



GOVERNMENT OF BERMUDA
Ministry of Home Affairs

Department of Environment and Natural Resources
Pollution Control Section

Guidance for Undertaking Generator Set Sound Level Modelling

1. Introduction

Fixed and moveable gensets require a Construction Permit (CP) and Operating License (OL) under the Clean Air Act 1991. The Environmental Authority (EA) has the authority to approve CP and OL applications and has set guideline sound values to inform its decisions (see Table 1 in section 2.2 below).

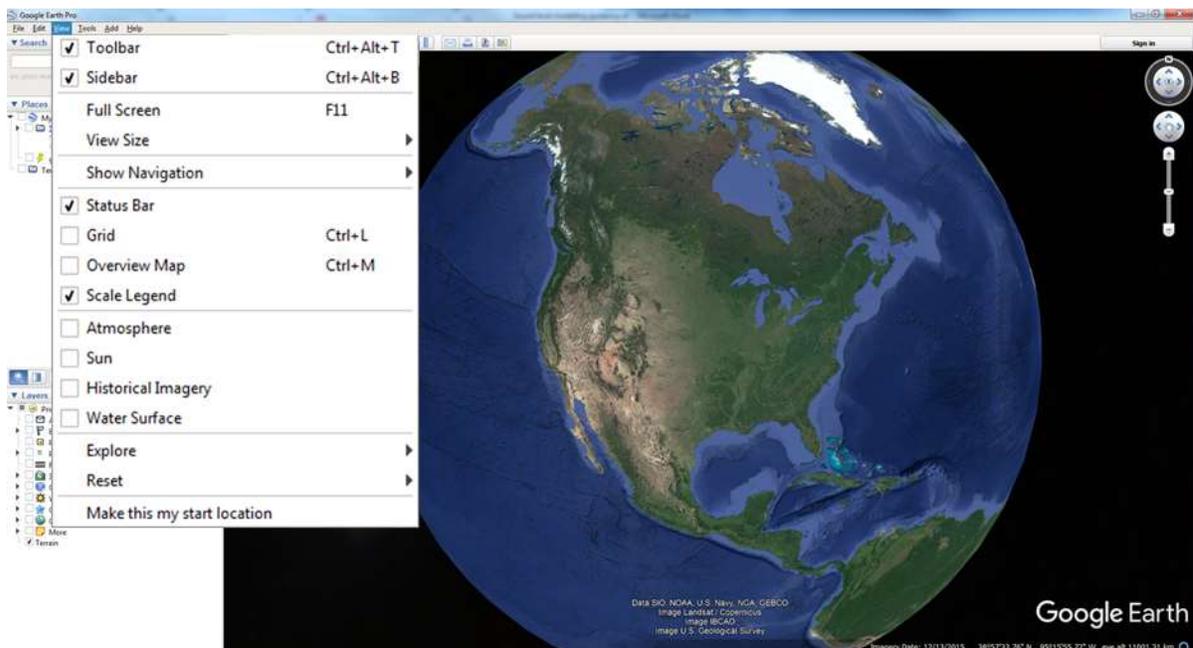
A low-cost and relatively accurate way of demonstrating that a genset will be compliant with the EA's guidelines is to undertake computer modelling. This document provides recommendations on how to carry out computer modelling using MAS Environmental's free sound mapping software "MASdBmap version 0.5," available here: <http://www.masenv.co.uk/dbmap>.

2. Undertaking Sound Level Modelling using MASdBmap

2.1. Define the Area to be Modelled

Before you use the MASdBmap software, you will require a scaled electronic site plan that shows the genset location and the nearest neighbouring properties. One way to create a site map is to use GoogleEarth and "snip" a satellite image showing the genset location and the nearest neighbours:

- Open Google Earth Pro (available here: <https://www.google.com/earth/>) and ensure the "View" settings are checked as shown in Figure 1.



- Navigate to the area where the genset will be installed, ensuring that all the nearest properties surrounding the proposed genset are shown (e.g. Figure 2);



Figure 2.

- Ensure you are looking at the most recent satellite image by clicking on  located on the tool bar. This will bring up a sliding scale  enabling the selection of the most recent image (Figure 2). Note that some recent images are of poor quality, so ensure you select the most recent, highest quality image.
- Determine the scaled dimensions of the site plan (i.e. its “real world” length and breadth) *in metres* using the Google Earth “ruler” tool . Set the scale to meters and place the cursor, which should look like a square with four small lines passing through each side, at the far edge of the image, then left click and move the cursor to edge of the image. A yellow line should be traced out (Figure 2). Ensure that the heading is $90^{\circ} \pm 0.5$ degrees or $180^{\circ} \pm 0.5$ degree for east-west and north-south measurements, respectively. Record the distances you have measured. Do not change how “zoomed-in” to the image you are after this point.
- Remove the “ruler” window from the GoogleEarth image.
- Use the windows “Snipping Tool” to select the entire GoogleEarth Image. It is essential that you snip the exact size you measured only, otherwise the site plan will not match the dimensions you recorded. Ensure that the scale bar is included in your “snip.” Then save the snipped image to an appropriate location, taking care to save it in the “.PNG” file extension. It is useful to add the dimensions to the file name e.g. SiteA_150mx75m.PNG
- Open MAS dBmap version 0.5 at: www.masenv.co.uk/dbmap. You will notice that the screen shows a dark-grey rectangle on a background of lighter grey. The dark grey

rectangle is the “grid” that the software uses for the model. The model currently does not “know” the dimensions of your site and so it is necessary to input them. To do this, create a temporary “building” (see below) with the dimensions you measured on your GoogleEarth image. Once you have created the building, you simply adjust the size of dark-grey grid rectangle to match the building and then delete the building.

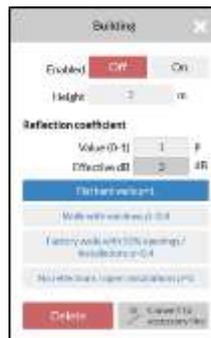
- To create the building, use the drawings tools by clicking on Add Objects ➕ > Building 🏠 tool. You will notice the cursor changing into a cross-shape. Click the left mouse button and use the Shift key to constrain the first side of the building (the shift key ensures that the building edge will be parallel to the model grid). The length of the building will be shown as you drag the cursor. Continue to drag the cursor until you have reached the length appropriate to your site plan. Some experimenting with the window’s zoom is usually required here. Use Page Back arrow ⬅️ to undo mistakes.
- Disable the “Building” by right-clicking the mouse when hovering over the building’s edge:



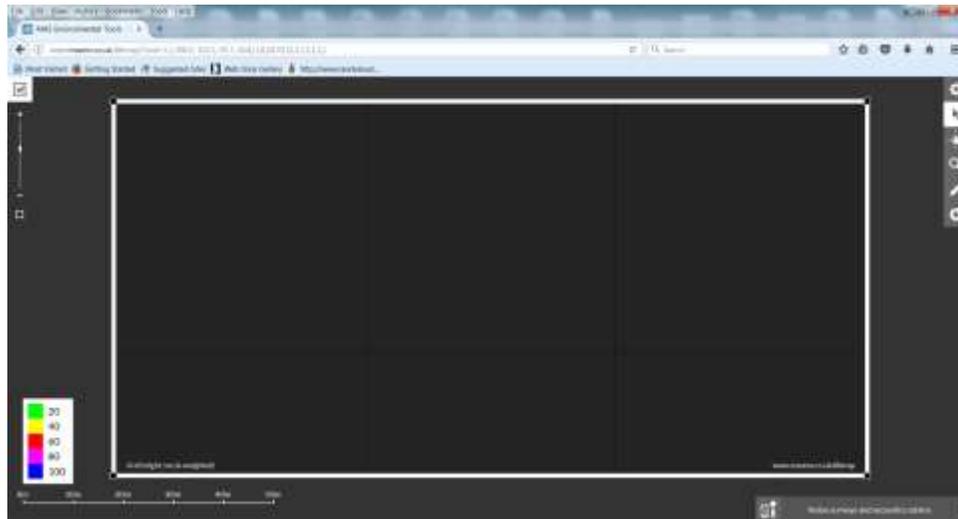
- Now hover the Select tool over model grid area to highlight the sound grid (the sound grid is the white rectangle, the disabled “Building” is the red dotted rectangle).
- Use the corner “handles” (the small black squares at the corner of the grid as shown above) to change the sound grid shape to match the building/picture dimensions. Move the sound grid corners to the building dimension lines, not vice versa.



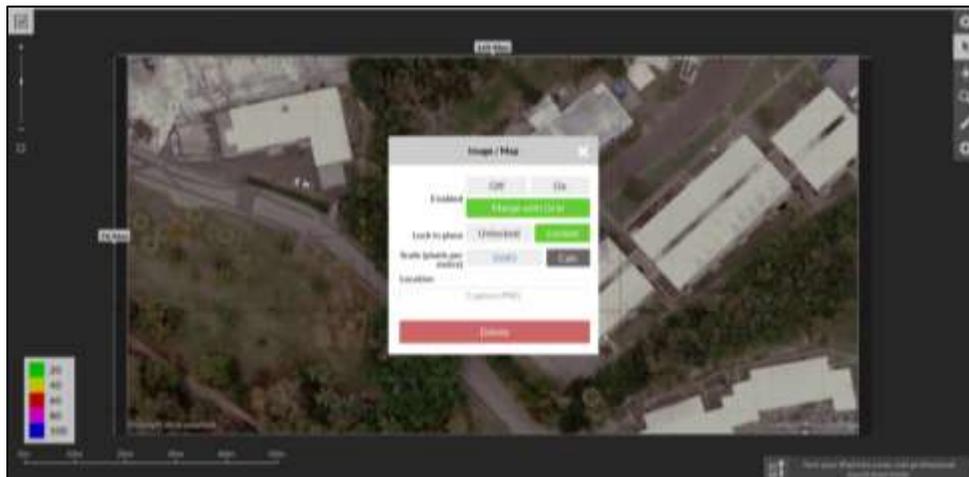
- Then delete the “Building”:



- This leaves the model grid drawn to the correct dimensions on display. The grid is dark grey as there is no sound source.



- **Now add the site map:** Use the Select Tool  to drag and drop the PNG image from the desktop to the model grid. Move and stretch image as needed to fit the grid. Hover the cursor over the image frame and right click. Select “Merge with Grid” and “Locked”. Then click close “X”:



(Refer to the Add Objects  Image Map Tool  for reminders regarding this step.)

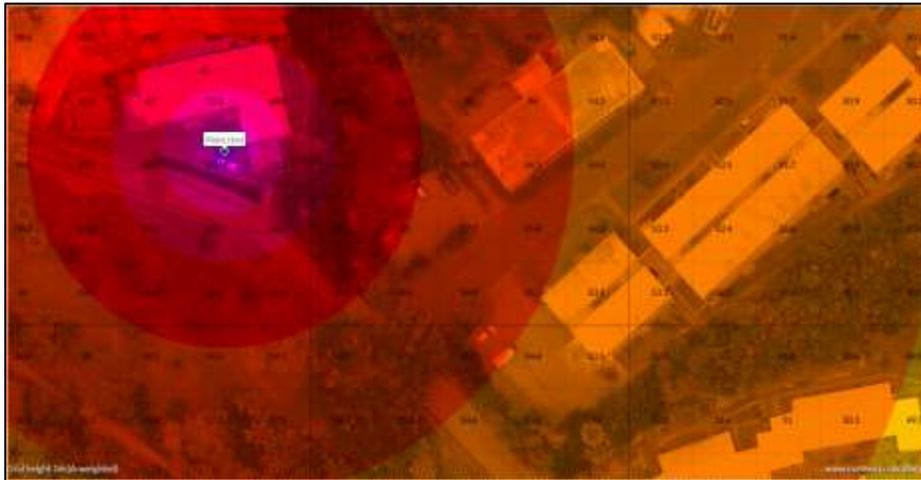
2.2. Set the Model Conditions

- In Global Settings  choose an appropriate Ground Factor ranging from “soft” (1 - grass/vegetation) to “hard” (0 - asphalt/concrete). For mixed ground types, use the fraction of the ground that is “soft”.
- Use the Add Objects toolbar to set up a sound source . Add 24.9 to the 7 m decibel reading specified by the manufacturer e.g. for a genset with full load rating of 78 dBA at 7

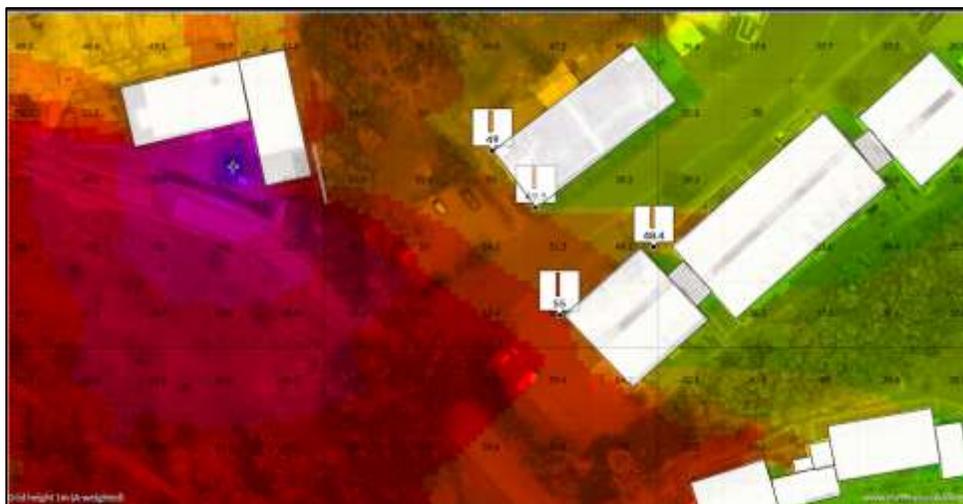
m, set the model source to 102.9 dBA. Modify the “Height” box in the window to match genset specs:



- The model will now show the free-field (i.e. no barriers) decibel values overlaid on the base image:



- Using the building footprints in the site plan as guides, place receivers  at the nearest neighbours, and create barriers  and buildings  using the relevant tools. For rectangular buildings, create the long dimension first. For irregular buildings, use the Barrier tool  or combine two or more Buildings. Edit (e.g. move, rotate, and stretch) using the Select Tool and the appropriate object handles:



- Note that the model assumes perfectly flat terrain, and vertical walls and buildings. It does not simulate the effects of topography or thick vegetation.
- The sound model will update every time a source or barrier is added or adjusted.
- The receivers should be placed at heights that represent the windows closest to the genset at the nearest neighbours'). The values shown by the receivers should be compared with the sound guidelines shown in Table 1.

Land Use Category	Time Period	Sound Level
Residential	Night (10 pm to 7 am)	45 dBA
	Day (7 am to 10 pm)	55 dBA
Office/Commercial	Any time	65 dBA
Industrial	Any time	70 dBA

Table 1. Sound guideline values for different times of the day and land use categories.

2.3. Saving the Model

All the modifications in each model are encoded in the (very long) website address (URL). There is no separate model file to save. When the modelling is complete, in Global Settings  select "Shorter URL". The shorter URL is much easier to work with. For reporting to DENR, copy the shorter URL from the Global Settings window (e.g. <http://dbmap.co.uk/zoklj>) and e-mail to pollutioncontrol@gov.bm together with the .PNG file used in the model and the supporting information outlined below.

When re-using (e.g. clicking on either the long or short URL or retrieving from Favourites), all the model elements will remain, but the PNG image used as the base map will be missing and will have to be re-loaded.

3. Supporting Licence and Permit Application: Report Requirements

In addition to the completed application form, fee and full generator specifications (including measured sound levels at 7 m), an application will require the following:

- Short URL link to the sound model;
- The .png basemap file;
- Short description of the site and supporting photographs (particularly if the site is complex) showing line-of-site to the nearest neighbours and other relevant features that might have an effect the propagation of sound (e.g. boundary walls);
- Justifications for any assumptions e.g. the setting of the ground factor; and
- Details of any sound absorbing equipment or proposed barriers/enclosures.