Harpley School, Tower Hamlets

Daylighting Report

Prepared for Rooff

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Revision 2

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BUILDING SERVICES DESIGN CONSULTANTS

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Executive Summary

The following report has been produced to assess the proposed Harpley School against the Department of Education's Generic Design Brief: Technical Annex 2E which sets the following criteria to be met:

- 80% UDI-a (100-3000 lux)
- Minimum target Daylight Autonomy (DA) of 50% of the time for 50% of the working plane.

Integrated Environmental Solutions Virtual Environmental (IES VE) software, version 2021.0.2.0, was used to assess the teaching spaces using the latest CIBSE weather files for London Heathrow Airport (LHR) which is a representative of intermediate urban and suburban locations.

The preferred glazing g-value for the proposed scheme is 0.5. This reduces solar gains but also still provides sufficient natural daylight, where a lower g-value can often be too dark causing discomfort and an increase in the demand for space heating and artificial lighting.

Initial simulations were run based on the original design granted for planning (shown in figure 2.2 on pg 6). The results showed that all classrooms passed the DofE's UDI-a criterion but three of the tuition rooms fell short of the required 80%. All rooms fell short of passing the DA criterion.

Window heights were increased to 1500mm and widths were adjusted for the next set of simulations and this improved the results so that all classrooms, student meeting room, interview room and three of the four tuition rooms passed the UDI-a criterion however the tuition rooms on the ground floor and all first floor classrooms failed to meet the daylight autonomy criterion.

The final simulations were run, splitting the large off centre windows in the first floor classrooms to provide greater illuminance distribution. The results indicate that 100% of classrooms, interview room and student meeting rooms now pass both criteria. Only one tuition room still falls marginally short of the UDI-a criterion and 3 ground floor tuition rooms do not meet the daylight autonomy requirement.

Contents

Revisions:

Rev No.:	Date:	Status/Comments:	Prepared by:	Checked by:
1	12/03/2021	Preliminary Issue	Katy Venables	Ellen Huelin
2	28/04/2021	Updated results	Katy Venables	Ellen Huelin

1.0 Introduction

It is generally considered that good quality daylighting within the learning environment is essential to increase alertness and improve academic performance.

This document has been produced for Rooff to present the daylighting results for the proposed Harpley School, located in Bethnal Green, East London.

A dynamic model of the proposed building has been constructed using Integrated Environmental Solutions Virtual Environment (IES VE) software. This allows dynamic simulations to be carried out taking into account all particulars that can affect the way a building performs, including building construction, light transmittance of glazing and building orientation.

The proposed 2 storey building consists of six classrooms and six one to one teaching rooms, plus an interview room and student meeting room.

2.0 Daylighting Criteria for Schools

Department for Education Technical Annex 2E: Daylight & Electric Lighting

To meet the requirements for daylighting in schools set in the Department of Education's Generic Design Brief: Technical Annex 2E, relevant teaching spaces should strive to achieve the following:

- 80% UDI-a (100-3000 lux)
- Minimum target Daylight Autonomy (DA) of 50% of the time for 50% of the working plane.

Useful Daylight Index (UDI) is defined as the annual occurrence of illuminances across the work-plane that is within a range considered 'useful' by occupants. 80% of the working plane should achieve this.

The optimum UDI, referred to as UDI-a, is where daylight is acceptable and electric lighting would not be needed for the majority of the day; achieving a high UDI-a percentage signifies the space is predominantly daylit throughout and glare is controlled. The current target UDI range is 100-3000 lux in each learning space.

DA is the amount of time a space can expect to reach a target illuminance level on the working plane. The target illuminance in teaching spaces is 300 lux.

3.0 The Model

A dynamic 3D model of Harpley School was produced using drawings issued by Rock Townsend Architects on 9th March 2021.

All teaching spaces have been modelled to provide a good representation of the daylighting across the development.

The model was built in IES Virtual Environment 2021.0.2.0 and takes into account a range of issues that could have an impact on the building's performance, including orientation and external conditions.

The first stage of building the model was to produce a 2D template of the building as shown in figure 2.1 below.

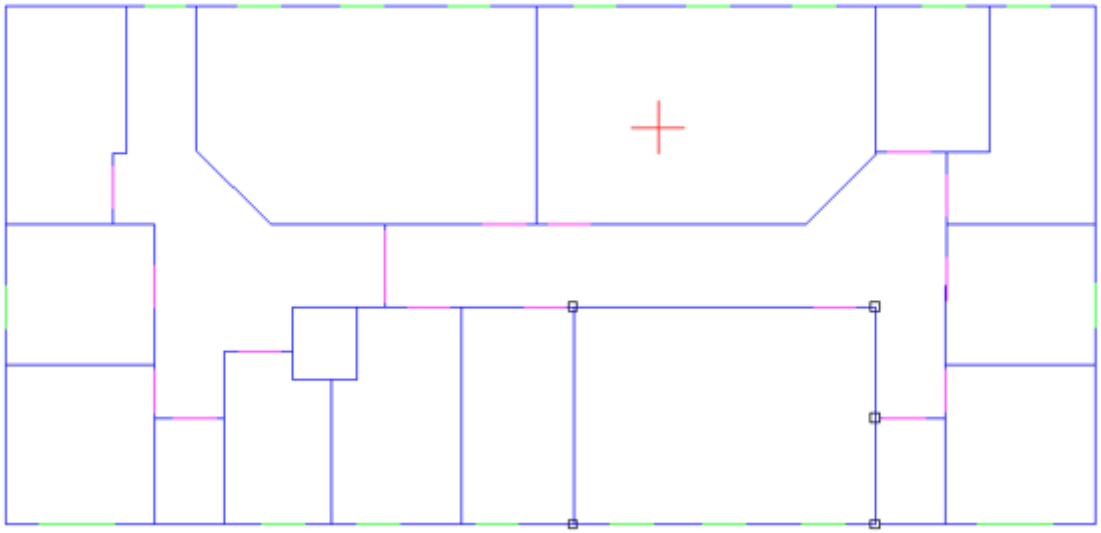


Figure 2.1 IES VE 2D template of ground floor

The next stage was to use the template in IES and elevations issued by Rock Townsend Architects on 9th March 2021 to create the 3D model of each floor culminating in the complete model as shown in figure 2.2 below.

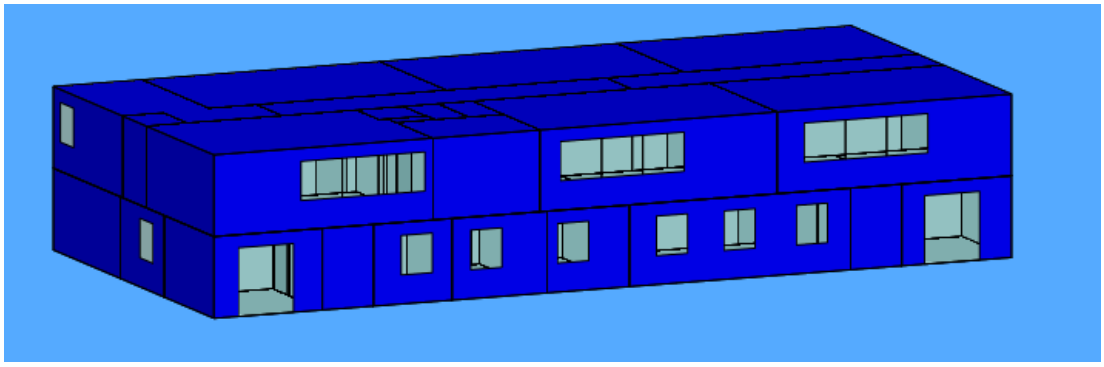


Figure 2.2 IES VE 3D model of Harpley School

4.0 UDI and Daylight Autonomy Simulations

CIBSE released a new set of weather files for London in the middle of 2016. Data from three weather stations have been examined and are available for use in simulation. London Heathrow Airport (LHR) is a representative of intermediate urban and suburban locations. London Gatwick Airport (GTW) and London Weather Centre (LWC) provide representative sites for rural and inner urban locations, respectively. As the proposed development is located in the Bethnal Green area of East London, the LHR weather profile has been applied.

Simulations were run for each teaching space of the building and below are the parameters used in the simulations:

Light Transmittance	0.7
G Value	0.5
Floor Reflectance	0.2
Ceiling	White matte paint with emissivity of 0.85
Weather File	London Heathrow (LHR), for the 2020s, high emissions, 50% percentile scenario
Simulation Time Period	365 days
Occupancy Hours	8am to 4pm including weekends and school holidays
Simulation Grid Size	250mm

The IES VE simulations calculate and display the % UDI-a (100-3000 lux) at each 250mm grid point in the room as shown in the figure 3.1 below.

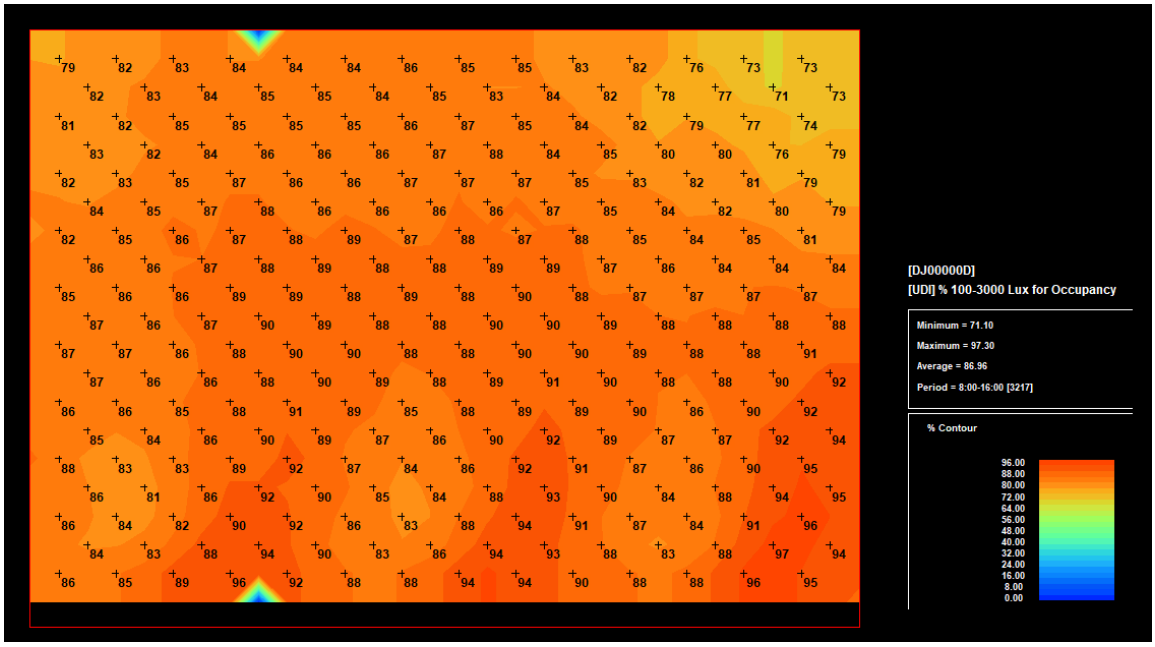


Figure 3.1

Points on the grid which achieve 50% daylight atomony >300 lux for 50% of the time are shown visually in green. The points of the rooms that fail to meet the criteria a shown in red.

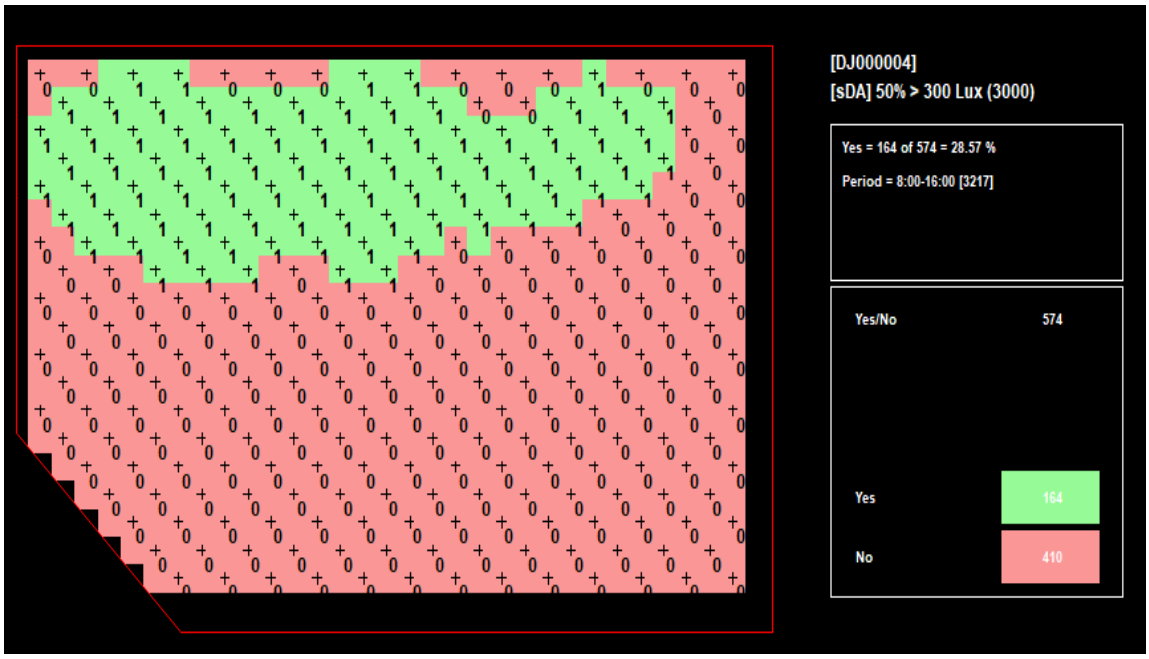


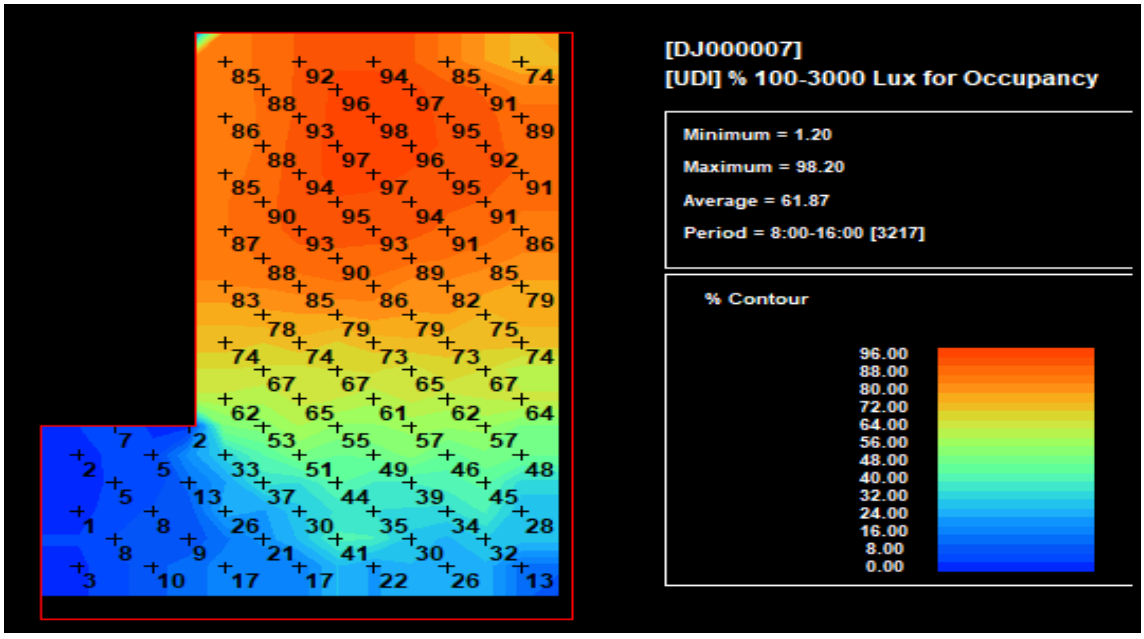
Figure 3.2

5.0 Daylighting Results

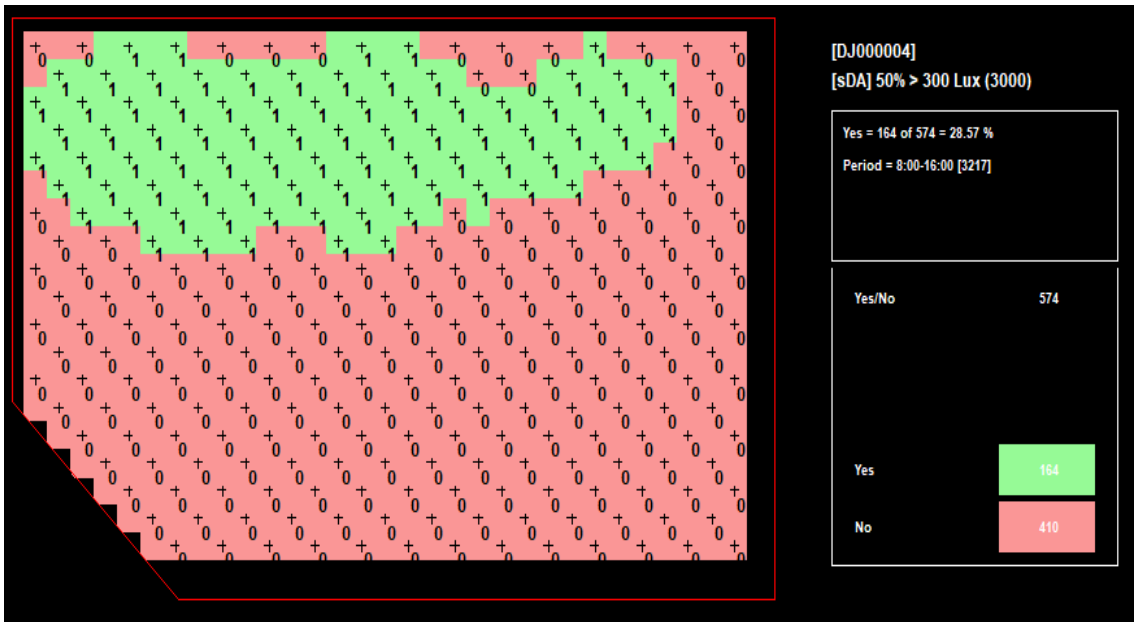
Simulation 1 - Baseline

Simulations were run based on the approved planning design. The results indicated that all classrooms passed the DofE's UDI-a criterion but three of the tuition rooms fell short of the required 80%. All rooms fell short of passing the DA criterion.

		DofE Technical Annex 12E (100-3000 lux)	
	Room	% UDI-a for room (Target 80%)	% DA >300 lux for 50% of the time on the WP (Target 50%)
Ground	Classroom 1	87	43
	Classroom 2	86	28
	Classroom 3	86	29
	Interview Room	84	33
	Tuition Room 1	73	19
	Tuition Room 2	73	21
	Tuition Room 3	62	18
	Tuition Room 4	87	27
First Floor	Classroom 1	84	36
	Classroom 2	83	35
	Classroom 3	86	37
	Classroom 4	85	39
	Classroom 5	83	36
	Student Meeting	85	37



The above image shows the UDI-a for Tuition Room 3.

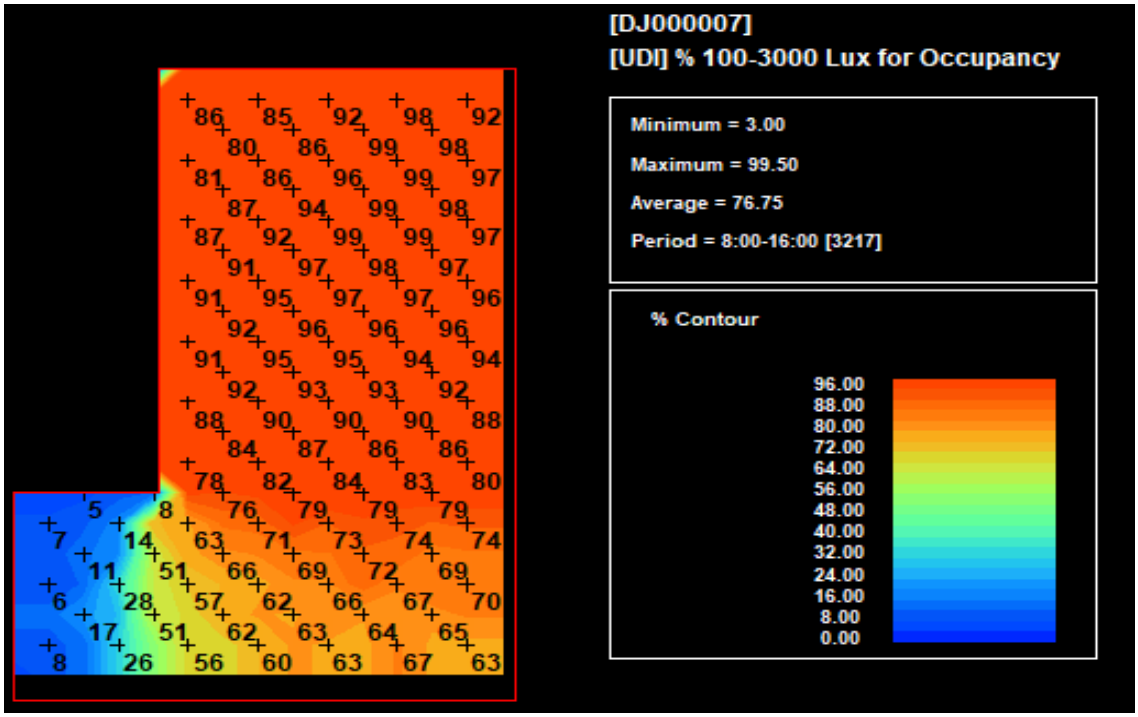


The above image shows the DA for Classroom 3 on the ground floor.

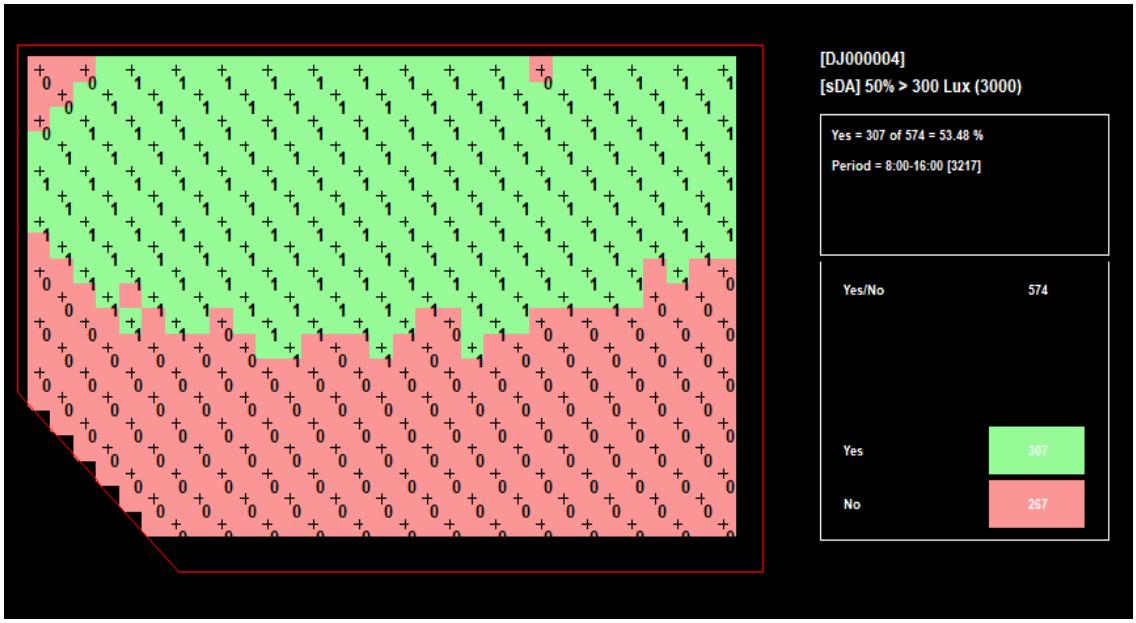
Simulation 2 – Width Adjustment and 1500mm Window Heights

To improve the results, the widths and heights of the windows were increased. This improved the results for the ground floor classrooms which all now passed the daylight autonomy criterion however the three tuition rooms still fell short of the DA requirement. One tuition room falls marginally short of the 80% UDI-a criterion.

		DofE Techincal Annex 12E (100-3000 lux)	
	Room	% UDI-a for room (Target 80%)	% DA >300 lux for 50% of the time on the WP (Target 50%)
Ground	Classroom 1	91	62
	Classroom 2	90	53
	Classroom 3	90	53
	Interview Room	86	53
	Tuition Room 1	80	34
	Tuition Room 2	80	35
	Tuition Room 3	77	36
	Tuition Room 4	91	62
First Floor	Classroom 1	88	41
	Classroom 2	87	41
	Classroom 3	89	43
	Classroom 4	88	45
	Classroom 5	85	42
	Student Meeting	86	47



The above image shows the improvement in UDI-a for Tuition Room 3, from 62% to 77%.

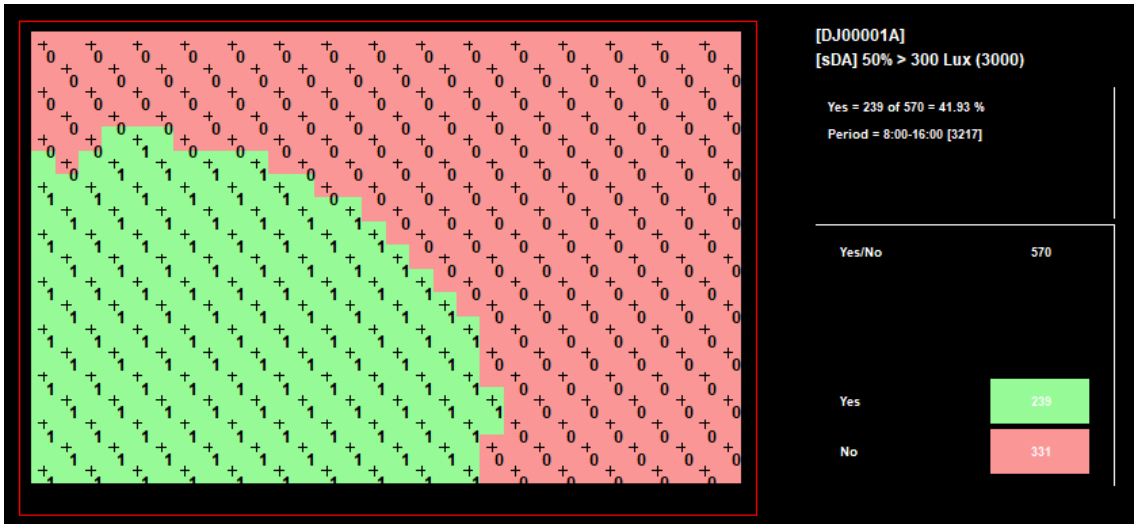


The above image shows the improvement in daylight autonomy for Classroom 3 on the ground floor. The results improved from 29% to 53%.

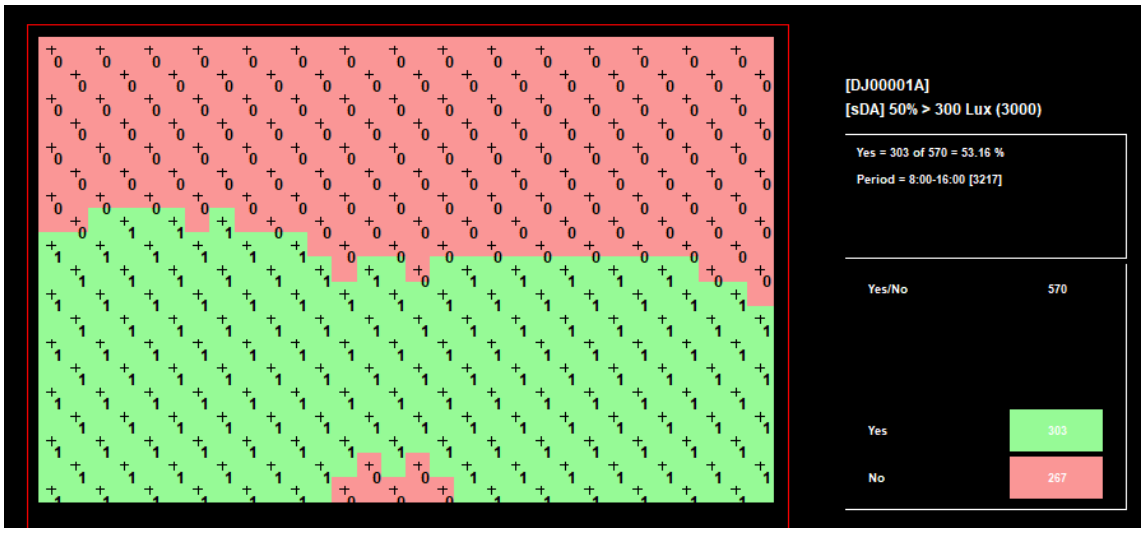
Simulation 3 - Split Windows First Floor

The design team suggested splitting the windows in half and repositioning them to improve illuminance distribution within the first floor classrooms. The below results show that 100% of classrooms, interview room and student meeting rooms now pass both criteria. Only one tuition room still falls marginally short of the UDI-a criterion and 3 ground floor tuition rooms do not meet the daylight autonomy requirement.

		DofE Techincal Annex 12E (100-3000 lux)	
	Room	% UDI-a for room (Target 80%)	% DA >300 lux for 50% of the time on the WP (Target 50%)
Ground	Classroom 1	91	62
	Classroom 2	90	53
	Classroom 3	90	53
	Interview Room	86	53
	Tuition Room 1	80	34
	Tuition Room 2	80	35
	Tuition Room 3	77	36
	Tuition Room 4	91	62
First Floor	Classroom 1	91	51
	Classroom 2	91	50
	Classroom 3	92	54
	Classroom 4	88	54
	Classroom 5	88	53
	Student Meeting	88	56



The above image represents the results from Simulation 2 for daylight autonomy in Classroom 5 on the first floor.



The above image represents the results from Simulation 3, with the split windows. The daylight autonomy has improved from 42% to 53% for Classroom 5.

6.0 Conclusion

The teaching spaces within Harpley School have been assessed in accordance with criteria set out in the Department for Educations Generic Design Brief: Technical Annex 2E.

Each teaching spaces should achieve:

- 80% UDI-a (100-3000 lux)
- Minimum target Daylight Autonomy (DA) of 50% of the time for 50% of the working plane.

Results show that with the new window arrangement on the first floor, and with increased height and width to all windows, all classrooms, interview room and student meeting room meet both daylighting criteria set by the DofE. Only 3 Tuition Rooms on the ground floor fall short of the daylight autonomy criterion, and one tuition rooms falls marginally short of the UDI-a criterion.

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