Parametric Design in Landscape Architecture

Exploring visual scripting in grasshopper as a tool for landscape design innovation

Contributors

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References

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01 Introduction

Parametric design is a tool that emphasizes the relationships between elements in the design and modeling processes. It combines the power of visual scripting with the design process. The term "parametric design" was first defined by Luigi Moretti in 1939 but it has become more common in the design industry following the advances in computer technology between the 1980s and today (Tedeschi, 2104). Although there are a number of parametric design software applications, this study explores the use of Grasshopper in Rhinoceros 3D.

Unlike the fields of architecture and engineering, parametric design has been relatively nonexistent in landscape architecture until very recently. Leading firms like Design Workshop, James Corner Field Operations, and PEG Office of Landscape + Architecture, are just some of the industry pioneers paving the way for the rest of the profession by exploring its untapped potential. There are many unique applications for parametric design, and more are being discovered as time goes on. Although its fame may in part be attributed to the unique forms shown in glamorous renderings found in magazines and on the internet, parametric design has a functional capacity that could be used to increase the precision and speed of nearly all aspects of the landscape design process (Madl, 2021).

02 Objective

The objective of this project is to explore how parametric design can be used as a functional tool in a typical landscape design project - in this case, a trail design.

03 Methodology

This project implemented an exploratory methodology to generate ideas for how a trail design could benefit from a parametric approach. After a quick sketch of a trail layout in Logan Canyon near Utah State University, possibilities of parametric incorporation were explored.

04 Analysis

Parametric tools generated:

Sketch to 3D Model Automation
This code projects a 2D line onto a 3D terrain model generated parametrically from DEM data.

Adjustable Width/Depth
After the trail centerline is projected, it can be offset and extruded to simulate trail width and depth.

Real-time Slope Analysis
Slope parameters are assigned to colorize the surface based on the slope suitability of the projected trail.

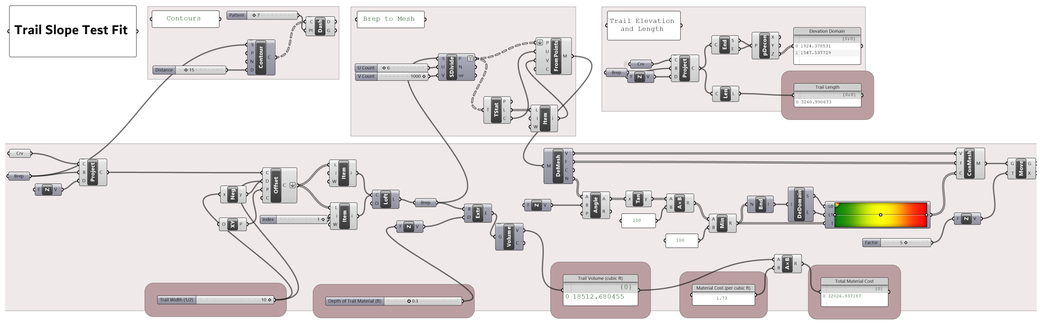
Material Volume and Cost Estimation
All manipulations of the trail geometry are linked to equations in the code to produce the associated data for material volume and cost.

05 Results/Findings

The grasshopper script allowed for the automation of many site calculations and parametric associations. The time required to define the script for this project was more than expected for a typical trail design process. However, now that the script has been written, it can instantly be applied to any other site which will improve the long-term time efficiency and overall accuracy.

06 Conclusion

This project shows some useful applications of parametric design but provides a only small glimpse into the many possibilities that it could have in landscape architecture. Similar explorations can help add value and transform design across the profession.



The scripting logic (above) shows the important adjustable parameters and associated data highlighted with a dark red border.