Fall 2013

A Post-Occupancy Daylight Analysis: Vernonia K-12 School

Julia Mollner
Portland State University

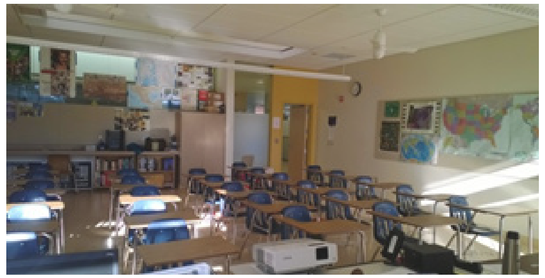
Corey T. Griffin
Portland State University, cgriffin@pdx.edu

A Post-Occupancy Daylight Analysis: Vernonia K-12 School

Julia Mollner, Graduate Student, Portland State University, Portland, OR, United States
Corey Griffin, Associate Professor, Portland State University, Portland, OR, United States

PORTLAND STATE UNIVERSITY :: SCHOOL OF ARCHITECTURE

boora architects



1 INTRODUCTION

Daylight is an important aspect of design, specifically in school settings. Daylight is not only desirable but crucial for the growth of children, including: increased connection to nature, reduced electricity bills, and increased attention spans. Recent studies have shown the positive relationship between diffuse daylight and student performance (Melton, 2012). The proper design of daylight can enhance a space without electric light. The main goals of daylighting are (1) control direct light during occupied hours (2) provide balanced illuminance on interior surfaces (3) provide sufficient ambient daylight illumination for visual tasks (Pattern Guide for Advanced Daylight, 2014). This research is focused on comparing one digital software program; Autodesk 3ds Max, with field measurements with the aim to inform future projects to integrate daylight analysis as a critical factor in design decisions.

2 METHODOLOGY

The aim of this workflow was to provide insight into the daylight relationship between digital software, AutoDesk 3ds Max, and field measurements. Digital software has been used to analyze daylight for many years, however, its integration into the design process has wavered throughout firms. There has been a challenge with integrating daylight analysis iterations into the early design process where it could inform design decisions. It was the intention of this daylight post-occupancy study to provide understanding of the daylight software's ability to accurately output real life numbers.

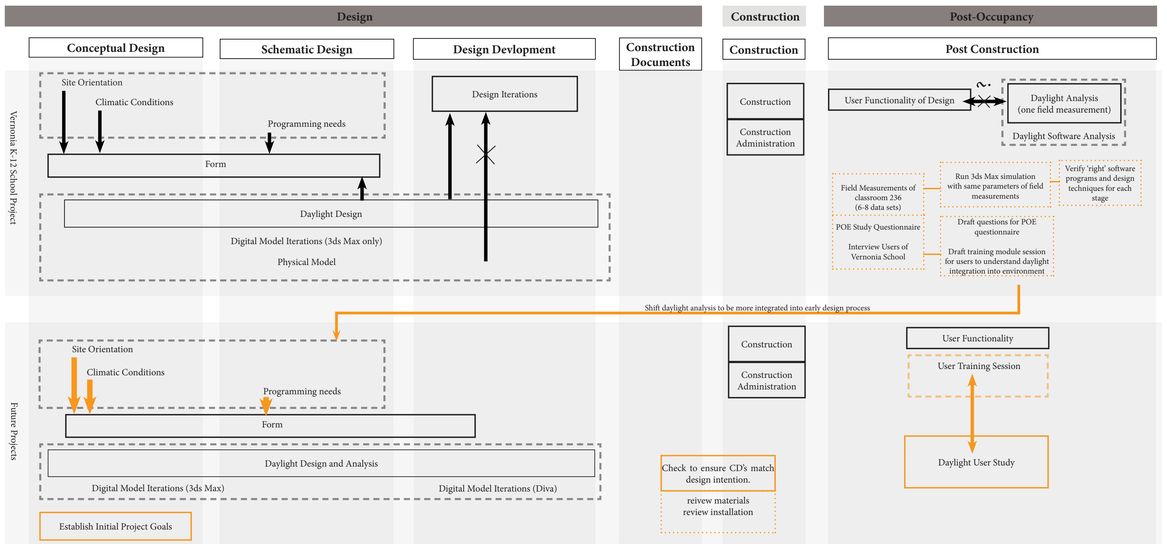
The room was left in its existing state except for raising all the blinds to calculate for optimum daylight from the design strategies used. There were no electric lights on through the duration of gathering field measurements. The measurements were taken using footcandles (fc), along a four foot grid throughout the classroom. Seven data sets were taken using a General Tools Instrument DLM1337 Digital Light Meter on January 26, 2014 between 12:00pm and 3:00pm on an unusually clear sky day. It is important to note that these conditions do not represent a typical day in Vernonia, Oregon. According to the National Weather Service Vernonia, Oregon in the typical January experiences nineteen cloudy days, seven partly cloudy days, seven fair days, and seven average cloud cover days. The average relative humidity is seventy-eight percent. (National Weather Service, 2013).

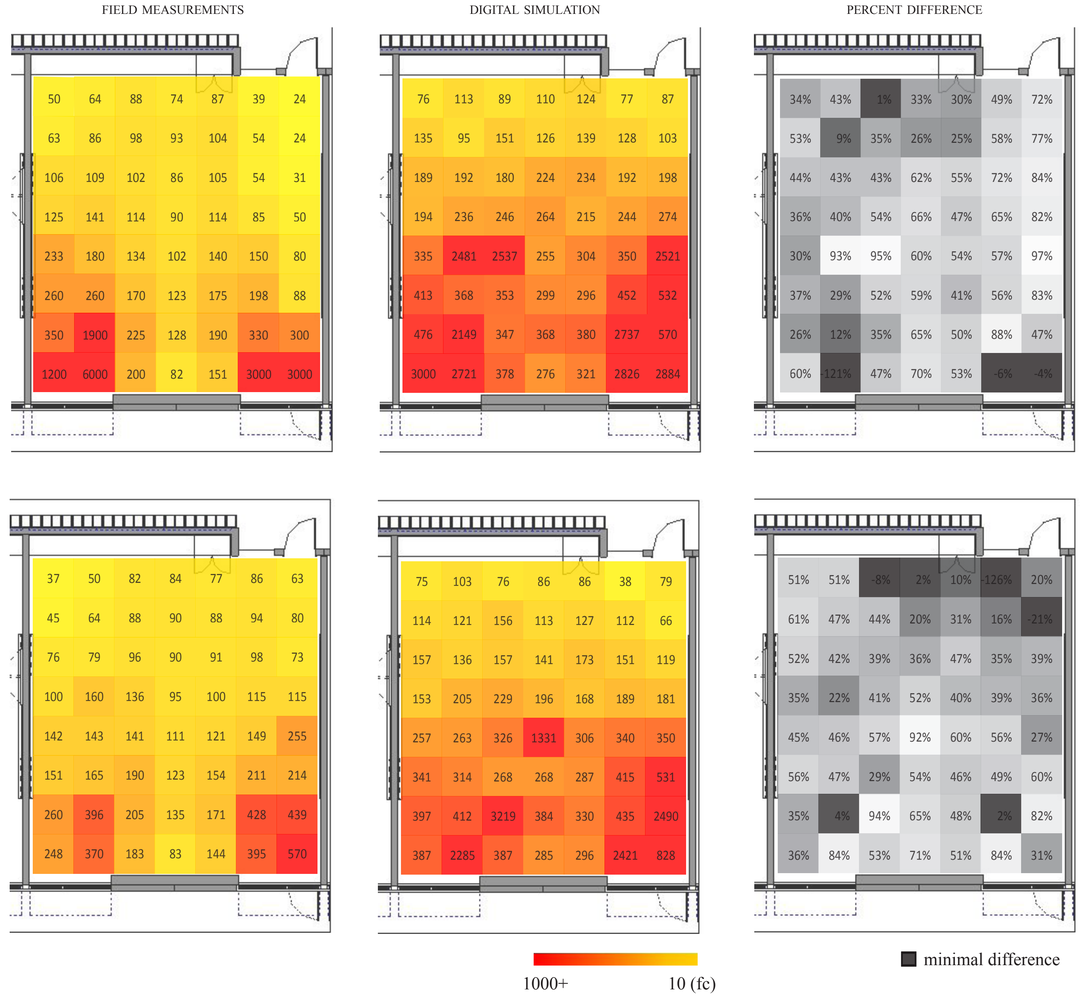
3 DATA

The data reveals a large margin of error between the digital simulation and the field data. Major influences of this difference can be seen in the material representation and sky conditions. AutoDesk 3ds Max is dependent on the RGB (red green blue) value code from Revit to calculate surface reflectance. This value is not an accurate representation of the material. It can be compared to the surface reflectance measurements taken using the Reflectometer Vis 410 Instrument. According to Breton & Laundry, the material can cause a margin of error up to twenty-five percent. To put this into understandable terms, this margin of error is the difference between a well lit space and a dark room.

4 CONCLUSIONS

As more research is being done with post-occupancy conditions and daylight design, it is important to gain knowledge on the transition from design intention to occupant use. Software is becoming more accurate and new software features, such as the daylight tool in Revit, are being developed in help integrate daylight design into the early design process. This research begins to find ways in which daylight can become more integrated in an informative design process. As technology and the importance of daylight as an informing design factor grows, the industry will develop more accurate tools that fall into the natural workflow of design professionals.





The current disconnection from design intention to user occupancy needs to be improved to maximize daily use of daylight in the classroom environment.