

# Research on the Application of Computer Aided Design Software SU in Landscape Design

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**Abstract.** SketchUp has simplified, three-dimensional and intuitive effects on landscape design optimization. The software changes from traditional manual drawing to computer-aided drawing, which promotes the improvement of landscape design and BIM modeling and analysis level. SketchUp enables real-time communication with customers. This paper is based on two-dimensional data accurately drawn by AutoCAD and uses the SketchUp ESRI plug-in between GIS and SketchUp to convert shape files into SketchUp recognizable. Then, Google SketchUp intelligent software was used to rapidly batch process GIS data. Finally, the 3D model is output into Multipitch (\*.mdb) format data. The software can realize roaming, query, data management and spatial analysis, and achieve the purpose of rapid realization of forest landscape visualization. This method can batch process the 3D modeling data of large areas and has important reference value for landscape visualization and landscape planning.

**Keywords:** SketchUp; landscape design; three-dimensional visualization; landscape planning.

## 1. Introduction

With the development of computer technology, the auxiliary application of computer in design has expanded from the early two-dimensional plane graphics to the current three-dimensional design and animation field. However, the current domestic design industry has not given full play to the great potential of computer-aided urban design, designers still put too much energy into the software operation rather than the creative design itself [1]. For modern landscape design work, also reduce the use of traditional drawing board, T-square, needle pen and other tools, more use of computer aided technology. The main auxiliary software includes AutoCAD, 3Dsmax, Google SketchUp, Photoshop and so on. As a result, SketchUp, a software that focuses on design and creation and is easy to operate, came out and was applied, which established a more convenient and intuitive channel for the communication between designers and users. This is the design flow of SketchUp, a modeling software known as Sketchup. This modeling software, combined with other related graphics information, can help designers complete their design tasks quickly and with good quality. Through the parametric editing of the software, users can use its simple operation and rich functional modules to complete the visual preview of architecture, landscape, civil engineering, structure, model making, scene creation, two-dimensional map generation and visual animation display and other work. In landscape design, SketchUp is usually used for 3D modeling based on two-dimensional terrain. With the assistance of some plug-ins, it can easily complete the modeling of terrain, roads, water, buildings and facilities and provide materials for the rendering of later renderings. It is convenient to deduce the detailed details and conducive to the image shaping of space. The software can achieve the best landscape effect by deeply comparing the texture of the material. SketchUp ESRI plug-in application can better complete the connection from 2D graphics to 3D modeling. The software can realize roaming, query, data management and spatial analysis, to achieve the purpose of quickly realizing landscape visualization.

## 2. Introduction to Sketchup software

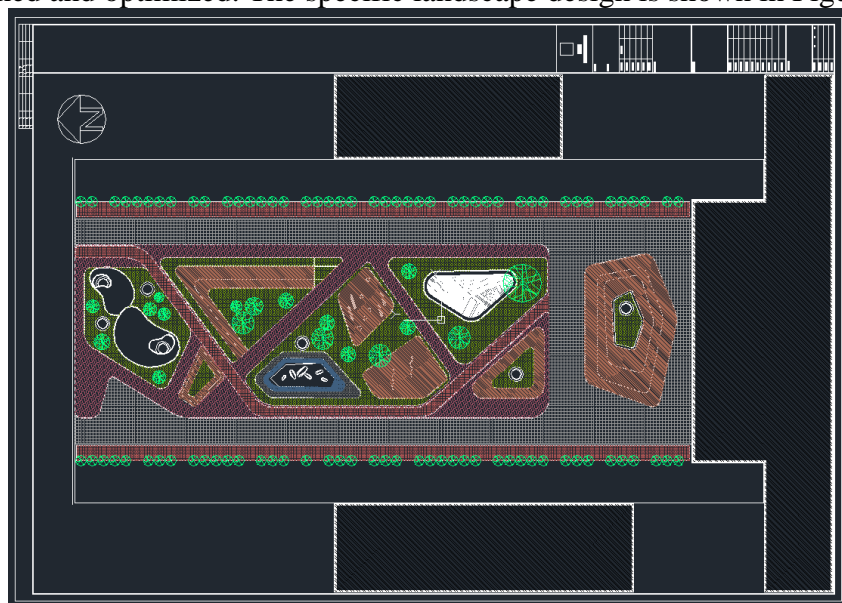
Sketchup, a 3D drawing software developed by @LastSoftware, an American development company, around 2000, is a design software mainly designed to solve the problem of visualization

and easy modification for designers. Google acquired this software in 2006 to enable users to build 3D models and then put them into Google Earth to enhance the three-dimensional sense of Google Earth maps and realize the function of 3D virtual cities. In 2012, Google sold the Sketchup software to Trimble, which focused on location and positioning technology of equipment such as positioning, architecture and Marine navigation. Sketchup may be better developed in the future, which may be further combined with GIS geographic information [2]. Features will be more and more rich. Due to its characteristics of simple command, quick hand, easy operation and fast modeling, as well as powerful and rich third-party plug-ins and vray rendering cloud rendering, it has been quickly recognized and used by architects, landscape designers, interior designers and other designers.

### 3. SketchUp process applied to BIM modeling for landscape design

#### 3.1. Early CAD finishing

In the process of using SketchUp software, I imported the CAD base map and designed it from the Angle of elevation, layer, etc., based on the base map positioning and structure design. It can improve the comprehensive application effect of landscape design. In the process of perfecting and optimizing landscape design, the vertical and horizontal landscape design process can be optimized according to landscape requirements [3]. It also needs to be based on the actual BIM modeling requirements. Redundant line layers are removed from dwg files to avoid having a direct impact on the speed of 3D modeling. In the process of optimizing the landscape design, different structures in the landscape need to be designed and optimized. The specific landscape design is shown in Figure 1.



**Fig 1.** CAD landscape design

On the basis of SketchUp software, the landscape design process can be optimized. On the premise of the design and construction of three-dimensional forms, the integrated application effect of landscape design can be improved. For example, in the design of shrub vegetation, can through the application of SketchUp model, to design of vegetation, however, in the process, from two-dimensional vegetation into three-dimensional vegetation, the data model of budget speed will be affected, therefore in the landscape stereo configuration is optimized under the premise of can improve the effect of the landscape design of integrated application [4]. After opening the SketchUp software, I drew a two-dimensional figure. I designed the bottom surface with the line tool and the rectangle tool. After drawing the base line, I drew a two-dimensional plan with the tool combined with the size of the design model. After the completion of two-dimensional graphics drawing, through the way of stretching, establish three-dimensional graphics, complete the preliminary design of landscape model.

### 3.2. Application of group and component commands

Both group and component commands exist to facilitate unified management and modification of the model. Take the landscape design of a square as an example, in which there are many landscape sketches and public facilities. Therefore, partition modeling should be done. For the single existing different landscape structures, the group command can be used for modeling. The function of the group is similar to that of the block function in CAD, which can form a group of multiple faces and objects. If you want to modify this group, you only need to double-click the group to enter the internal modification, and other building models will not be affected [5]. However, for structures that occur more than once, such as tree pools, rest chairs, trash cans, railings, etc., modeling with component commands is more appropriate (Figure 2). If these components are modified later, if it is the same kind of structure, only one of them needs to be modified, and other similar structures will also be modified synchronously, avoiding the trouble of repeated operations and greatly reducing the modeling time.



Fig 2. Use of component commands

### 3.3. Three-dimensional model design

Import the optimized CAD file into the SketchUp software. Select the same drawing units and ensure that the actual scale of the model is equal to ensure that the model is true and accurate. Aerial images such as Google Earth and tilt photography of UAV were combined to further optimize the accuracy of project positioning. I ran commands and tools such as line segments, arcs, sandboxes, object push and pull, and path following in SketchUp software to conduct 3D modeling for major engineering projects such as roads and buildings, and completed the modeling of the site and the main project [6]. At the same time, I used various plug-in tools to improve the efficiency of 3D modeling. After the 3D modeling was completed, simple materials were added to the main model of the site. On the one hand, the model was more real and could meet the needs of simple communication between planners and owners in the early stage. It fully reflected the characteristics and advantages of SketchUp software, such as simple use, intuitive display and convenient modification. On the other hand, it can provide the basis for the next stage of Lumion real-time simulation, so as to improve the efficiency and accuracy of the work. The schematic diagram of 3D model design is shown in Figure 3.

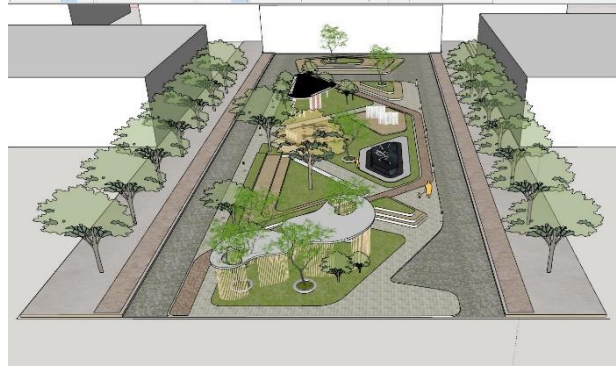


Fig 3. Schematic diagram of three-dimensional model design for some areas of the farm

### 3.4. In-depth contrast of material texture

In urban landscape design, it is usually necessary to express design concepts through hand-drawn design. The flexibility of hand-drawn design facilitates the change of design ideas. In the in-depth design stage, hand-drawn design can no longer meet the needs due to the complexity of design. Different material texture contrast in the design of urban landscape, a good designer must have a deep understanding of different material texture form characteristics, modern featured landscape form of changeable, continuous innovation, the traditional design application cannot meet the demand, the emergence of Sketchup software effectively solves the detail design phase of the problem, It is of great significance to better show the composition ratio of landscape materials and the order beauty of texture. It is convenient for creators to better express their design themes and concepts, highlight the unique aesthetic feelings of different texture materials, and is also a typical way to combine aesthetic elements with design creation [7]. The application of Sketchup software is convenient for designers to better practice and understand the effect of texture in landscape design creation, increase operational experience, accumulate design inspiration, and further enhance the ability of design perception and aesthetic experience. The real-world simulation of material texture in SketchUp software can be described from points, lines, surfaces, colors, textures and other aspects to achieve accurate expression. It is convenient to explore the emotions expressed by different material textures and conducive to the accumulation of experience and skills in the application of material textures.

### 3.5. SketchUp software application strategies and methods

The application of SketchUp software in urban landscape design planning can quickly, accurately and scientifically develop design schemes, and make use of its own design advantages to interact with other software to develop design schemes. The different design phases of SketchUp are shown in Figure 4.

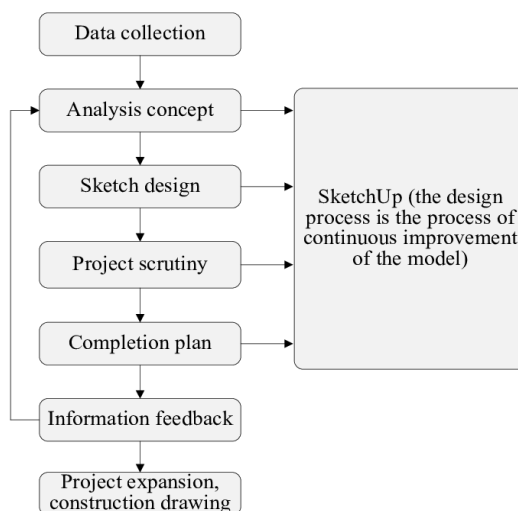


Fig 4. SketchUp in different design stages

In urban landscape design, data collection should be done first in the early stage. Again according to the preliminary analysis, improve accuracy, on the basis of combining with other relevant data, the results of the analysis and design of the draft design, preliminary design stage should actively collect design scheme of natural environment, ecological environment, artificial facilities, social and economic development and other related data, determine the design theme and core, convenient for the follow-up design. SketchUp software was used to preliminarily determine the design theme and determine the spatial image shaping around the landscape design requirements. After the preliminary determination of the scheme, it is necessary to enter the stage of scheme improvement, modification and optimization. 3D modeling is completed with SketchUp software [8]. After the design sketch is completed, detailed planning and design should be carried out according to the design site and landscape requirements, and optimization and adjustment should be made at any time. After the space model is established in the SU interface, the actual landscape effect and organizational relationship are constantly optimized according to its own design concept and environmental conditions, and possible problems in the scheme are actively found. In the modeling process, redundant lines and planes should be deleted as far as possible to maintain a clear hierarchical and organizational relationship, so as to complete the modeling process efficiently and quickly.

#### **4. Feasibility analysis of combining Sketchup and BIM**

Now, although more and more design units begin to use BIM technology to participate in engineering projects, there is still a long way to go before the popularization of BIM technology. First, the design period of BIM solution is long and the consulting cost is high. BIM pursues the cooperation of the whole process of various professions, which requires the collaborative participation of owners, design units and equipment construction manufacturers. Second, the user fee of BIM software and the training cost of a large number of personnel are very high. This leaves current BIM solutions only available for a small number of projects with sufficient budgets and engineering cycles. Although software manufacturers are constantly expanding their component libraries, without a large number of users, the business value of BIM software companies will be greatly reduced. Therefore, finding a cheap BIM solution is an important measure to promote the development of landscape design. Sketchup has become the first choice for most architects, landscape architects and other designers in China due to its simple interface, free and flexible use, and fast and easy to use modeling. It has a good user base. Sketchup has been widely used in planning, landscape, architecture, equipment, interior design and other professional fields. It also preliminarily has the prerequisite for multi-professional collaborative operation of BIM platform.

Starting with the 2018 version of Sketchup, Trimble has gradually enhanced the BIM capabilities of Sketchup. The import/export function of BIM standard data format, which is widely used by IFC, has emerged. Users can assign and manipulate attributes of the model depending on IFC. IFC data format enables Sketchup model to interact with various working software, which marks the beginning of Sketchup joining the ranks of BIM software. Not only that, but you can add advanced attributes to the component, such as price, size, URL, type, manufacturer, and so on, and it starts to become easier to embed valuable information in your project. There is also a summary report feature that summarizes component data. Users can click "File" - "Generate Report" in Sketchup to generate a report. The report can generate configuration reports, parts lists and quantities, such as simple paving and rebar statistics tables.

Sketchup has an open 3D Warehouse component library platform (Figure 5) that allows users to download and upload their own components. Coupled with a large user base, this creates endless possibilities for BIM family libraries. Moreover, Sketchup has strong scalability, built-in Ruby language console, with a complete and open API interface, with the Ruby console to develop plug-ins can achieve all the complex operations including database operations. At present, there are thousands of plug-ins at home and abroad. For example, the domestic embryo plug-in library is very powerful, not only can provide a large number of classified components and a variety of auxiliary

modeling plug-ins. In recent years, there have been more and more BIM plug-ins, such as building construction tools, modeling, vertex editor, ARC, DFC pipeline tools and other Sketchup BIM plug-ins. Sketchup can directly make buildings and structures in layers, equipment in subsystems, all architectural elements in groups, and model information. The collision detection of these models can be carried out in Tekla Bim sight software, which makes the working efficiency and drawing quality greatly improved.



**Fig 5.** 3D Warehouse component library platform

## 5. Conclusion

This study combines SketchUp and GIS technology to realize landscape visualization. First of all, vectorized topographic map, create tree layer, small class layer, establish the forest scene; Secondly, the coordinate information of ground objects is collected by total station and GPS and mapped in AutoCAD. The plug-in between ArcGIS and SketchUp was used to import the shape file into SketchUp for rapid mass modeling in SketchUp. In the research process, the power of Sketch Up ESRI was demonstrated again. The built 3D model will be imported into Geodatabase for storage. This design process can accurately and efficiently complete the production of virtual landscape terrain and scene rendering. SketchUp will have more room for improvement and development in the future landscape design.

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