

Automating CAD – Making 3D Models Programmatically - Handout

Dave Ackmann – Gateway Division NMRA, July, 2022

This Clinic describes the use of “Generators” to design 3D model “primitives” for structures in an easier fashion than traditional Computer Aided Design. Primitives such as a basic four walled building, with clapboard, log or board-and-batten siding, and sloped or peaked rooflines are possible. Other generators create different varieties of roofing, flooring, foundations, windows and other structural elements.

Generators are individual Microsoft Windows-based computer programs into which the user enters design parameters to meet their needs. Parameters such as the item width, depth, and many more primitive-specific options are provided. When the “green Generate button” is pressed, the Generator calculates a set of instructions for the OpenSCAD program. OpenSCAD then converts the instructions into a Stereo Lithography file, suitable for 3D printing or further modification in a traditional CAD package such as TinkerCAD.

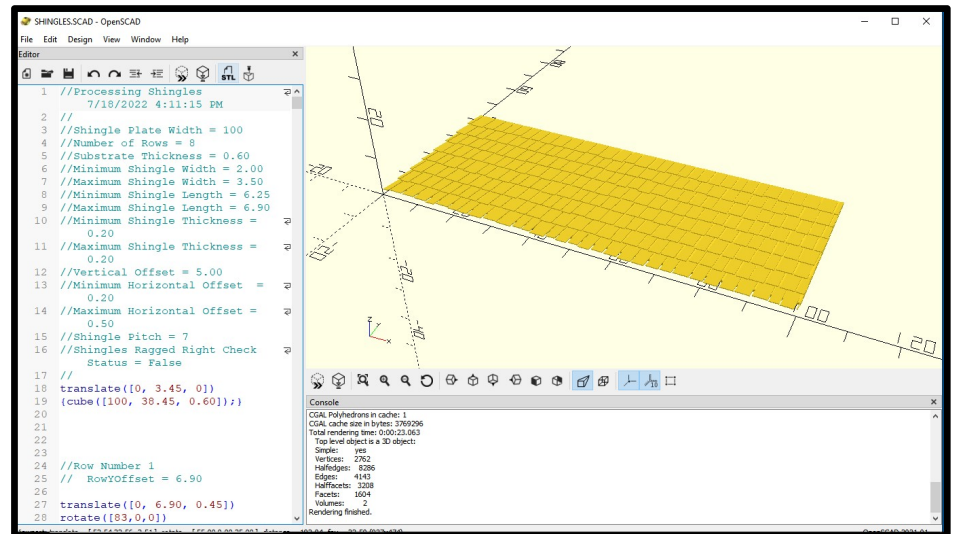
Although copyrighted, Generators are available for download at <http://daackm.github.io>, at no charge, and may be used to construct structures on an individual or club layout; they may not be resold. A matrix at the website provides links to each Generator type. OpenSCAD may be downloaded from <http://www.openscad.org>, and is also free. A “trailer” video and a complete instructional clinic video are also available at <http://daackm.github.io>. Eventually documentation will be available for each generator type, but as of July, 2022 only field descriptors are provided.

Generator dimensions are specified in real millimeters, and thus are scale independent.

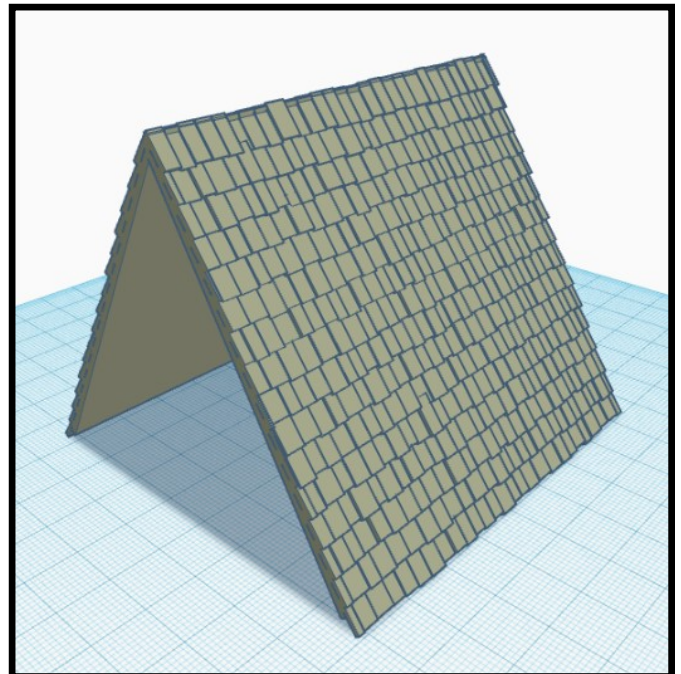
A sample generator screen for a Shake Shingle Generator is shown below:

The screenshot shows the 'Shake Shingle Generator' window. It features a grid of input fields for various parameters: Shingle Plate Width (100), Number of Rows (8), Substrate Thickness (0.60), Vertical Offset (5.00), Minimum Horizontal Offset (0.20), Maximum Horizontal Offset (0.50), Minimum Shingle Width (2.00), Maximum Shingle Width (3.50), Average Shingle Width (3.00), Minimum Shingle Length (6.25), Maximum Shingle Length (6.90), Average Shingle Length (6.75), Minimum Shingle Thickness (0.20), Maximum Shingle Thickness (0.20), Average Shingle Thickness (0.20), Shingle Pitch (7), Raggedness (1), and Shingles Ragged Right (checkbox). A text box on the right indicates 'Shingle Plate Height will be 41.90'. At the bottom, there are five buttons: 'Generate Shingles' (green), 'Load Parameters' (red), 'Save Parameters' (cyan), 'Restore Parameters' (light red), and 'Click to Exit' (red). Below the buttons, a small text block states: 'Dimensional Units are in Real Millimeters. One Real Foot equals 304.8mm, or 3.50mm in HO Scale. Copyright (C) 2022, David A. Ackmann. All rights reserved; Use of Program explicitly permitted.' The version 'Version 0.03 22MAR22' is displayed in the bottom right corner.

The OpenSCAD file produced by a Generator is basically a programming language and is human-readable. To process the file, just launch OpenSCAD, and do a “File/Open” on the file created by the Generator. A “quick and dirty” drawing of the object will appear, and if the drawing looks promising, the “F6” key is used to do a final rendering. Once the final rendering is completed, a Stereo Lithography model can be saved by pressing the “STL” icon.



A sample of the resulting roofing, once processed through OpenSCAD, is shown at right:



A sample generator screen for a Basic Building Generator is shown below:

The screenshot shows a software window titled "Basic Building Walls and Rafters". It features a "Building Style" section with radio buttons for "Flat Wall", "Clapboard", "Log Cabin" (selected), "Brick", and "Board/Batten". Below this are input fields for "House Width" (80.00), "House Length" (40.00), "Substrate Thickness" (1.50), "Wall Height" (35.00), "Log Diameter" (3.50), "Log Overlap" (0.10), and "Log Offset" (2.00). A "Roof Pitch" dropdown menu is set to "Peaked - 30.00°". To the right is a large empty rectangular area. Below the input fields is a "Print" section with radio buttons for "All Walls", "North Wall Only", "East Wall Only", "South Wall Only", and "West Wall Only". At the bottom are five buttons: "Generate Basic Building" (green), "Load Parameters" (red), "Save Parameters" (cyan), "Restore Parameters" (orange), and "Exit" (orange). Footer text includes: "Dimensional Units are in Millimeters", "One Real Foot equals 304.8mm, or 3.50mm in HO Scale.", "10' in HO corresponds to 35.00mm", "Copyright (C) 2022, David Ackmann. All Rights Reserved. Use of Program explicitly permitted.", and "Version 0.05 26JUN22".

At right is a log cabin. The basic building was created with a "BasicBuilding" Generator, and the roofing, windows and decking were also created with their respective Generators; the railings, chimney and steps were created with traditional Computer Aided Design.



At right is a table of Generators available at <http://daackm.github.io> as of July, 2022. No warranty is expressed or implied as to their suitability for use or freedom from programming errors; they are provided “As Is”. Users are welcome to submit suggestions for improvement or discovery of errors to Ackmanns@charter.net,

but no guarantee of correction is promised. Although the author does employ multiple pieces of malware (virus) protection, after download and prior to use, it is highly recommended that every user scan the generators for malware.

Topic	Download Link	Tutorial Link
Basic Building Assemblies	Click Here	Not Yet Available
Shake Shingles	Click Here	Not Yet Available
Brick Walls	Click Here	Not Yet Available
Windows	Click Here	Not Yet Available
Floors	Click Here	Not Yet Available
Foundation	Click Here	Not Yet Available
Roofing and Rafters	Click Here	Not Yet Available
Shutters and Louvers	Not Yet Available	Not Yet Available
Piers and Purlins	Not Yet Available	Not Yet Available
Canopies and Awnings	Not Yet Available	Not Yet Available
Masking Tools	Not Yet Available	Not Yet Available
Trestles	Not Yet Available	Not Yet Available
Staircases	Not Yet Available	Not Yet Available
Lattices	Not Yet Available	Not Yet Available