsx**. These files can be downloaded from the Help\Get\Started\Fast track section of the LDAT website.

Next steps:-

Sources of additional advice on ‘Getting Started’ with LDAT are introduced below.

<u>Example of using the Default Ten Element Stack model</u>

Three configurations of a simple Ten Element Stack model are provided in the Default Cases section of the Cases Table in the LDAT website Dashboard page. These can be cloned into the User Cases section, which then makes them available for editing and running as part of the private collection of individual User Cases.

A description of the editing of the Ten Element Model, which demonstrates how you can simulate Leachate recirculation and Aeration in a landfill, can be downloaded from the website landing page or the website Help/Get started/Some results section.

In addition you can download three MergedResults Excel templates that demonstrate how you can process the MergedResults files for the three Default Cases - passive degradation, recirculation and aeration.

Download - Examples of results from 10 Stack Model

Template: 10_el_stack template - passive

Template: 10_el_stack template - recirculation

Template: 10_el_stack template - aeration

Reference: Using a Results Template

A fourth Template has been produced to extend the analysis of the passive configuration in order to focus on the gas and leachate emissions results, which are two key areas of interest in the context of long term landfill management.

The results have been analysed and plotted in:

Template: 10_el_stack template – passive gas and leachate emission.

Help with getting started with configuring an LDAT model is provided in the four parts of a document entitled *Editing a Case.* The contents are summarised below.

Editing a Case - Part 1

Set the scale of your model by setting the dimensions of the element framework within an x, y, z co-ordinate system.

Start the process of editing the Waste Type by applying an initial leachate concentration, bacteria fraction and inert fraction.

Start to take control of the calculation parameters:

- Learn where to set the calculation start and finishing times, the time step intervals, and the frequency of recording the results.
- Control which landfill processes are active.

Start applying your own boundary conditions:

- Apply boundary pressures and temperatures.
- Apply the boundary permeabilities.
- Apply the initial quantities of inert waste, liquid and gas contained in a boundary.

Learn about estimating waste settlement.

Information files.

Links to download the following information files for Editing a Case - Part 1 may be found on the LDAT website landing page or in the relevant tab in the **Get started** section of **Help**. Access to **Help** requires user registration.

Download a pdf version of Editing a Case Part 1

LDAT code Note - initial mass calculation

Editing a Case - Part 2

Application of time dependent boundary conditions to simulate waste treatment by leachate recirculation and aeration technologies.

Setup specific solid waste characteristics by setting the fractions of Green waste, Food, Paper and Textiles.

Setup the initial chemical profile of the liquid and gas contained in the pore space of the waste material.

Take control of the way the waste permeability and dry density varies with depth.

Information files.

Links to download the following information files for Editing a Case - Part 2 may be found on the LDAT website landing page or in the relevant tab in the **Get started** section of **Help**. Access to **Help** requires user registration.

Download a pdf version of Editing a Case - Part 2

Setting Transient BCs 04_08_17

Liquid and gas permeability 07_08_17

Dry density and porosity 07_08_17

Editing a Case - Part 3

Change the number of elements in the x, y, and z directions of the element framework.

Control the waste degradation bio-chemical reactions.

Information files.

Links to download the following information files for Editing a Case - Part 3 may be found on the LDAT website landing page or in the relevant tab in the **Get started** section of **Help**. Access to **Help** requires user registration.

Download a pdf version of Editing a Case - Part 3

Development of the LDAT degradation algorithm

Editing a Case – Part 4

Explore the advanced editing capabilities related to:

- The behaviour of leachate and gas flow in partially saturated conditions.
- The chemical inhibition of bio-degradation.
- Heat generation and transfer.

Information files.

Links to download the following information files for Editing a Case - Part 4 may be found on the LDAT website landing page or in the relevant tab in the **Get started** section of **Help**. Access to **Help** requires user registration.

Download a pdf version of Editing a Case - Part 4

Role of VG equations and effective density

Bacteria growth rate inhibition functions

Heat generation and transfer

LDAT heat generation and transport algorithm