Scottish Opera New Rotterdam Wharf

Daylight and Sunlight Report

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MAX FORDHA

MAX FORDHAM

Max Fordham LLP
42/43 Gloucester Crescent
London
NW1 7PE

T 020 7267 5161

maxfordham.com

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P01	22/01/2024	Initial Draft
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1.0 OVERVIEW AND SUMMARY

1.1 Introduction

Daylight and Sunlight analysis of a building can be split into two categories: performance of the proposed design and impact on the surroundings. Daylight analysis refers to a calculation of the general illuminance of a space, whereas sunlight access is an analysis of the hours of direct sunlight on a window or amenity space.

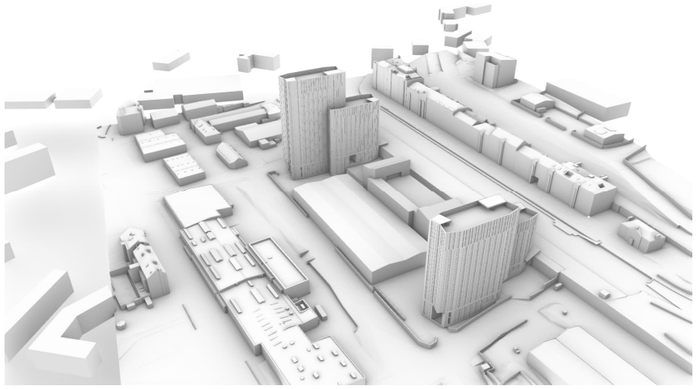
The Scottish Government has recently released National Planning Framework 4 (NPF4) as its national spatial strategy for Scotland. It sets out the principles for future developments as part of its national planning policy. NPF4 does not directly address daylight and sunlight. Daylight and Sunlight however can be linked to many Sustainable Development Goals referenced in the document such as SDG3 and SDG11.

The guidance for assessing both the performance of the proposed development and the impact of the new development in this report is from BRE Guide 209: Site Layout Planning for Daylight and Sunlight. This is in reference to *Glasgow City Council – Part 3: Development Policies and Design Guidance*, which recommends using the tests given in the guide for assessing the impact of a new development. The advice given in the guide is advisory only and can be interpreted based on the context of the project. However, daylight in a building is crucial for occupant wellbeing, as well as helping reduce energy usage through lighting. Depending on location and time of year, occupants will have a certain expectation of daylighting. Furthermore, a proposed development that will have a significantly adverse effect on its neighbours will encounter opposition during the planning process.

The tests conducted and shown in this report show that the design does not significantly decrease access to daylight or sunlight to its neighbours and allows a healthy amount of daylight to its inhabitants.

1.2 Summary

The figures below show an overview of the proposed development and surroundings. The first is a render produced by the architects Page and Park (P\P) and the second is a render of a model used by Max Fordham for daylighting analysis.



1.2.1 Performance of Proposed Development

The interior daylighting for studio flats was examined and compared against BS EN 17037:2018+A1:2021 - Daylight in Buildings. Simulations were carried out via Radiance, which is a validated daylighting tool. Rhino and Grasshopper were utilised to facilitate simulations. Focusing on worst-case scenarios, rooms in potentially unsuitable locations were studied. The results were highly positive in terms of interior daylighting. The daylighting study was conducted on a model received from the architects and fed into the final design. The architect has placed great care in locating studios of different sizes. Larger studios with kitchens, which benefit from higher light levels, are placed on southern façades. This coupled with the placing of smaller studios on northern facades allow them to reach the recommended daylight illuminances. Based on our analysis we expect the majority of studios to reach and surpass the illuminance recommendations found in BS EN 17037:2018+A1:2021. No room studied received a level of daylight that suggested that further overheating analysis may be required.

1.2.2 Impact on Surroundings

The external impact on the surroundings of the proposed development was assessed using guidance in BRE Guide 209: Site Layout Planning for Daylight and Sunlight. Simulations were carried out using Radiance. Impacted windows and areas were identified and the applicable tests were carried out. Overall, the impact of the new development was minorly adverse. The results of the studies are summarised below.

Speirs Wharf
The impact of the new development on Speirs Wharf has been classed as negligible. All windows in Speirs Wharf passed the VSC and APSH tests specified by BRE 209. This means that neither the daylight nor the sunlight access to Speirs Wharf will be greatly affected. This is likely due to the orientation of the towers; their perpendicular direction to Speirs Wharf ensures that the total impact on any of the windows is minimal. The lowered sections to the East also help with retaining light to Speirs Wharf; this minimises the obstruction angle of the development given its height and thus ensures more of the sky and sun is visible from the windows of Speirs Wharf.

Houseboats and Moorings
Overall, there was a negligible adverse impact on the daylighting and sunlight access to the moorings at Speirs Wharf. All tested houseboat window locations passed these the VSC and APSH tests as specified in BRE 209. The mooring area itself still receives an adequate amount of sunlight.

Non-residential
Overall, it was judged that the impact of the new development on the surrounding non-residential buildings was minorly adverse.

Royal Conservatoire of Scotland – Wallace Studios

No windows in this building were adversely affected by the new development.

230-260 Garscube Road

One window here failed both the tests applied here, however this window is unlikely to have a high expectation of daylight due to the nature of the building.

12 Burns St

One window failed on this building; however, we believe that the expectation for daylight from this window is low due to the storage nature of the building and the lack of other windows.

22 Farnell St

All analysed windows on this building passed.

Civic House

There were no windows that faced the proposed development on this building.

Amenity Spaces and Canal
All the tested amenity spaces still receive enough hours of sunlight to appear adequately sunlit with the proposed development in place. The canal also still receives an adequate amount of sunlight.

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2.0 PERFORMANCE OF PROPOSED DEVELOPMENT

2.1 Internal Daylight

2.1.1 Summary of Internal Daylighting

The internal daylighting of the PBSA studios is likely to be very good. Sample floors and rooms were analysed using validated daylighting tools and tested against the relevant standards. Based on our findings we summarise expect the majority of studios to meet and surpass the target illuminance as per BS EN 17037:2018+A1:2021.

2.1.2 Standards and Definitions

BRE Guide 209 - Site Layout Planning for Daylight and Sunlight offers two methods for assessing interior daylight in new buildings: Daylight Factor (DF) or Daylight Autonomy (DA)/Target Illuminance. The latter method falls under the category of climate-based daylight modelling, which accounts for orientation and direct sunlight. This assessment uses the Target Illuminance method.

Daylight Autonomy is the percentage of the occupied time when the target illuminance is met at a point in space. For this internal analysis we have considered all the daylight hours in the year.

The guide references BS EN 17037:2018+A1:2021, which has targets for minimum amounts of daylight for rooms, as well as a British National Annex that gives targets for “hard to light dwellings.” The table below shows median illuminance levels from the national annex of BS EN 17037:2018. The target is for these levels to be achieved over half of the working plane for half of the daylight hours in a year. In practical terms, this means that for an analysis point to pass it should be above this illuminance target for at least 50% of the daylight hours. If over 50% of the test points in the test plane of a room achieve this, then the room passes the test. We have chosen to follow the targets set out in the national annex as dwellings on the north face on the towers are likely to be considered hard to light.

Room Type	Illuminance (lux)
Kitchens	200
Living Rooms	150
Bedrooms	100

Kitchen-Diners or Kitchen-Living-Diners are required to achieve the level of the kitchen as this room has the higher/highest requirement of the combined room types. Studios without kitchens require only to pass the 100lx illuminance level.

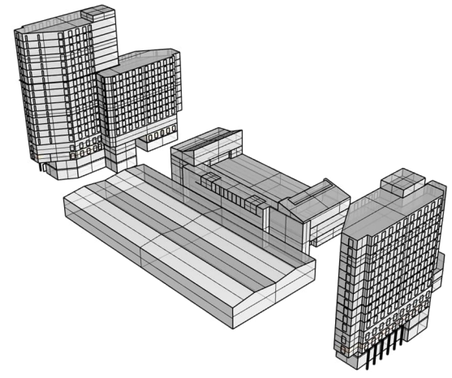
BS EN 17037:2018 National Annex suggests that where a dwelling exceeds 500lx on 50% of the grid points for more than half of the daylight hours, that it is checked for overheating risk.

2.1.3 Areas Examined

It was important to look at worst-case scenarios for both types of studios. As the floor plans are similar from L04 and higher it was deemed not necessary to conduct simulations on each individual room.

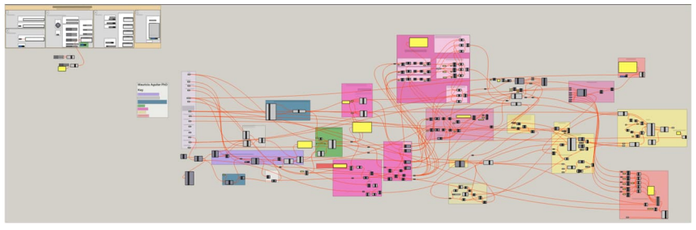
All studios on L02 for both towers were decided to be most at risk from orientation issues and blockage from nearby buildings. The north facing studios on L04 south tower were looked at as worst-case scenarios for the smaller studios without kitchens.

2.1.4 Simulation



The geometry was provided by the architect dated 30/10/2023. The indoor daylight analysis was carried out via a purpose-built script in Grasshopper within Rhino. This script uses Radiance which is a validated daylighting tool. A weather file for Glasgow was used, the same weather file was used for all relevant tests on New Rotterdam Wharf.

The results for interior daylighting fed into the final design but are not an analysis of the final design.

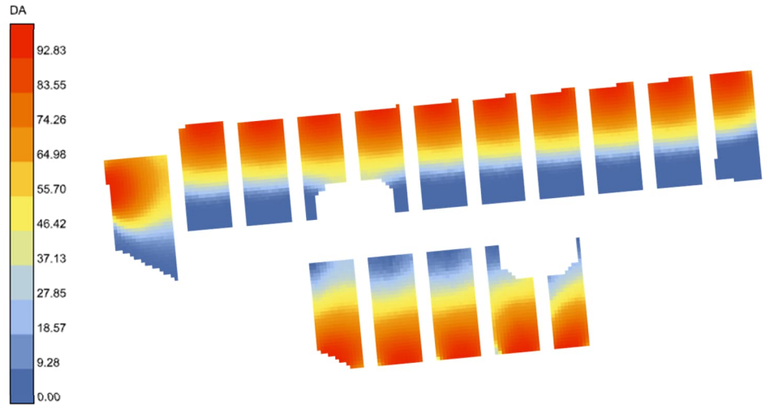


The optical properties chosen for the simulation can be found in the table below.

Optical Property	Value
Interior Ceiling Reflectance	0.7
Interior Ceiling Specularity	0.1
Interior Wall Reflectance	0.5
Interior Wall Specularity	0.1
Interior Floor Reflectance	0.2
Interior Floor Specularity	0.1
Exterior Window Transmittance	0.7
Exterior Window Refraction	1.52

2.1.5 Results

Studios with kitchens on southern facades pass the 200lx requirement for kitchens. On northern facades, if the studio is modelled with a bathroom, then it will pass the 200lx requirement. Below is an image showing daylight autonomy for studios inside the north tower L02. A representative bathroom is modelled in two passing studios on each façade. This shows that when bathrooms are included in the simulations at least half of the space reaches at least 50% Daylight Autonomy on the northern façade. Reaching 50% DA in at least half of a studio signifies a passing result. No north facing studios face any obstructions that would cause them to fail.



The smaller studios which lack kitchens pass the lower 100lx requirement in all areas tested and likely pass on every floor in both PBSA towers. The smaller depth of these studios means that they average a higher lux level than the studios with kitchens. This coupled with the lower illuminance requirement allows placement in less optimal locations within PBSA without compromising the expected daylight illuminance for a room of its type.

The north façade on the southern tower appears to be slightly impacted by the new developments on the rehearsal building. However, the architect has

avoided placing studios on the lower floors on the eastern side of the southern tower. This minimises impact on any potential impact to the studios. On a similar note, the southern PBSA tower does not present an issue to the internal daylighting of the studios within the northern PBSA tower.

No studios analysed exceeded 500lx on 50% of the grid points for more than half of the daylight hours. Therefore, the interior daylighting analysis conducted does not indicate any rooms at particular risk of overheating.

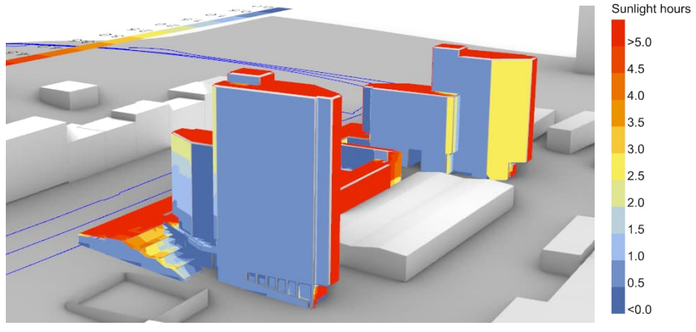
2.2 Sunlight on Windows

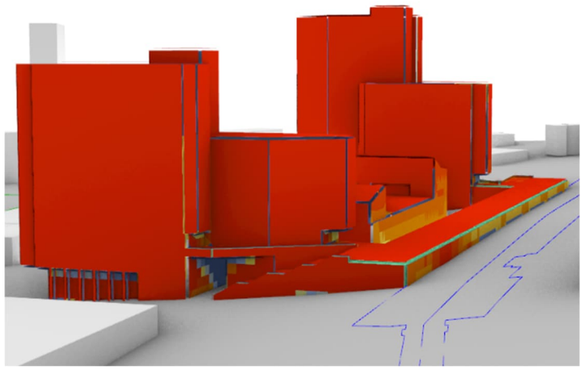
The BRE guide suggests that for a building that has a particular requirement for sunlight to appear reasonably sunlit, it should fulfil the following criteria. Firstly, it should have at least one window wall within 90° of due south. Secondly, it should have a habitable room served by at least one window that can receive a total of at least 1.5 hours of sunlight on the 21st of March. This is assessed at the centre of the window(s); sunlight received by different windows can be added provided they occur at different times and sunlight hours are not double counted.

In multi-residential buildings, it is not always possible to ensure every dwelling has a window that meets these criteria. In this case it is best practice to minimise the number of dwellings that fail this test.

2.2.1 Sunlight on Windows – Results

As the figures below demonstrate, there are large portions of the north faces of both the towers that fail to receive more than 1.5 hours of sunlight on the 21st of March. This means that any dwellings that only have rooms on these facades will not pass this test. Based on current layouts we estimate this to be 20 % of dwellings.





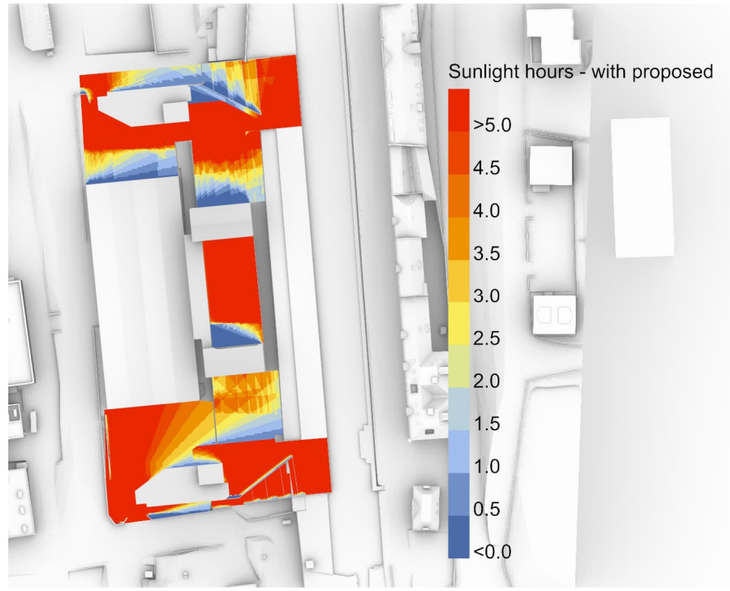
Therefore, studio dwellings are better served on the south façade. Accommodation can be put on the north façade providing that each room has access to an amenity space that has a window that faces within 90° of due south and is not overly shaded by the rest of the tower. This has been incorporated into the current design; most of the studios are on the south façade. The apartment style accommodation has been placed on the north façade but with kitchens that have East or West facing windows. This should ensure adequate access to sunlight.

2.3 Amenity spaces

It is recommended that at least half an amenity space should receive at least two hours of direct sunlight on March 21st. Amenity spaces were determined from plans issued by P\P as well as areas that are likely to be used by occupants and visitors.

2.3.1 Amenity Spaces – Results

The figure below shows the hours of sunlight received at test points around the site on the 21st of March with the proposed development in place. These points are grouped into twenty-seven amenity areas.



Of the twenty-seven areas tested, 25 had more than 2 hours of sunlight on the 21st of March and hence passed the test. The two that failed were located to the north of the northern tower on the steps. This means that this area may not be suitable to designate as an amenity space for sitting. See appendix A for a summary of the results.

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3.0 IMPACT ON SURROUNDINGS – METHODOLOGY AND CRITERIA

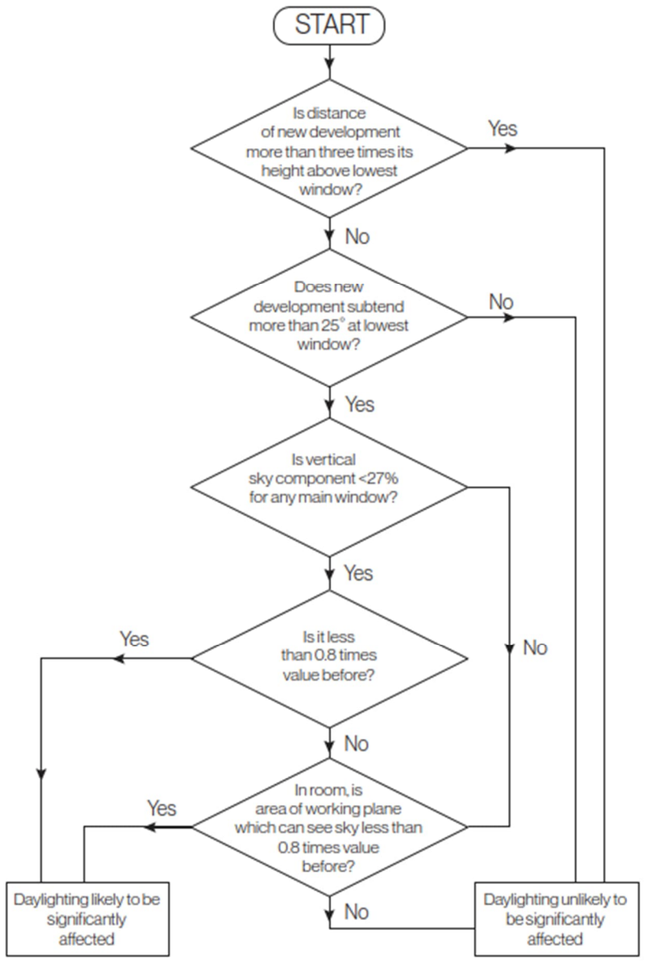
There are several elements to this assessment, which in general can be broken down into two categories: daylight impact and sunlight impact. Further information about these is provided in the following sections.

3.1 Daylight Impact Analysis

In designing a new development, it is important to safeguard the daylight to nearby buildings. The BRE guide provides a decision process for this analysis which is summarised in the flowchart below.

The guide identifies which surrounding windows and areas should be analysed. Unless stated otherwise, these are locations that are within three times the distance of the difference between the height of the proposed development and the centre of the window or area in question (as measured from the edge of the new development closest to the window or area).

Furthermore, the guidance only applies to windows where there is an expectation of daylight or sunlight. In residential buildings this includes windows of kitchens, living rooms and bedrooms. For non-residential buildings, the guidance would also apply for buildings where the occupants have a reasonable expectation of daylight. This includes schools, hospitals, hotels and hostels, small workshops, and some offices.



3.1.1 Obstruction Angle

If the existing window is within the distance limit, then, as an initial test, the obstruction angle can be calculated. This is the angle to the horizontal subtended by the new development at the level of the centre of the lowest window, as measured in a plane perpendicular to the existing window. If any part of the new development exceeds an angle of 25° along the entire window wall, then there is a potential risk of loss of skylight. In this case further analysis is required to accurately assess the loss of skylight.

3.1.2 Vertical Sky Component (VSC)

If the obstruction angle is greater than the recommended 25°, then to further assess the loss of skylight, the BRE Guide recommends using the Vertical Sky Component (VSC) as a metric, comparing existing values for nearby windows with proposed values with the proposed building in place.

The VSC indicates the degree of daylight availability on a vertical surface and is expressed as a percentage, with 40% being the maximum for a vertical surface. It represents the extent to which light from an overcast sky can reach a window as a proportion of the whole sky hemisphere. In suburban areas, the recommended minimum is 27%, any change below this should be limited to 0.8 of the existing value.

As the site around New Rotterdam Wharf is quite open and sparsely populated, it should be possible to maintain the daylight access to the surrounding windows such that the 27% target is achieved for residential and most commercial buildings.

3.1.3 No-Sky Line (NSL)

The second measure recommended by the guide in order to assess the daylight impact is the No-Sky Line test. This metric measures the daylight distribution in the rooms of surrounding buildings. The NSL divides the area of the working plane that has a direct view of the sky to that that does not. The working plane is defined as a plane parallel to the floor with a vertical offset of 850 mm.

The guide states that the NSL should only be calculated where accurate room layouts and window locations are known, otherwise significant inaccuracies are likely to arise. To pass the test, the area of the room that has a direct view of the sky should not be reduced to less than 0.8 times its original value with the proposed development in place.

3.1.4 Daylight Impact Analysis – Proposed Developments

It is also important to consider the impact of a new building on proposed development sites. The BRE guide states that in general, *"a development site next to a proposed new building will retain the potential for good diffuse daylighting provided that on each common boundary:*

a. no new building, measured in a vertical section perpendicular to the boundary, from a point 1.6 m above ground level, subtends an angle of more than 43° to the horizontal.

b. or, if (a) is not satisfied, then all points 1.6 metres above the boundary line are within 4 m (measured along the boundary) of a point which has a VSC (looking towards the new building(s)) of 17% or more."

However, the guide is clear that there are exceptions to this guidance. A key exception occurs when the proposed new building is significantly larger than the likely future development. In this case, a better approach is to make a rough prediction of where the nearest window wall of the future development will be and then carry out the analysis as if the window were in a new building.

3.2 Sunlight Impact Analysis

3.2.1 Annual and Winter Probable Sunlight Hours (APSH and WPSH)

APSH and WPSH (Annual and Winter Probable Sunlight Hours) measure the percentage of sunlight hours a window is likely to receive for a year or for the winter months between 21st September and 21st March. The recommendation for a room to appear adequately sunlit is for it to receive 25% of annual probable sunlight hours, including at least 5% of winter probable sunlight hours. It is recommended that reduction in sunlight access below these levels be kept to a minimum; if the available sunlight hours are both less than the percentages stated above and less than 0.80 times their former value in either period, and the overall annual loss is greater than 4% of APSH, then the reduction in sunlight may be noticeable.

The guide suggests that the recommendation be applied to main living rooms of dwellings with a window facing within 90° of due south. Kitchens and bedrooms are considered less important and need not be analysed, although it is recommended not to block too much sun. In this study, room uses are mostly unknown, so all rooms tested for daylight and facing within 90° of due south have been analysed.

3.2.2 Sunlight to Surrounding Amenity Areas

It is recommended that at least half an amenity space should receive at least two hours of direct sunlight on March 21st, and any change to this area that may be caused by a new development not result in this area being less than 0.8 times its existing value.

3.3 BRE Impact Assessment Classification

In Appendix H, the BRE Guide states the following:

"The assessment of impact will depend on a combination of factors, and there is no simple rule of thumb that can be applied.

Where the loss of skylight or sunlight fully meets the guidelines in this document, the impact is assessed as [either] negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or a limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate. Where the loss of light is only just within the guidelines, and a larger number of windows or open space area are affected, a minor adverse impact would be more appropriate, especially if there is a particularly strong requirements for daylight and sunlight in the affected building or open space.

Where the loss of skylight or sunlight does not meet the guidelines in this document, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:

- *Only a small number of windows or limited area of open space are affected.*
- *The loss of light is only marginally outside the guidelines.*
- *An affected room has other sources of skylight or sunlight.*
- *The affected building or open space only has a low-level requirement for skylight or sunlight.*
- *There are particular reasons why an alternative, less stringent guideline should be applied, for example an overhang above the window or a window standing unusually close to the boundary.*

Factors tending towards a major adverse impact include:

- *A large number of windows or large area of open space are affected.*
- *The loss of light is substantially outside the guidelines.*
- *All the windows in a particular property are affected.*
- *The affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight, e.g. a living room in a dwelling or a children's playground."*

Beneficial impacts from the development are classified as follows:

"Beneficial impacts occur when there is a significant increase in the amount of skylight and sunlight reaching an existing building where it is required, or in the amount of sunlight reaching an open space. Beneficial impacts should be worked out using the same principles as adverse impacts. Thus a tiny increase in light would be classified as a negligible impact, not a minor beneficial impact.

An adverse impact on one property cannot be balanced against negligible or beneficial impacts on other properties. In these situations it is more appropriate to quote a range of impacts.

The provision of new dwellings, or commercial or industrial buildings, or private gardens that meet the skylight or sunlight guidance in this document should not be classified as a beneficial daylight or sunlight impact on the local environment. However, the provision of community buildings or public open spaces with good skylight and/or sunlight could be classed as a beneficial impact."

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4.0 REFERENCED DOCUMENTS

The Sustainable Urban Housing: Design Standards for New Apartments – Guidelines for Planning Authorities (December 2020):

"Planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd Edition) or BS 8206-2:2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken by development proposers which offer the capability to satisfy minimum standards of daylight provision."

"where an applicant cannot fully meet all of the requirements of the daylight provisions above, this must be clearly identified and a rationale for any alternative, compensatory design solutions must be set out, which planning authorities should apply their discretion in accepting taking account of its assessment of specific. This may arise due to a design constraint associated with the site or location and the balancing of that assessment against the desirability of achieving wider planning objectives.

Such objectives might include securing comprehensive urban regeneration and or an effective urban design and streetscape solution."

Glasgow City Council – Part 3: Development Policies and Design Guidance
"In order to ensure that a proposal does not reduce daylighting excessively on an adjacent site, a daylighting assessment, where appropriate, will be carried out in accordance with the British Research Establishment publication – 'Site Layout Planning for Daylight and Sunlight, a guide to good practice' – P.J. Littlefair".

The Urban Development and Building Heights – Guidelines for Planning Authorities (March 2018)

"At the scale of the site/building:

• The form, massing and height of proposed developments should be carefully modulated so as to maximise access to natural daylight, ventilation and views and minimise overshadowing and loss of light.

• Appropriate and reasonable regard should be taken of quantitative performance approaches to daylight provision outlined in guides like the Building Research Establishment's 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'.

BR 209 (2022) – Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice (Third Edition)

This document is widely used as a methodology for daylight and sunlight assessments, both for the impact of a new development on its surroundings and for assessment of natural light within proposed buildings. The third edition incorporates BS EN 17037.

BS EN 17037:2018 – Daylight in Buildings

A new, European-wide standard for daylight in buildings was introduced in 2018. The UK National Annex A of BS EN 17037 also gives minimum values for housing, in living rooms, kitchens, and bedrooms. These are minimum recommended values for locations where a predominantly daylit appearance is not achievable; *"for example in basement rooms or with significant external obstructions (perhaps in a dense urban area...)"*

The national annex contains minimum daylight targets for kitchens, living rooms and bedrooms.

Greater London Authority, representation hearing report D&P/3067/03 – Appendix 1, 18/11/2013.

Comments by Greater London Authority (GLA) in the context of a planning appeal have been used as guidance on urban sites in the UK:

"It should, nevertheless, be noted that the 27% VSC target value is derived from a low-density suburban housing model. The independent daylight and sunlight review states that in an inner-city urban environment, VSC values more than 20% should be considered as reasonably good and that VSC in the mid-teens should be acceptable. However, where the VSC value falls below 10% (to be in single figures), the availability of direct light from the sky will be poor."

4.1 Impact on Canal and Canal Boats

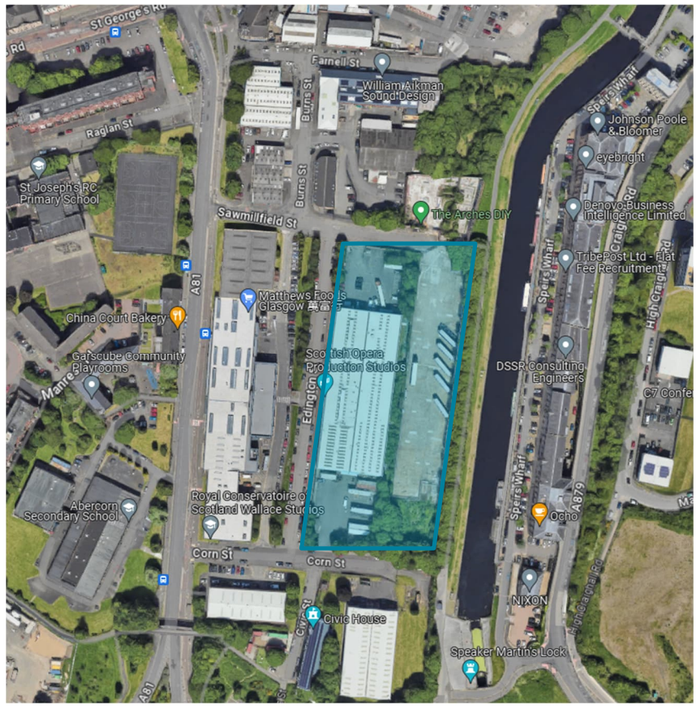
Although these are not in Scotland, they are evidence that this impact is something that will likely be raised in planning.

City of Westminster, Planning Applications Sub Committee Report 19/09638/FULL 12/05/2020
This document refers to the daylight and sunlight available to canal boats, taking them into consideration when making a judgement about the impact of the building.

5.0 MODELLING

5.1 Site and Surroundings Overview

As the site and its surroundings is open, with mostly low-rise developments, it is likely that the daylight impacts of the proposed buildings will be minor. This is because although the proposed buildings will block some of the sky and sunlight, there is likely to be enough of the sky dome still visible to ensure good access to light. The greatest impact is most likely to occur in areas close to the north of the proposed development. The tests carried out as part of this report ascertain the extent of the impact.



5.1.1 Amenity Space

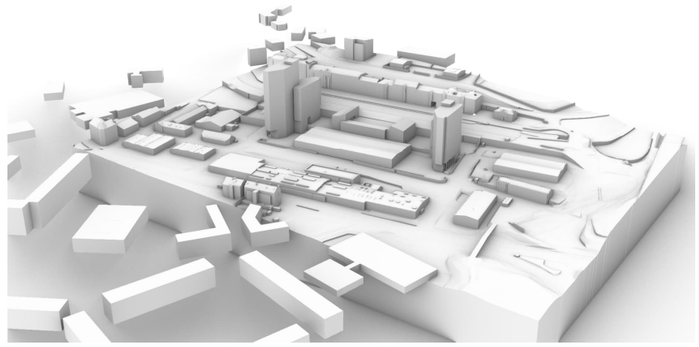
Areas were identified that counted as amenity space, including those already existing and that proposed by P\P in drawings NRW-PPA-0-DR-A-100(1, 3, 7).

5.1.2 Canal

In line with planning decisions in London – see the referenced documents, daylight impact on the canal, moorings and any canal boats moored there was also considered. This is because these areas will have an expectation of both daylight and sunlight, both for natural reasons (effect on animal and plant populations) and human habitation.

5.2 Geometry

The geometry for the proposed development was derived from the Revit model of the project issued by Page and Park on 17/10/2023. The geometry for the surrounding area was taken from two sources: A VU.City model provided by Page and Park and outlines for further buildings from CadMapper. We simplified the surrounding geometry such that only key features were remaining. Trees and bushes were omitted as per the guidance given in BRE 209. In line with the guide, all surrounding buildings that sit within three times the height of the proposed development have been included in the assessment. We also extended the scope of the assessment slightly further away to test for any potential overshadowing during winter.



Reasonable approximations of neighbouring window locations and geometries have been used, derived from either the VU.City model or online data.

5.2.1 Speirs Wharf – Window Generation

For Speirs Wharf, where there were a large number of windows to analyse, an initial study was carried out. This was because there was a lack of information about window sizes and locations. A uniform grid of windows was created on the façade and results were determined for these windows. If there were any areas that were significantly impacted (failing or a marginal pass) then these would be analysed further.

5.2.2 Canal Boat Windows

As there are many potential mooring locations, window locations were generated that ran along the length of the mooring at 1 m above the height of the canal and 2m from the edge of the jetty. The windows were spaced at 1 m intervals. These window locations were tested as if they were windows in an existing building.

5.3 Procedure

To determine which windows needed to be included in the assessment, several aspects were considered. Firstly, focus was applied to all the windows in Speirs Wharf that faced the proposed development as these buildings are the closest residential buildings. The obstruction angle was then calculated for the walls of the surrounding buildings and areas where it was greater than 25° were identified. Windows incident on these walls were further analysed by applying the VSC and APSH tests where applicable. Buildings that were likely to be overshadowed due to their location were also included.

5.3.1 Software Used

To carry out the modelling, several pieces of software were used. Geometry was imported into, simplified, and created in Rhino. Grasshopper scripts using the Ladybug and Honeybee plugins were created for the analysis. In general, these plugins use Radiance as a backend to carry out the calculations. Radiance is a validated daylighting tool.

Images were either captured from Rhino or Google Maps where appropriate to visualise the site.

5.3.2 Model Parameters

The weather file used for this analysis was GBR_SCT_Glasgow.Wea.Center.031450_TMYx. As all the calculations done were direct point of view calculations no further radiance parameters needed to be established and were therefore left as default.

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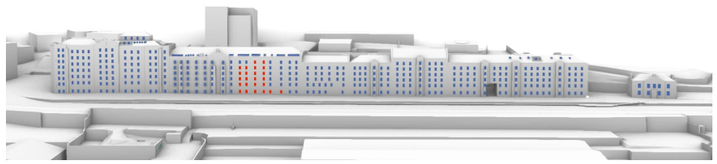
6.0 IMPACT ON SURROUNDINGS - RESULTS

6.1 Speirs Wharf

In the initial study, a total of 436 window locations at Speirs Wharf were tested. These corresponded to all the windows where the proposed development was in view of the window. Twenty-four of the windows had an obstruction angle greater than 25° All the windows locations comfortably passed both the VSC and APSH tests. No internal plans for dwellings in the affected buildings in Speirs Wharf (34 and 36 Speirs Wharf) were available on the Glasgow Council planning portal and therefore the no-sky line could not be calculated for the rooms served by the potentially obstructed windows. Although due to the high obstruction angle it was not necessary to carry out the VSC and APSH for all the dwellings, due to concerns raised by residents it was deemed a sensible precautionary measure.

Speirs Wharf – Obstruction Angle
The obstruction angle was calculated for the centre points of all the windows. Twenty-four of the windows had an obstruction angle greater than 25°. These windows are shown in the figure below (highlighted in red). They are located directly facing the north tower (the new development has been hidden for clarity). All the potentially affected windows are part of either 34 or 36 Speirs Wharf. It was unclear as to exactly which apartments these windows belonged to. For reassurance, all windows locations on Speirs Wharf were further analysed.

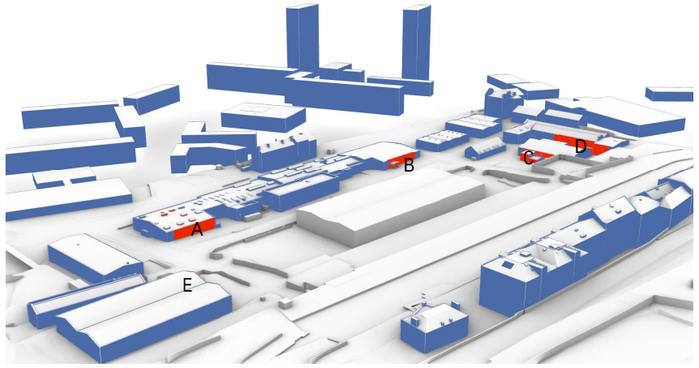


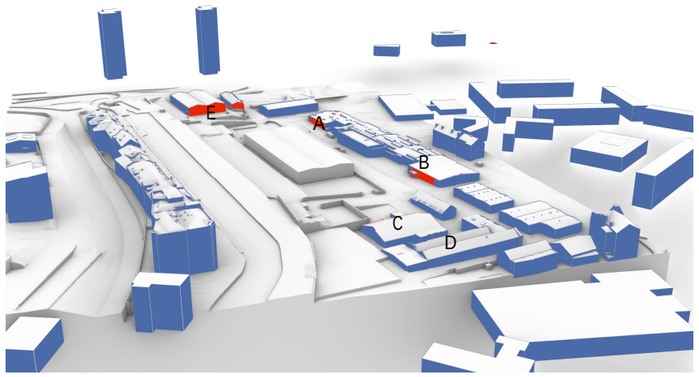
Speirs Wharf - VSC Results
All the window locations comfortably passed, with no windows dropping below the 27% threshold. A full list of the results and window identifiers can be found in appendix D. This means that the portion of the sky dome seen from each window is not overly obstructed, and hence the daylighting in the room is very unlikely to be significantly affected. We would classify this as a negligible impact.

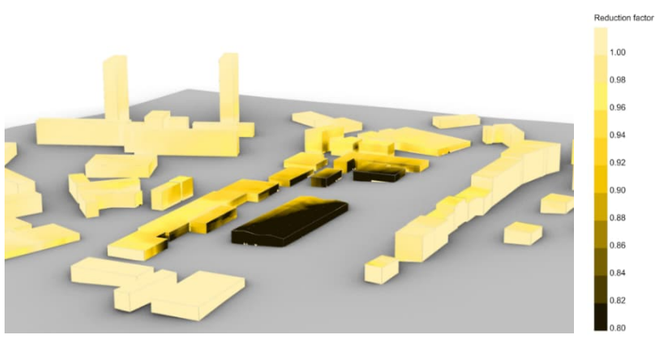
Speirs Wharf - APSH and WPSH Results
All the window locations passed the test with a comfortable margin. This means that the number of hours of sunlight incident on the window is suitably high such that the sunlight access in the room will not be adversely affected. As before, a full list of the results can be found in appendix D. Again, we would classify this as a negligible impact.

6.2 Non-Residential Buildings

To assess which areas needed further analysis, the obstruction angle was assessed for the surrounding building facades. This analysis identified several buildings that needed further investigation. The figures below show these areas highlighted in red. Again, for clarity the new development has been hidden. A preliminary sunlight study was also carried out to ascertain areas where there may be potential impact from overshadowing. The preliminary study used slightly simplified geometry for speed of calculation. These are summarised in the following sections, which have been labelled to correspond to the figures.

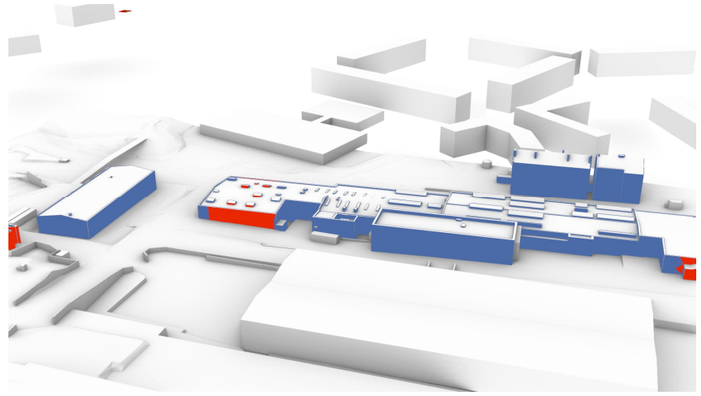






6.2.1 A) Royal Conservatoire of Scotland – Wallace Studios

This building is a rehearsal, design, and storage space for the Royal Conservatoire of Scotland. As such it is likely that there will be an expectation of daylight and sunlight to some of the rooms. As can be seen in the figures below, there is an east facing wall which has an obstruction angle of greater than 25°. This is marked in red.



A total of nineteen windows were analysed. The VSC test was carried out on the windows on this wall. All windows passed this test – see appendix E for detailed results. The APSH test was also carried out – all windows also passed this test. This suggests that the impact to the daylighting and sunlight access should be minor.

6.2.2 B) 230-260 Garscube Road (Matthew's Foods Glasgow)

There were two windows on this building that were on a window wall which had an obstruction angle of greater than 25°. These are shown in the figure below and are labelled windows 0 and 1. It is unknown as to what type(s) of room these windows serve. One likely option is that they are offices.

Window 0 passes both the VSC and APSH tests, but window 1 fails both. See appendix F for more details. Window 1 is a highly shaded window already (effectively equivalent to having a balcony) and hence it is expected that the daylighting and sunlight access will already be poor. We would class this as a minor to moderate impact, as even though half of the windows are affected the expectation for daylight to this window is likely to be low.

6.2.3 C) 12 Burns St (Harvest Foods)

There is one window directly facing the proposed development, which is shown in the figure below. As the building is a supermarket/storage facility with very few windows it is likely that the expectation for daylight and sunlight is low.

This window fails the VSC test. However, it passes the APSH test, although it is predicted that the expectation for sunlight to this window will be low. See appendix G for detailed results.

6.2.4 D) 22 Farnell St

There are five windows on the wall which has an obstruction angle greater than 25°.

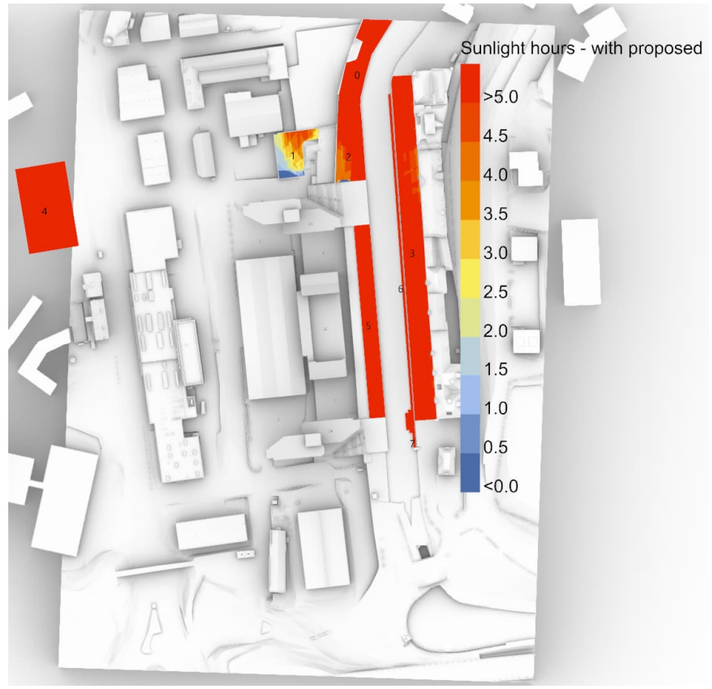
All five windows passed both the VSC and APSH tests, see appendix H.

6.2.5 E) Civic House and neighbouring warehouse

There are no windows on the walls that faces the new development, and hence no further analysis was needed for this area.

6.3 Sunlight on Existing Amenity Space

The figure below shows a top view of the surroundings and the hours of sunlight received by each test point on the 21st of March in selected amenity areas.



All existing amenity areas tested had over 50% of the area receiving more than 2 hours of sunlight on 21st of March and hence passed the test. See Appendix B for a breakdown of the results.

6.4 Impact on the Canal and Moorings

6.4.1 Canal Boat Windows

Twenty-two of the tested window locations have an obstruction angle greater than 25°. However, all the tested canal boat window locations passed the VSC and APSH tests. This means that it is unlikely that the daylighting will be adversely impacted. See Appendix J for a breakdown of the results.

6.4.2 Sunlight on Canal

The number of sunlight hours that the canal itself would receive was also tested. 91% of the canal area tested still received over 2 hours of sunlight, with most of the canal receiving over 5 hours of sunlight on 21st of March. Therefore, the sunlight impact on the canal will be negligible. The figure below demonstrates the number of hours of sunlight received, see appendix C.

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7.0 APPENDICES

In the tables of data for VSC, APSH and WPSH results, subscript “e” refers to the existing scenario, whereas the subscript “p” is with the proposed development in place. Subscript “rf” stands for reduction factor and “ar” stands for the absolute reduction (proposed minus existing).

7.1 Appendix A: New Amenity Space

Area Locations
Green colour denotes a pass, red areas fail the test.

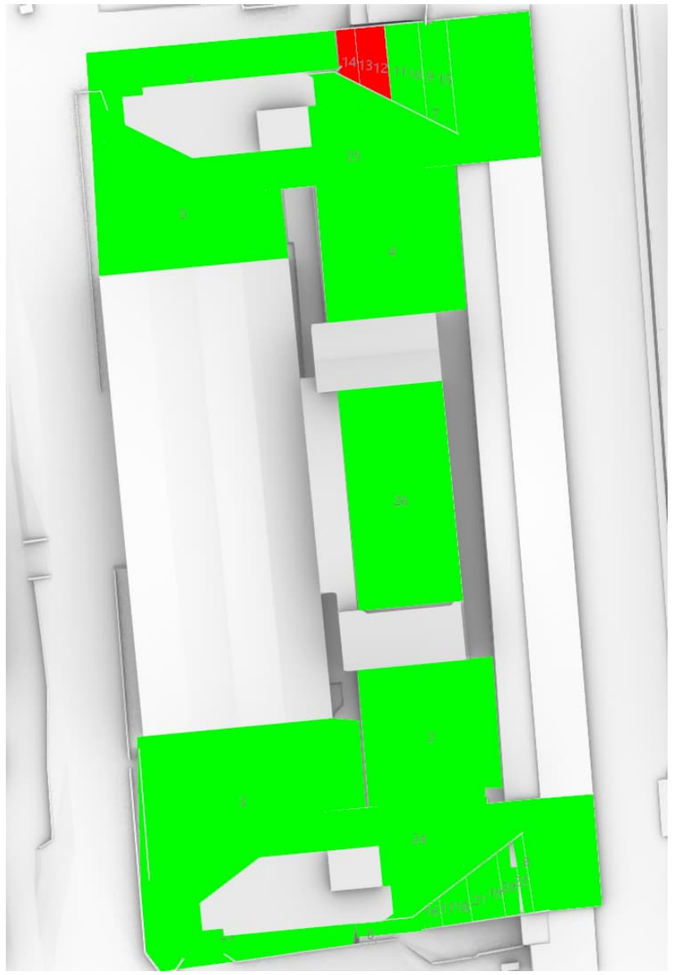


Table of Results

AreaRef	*AvSunHours_p*	*%AreaOver2Hours_p*	*Pass/Fail*
0	7.65	100.00	Pass
1	6.92	95.67	Pass
2	2.52	72.06	Pass
3	4.66	95.64	Pass
4	3.64	69.17	Pass
5	4.25	65.12	Pass
6	3.45	57.24	Pass
7	3.49	58.16	Pass
8	7.72	95.82	Pass
9	2.84	84.71	Pass
10	1.79	56.71	Pass
11	2.00	63.05	Pass
12	1.01	21.17	Fail
13	1.21	32.39	Fail
14	0.72	2.39	Fail
15	2.97	90.04	Pass
16	6.65	95.77	Pass
17	6.98	95.12	Pass
18	6.84	94.91	Pass
19	6.96	96.54	Pass
20	7.20	96.21	Pass
21	7.16	93.66	Pass
22	6.34	86.72	Pass
23	7.16	83.46	Pass
24	7.23	96.07	Pass
25	11.32	100.00	Pass
26	6.43	84.14	Pass

7.2 Appendix B: Existing Amenity Space

Area Locations

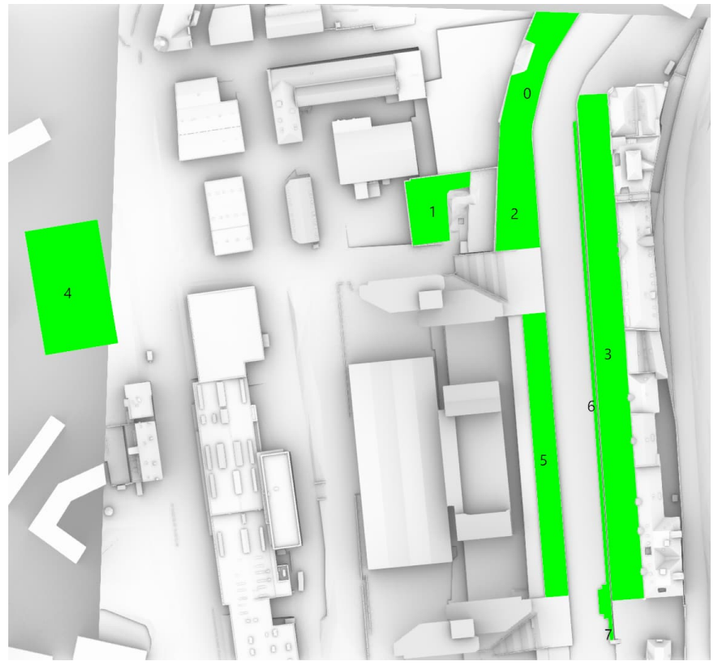


Table of results

AreaRef	*AvSunHours_e*	*%AreaOver2Hours_e*	*AvSunHours_p*	*%AreaOver2Hours_p*	*AreaRedFact*	*Pass/Fail*
0	8.9	100.0	8.4	100.0	1.00	Pass
1	6.5	91.7	2.6	74.3	0.81	Pass
2	8.3	100.0	5.3	98.6	0.99	Pass
3	7.0	99.4	6.1	99.4	1.00	Pass
4	10.2	100.0	10.1	100.0	1.00	Pass
5	9.7	100.0	8.1	100.0	1.00	Pass
6	8.3	100.0	7.1	100.0	1.00	Pass
7	8.9	100.0	8.3	100.0	1.00	Pass

7.3 Appendix C: Sunlight access to Canal

Area Location

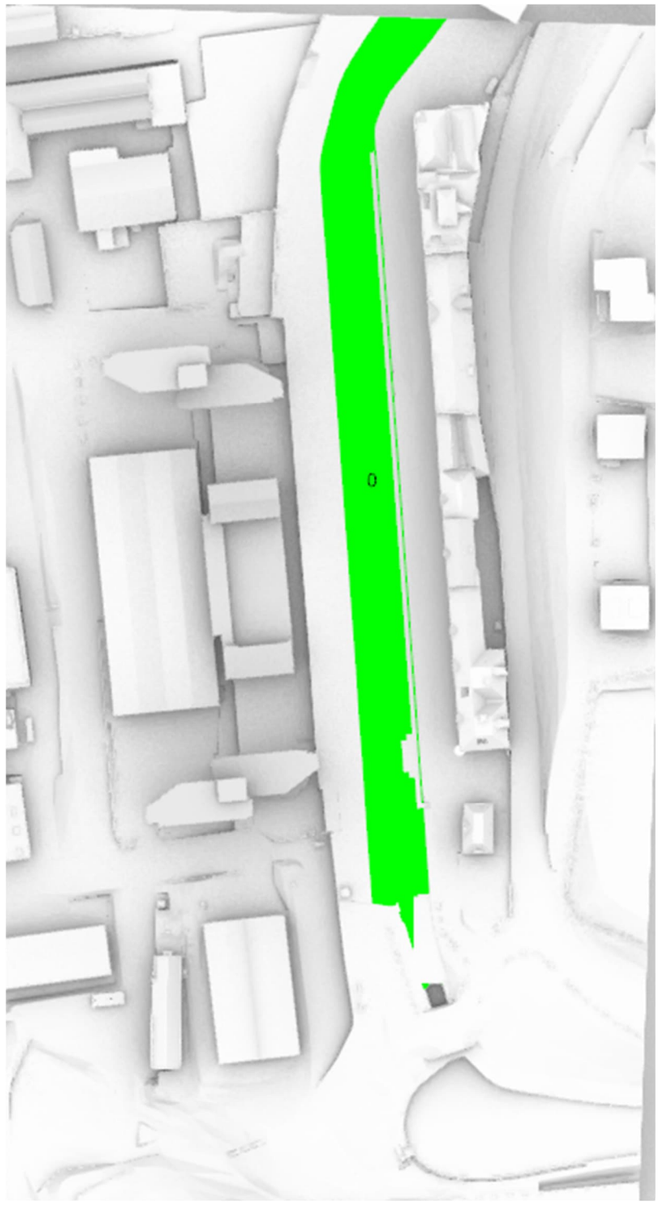


Table of Results

AreaRef	*AvSunHours_e*	*%AreaOver2Hours_e*	*AvSunHours_p*	*%AreaOver2Hours_p*	*AreaRedFact*	*Pass/Fail*
0	7.4	95.9	6.2	91.8	0.96	Pass

7.4 Appendix D: Speirs Wharf Results

Speirs Wharf Window Location References

Window Location References

Figure 1: 2 Canal House

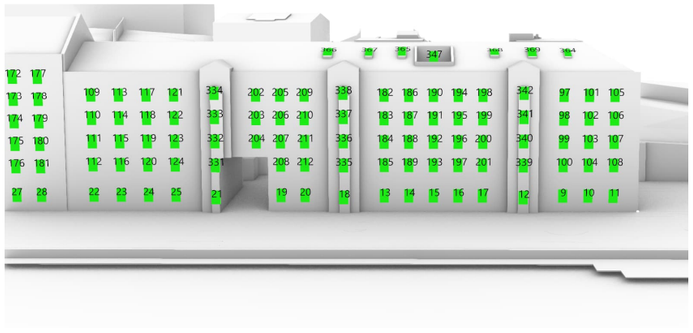


Figure 2: 4-18 Speirs Wharf

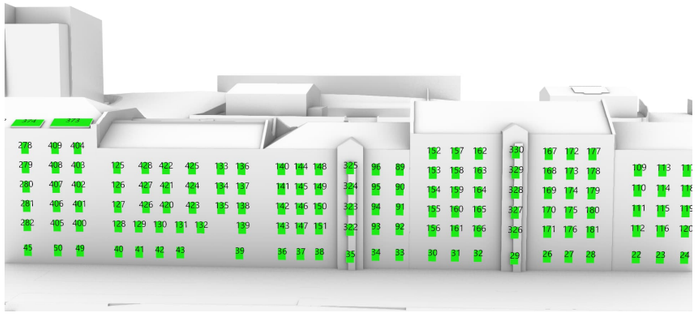


Figure 3: 20-32 Speirs Wharf

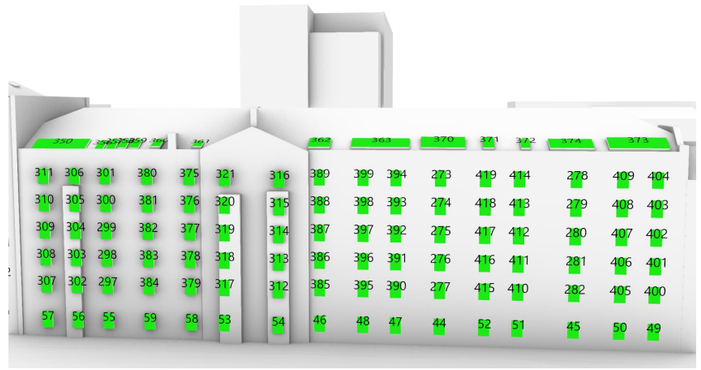


Figure 4: 34-38 Speirs Wharf

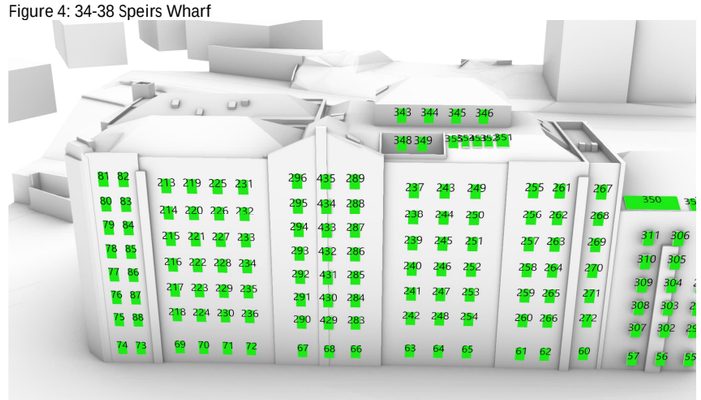


Figure 5: 40-48 Speirs Wharf

VSC - Table of Results

W_ref:	*VSC_E:*	*VSC_P:*	*P/E:*	*Pass/Fail*
0	38.8	35.8	0.92	Pass
1	38.4	35.2	0.92	Pass
2	38.9	35.8	0.92	Pass
3	38.6	35.3	0.92	Pass
4	38.8	35.8	0.92	Pass
5	36.8	33.6	0.91	Pass
6	38.7	35.7	0.92	Pass
7	38.7	35.7	0.92	Pass
8	36.5	33.5	0.92	Pass
9	37.9	35.3	0.93	Pass
10	38.5	35.7	0.93	Pass
11	38.5	35.6	0.93	Pass
12	38.6	35.9	0.93	Pass
13	38.4	35.4	0.92	Pass
14	38.5	35.6	0.92	Pass
15	38.6	35.7	0.93	Pass

16	38.4	35.5	0.92	Pass
17	38.2	35.4	0.92	Pass
18	38.7	35.8	0.93	Pass
19	38.3	35.5	0.93	Pass
20	38.2	34.9	0.91	Pass
21	38.7	35.6	0.92	Pass
22	38.5	35.4	0.92	Pass
23	38.6	35.5	0.92	Pass
24	38.5	35.2	0.91	Pass
25	38.2	34.8	0.91	Pass
26	38	34.4	0.91	Pass
27	38.4	35.2	0.91	Pass
28	38.6	35.4	0.92	Pass
29	38.6	35.2	0.91	Pass
30	38.5	35.2	0.91	Pass
31	38.3	34.9	0.91	Pass
32	38	34.6	0.91	Pass
33	38.2	34.9	0.91	Pass
34	37.2	34	0.91	Pass
35	38.6	35.2	0.91	Pass
36	38.6	35.2	0.91	Pass
37	38.4	35	0.91	Pass
38	38.2	35	0.92	Pass
39	38.5	35.5	0.92	Pass
40	38.7	35.4	0.91	Pass
41	38.5	35.4	0.92	Pass
42	38.5	35.5	0.92	Pass
43	38.6	35.5	0.92	Pass
44	38.5	34.9	0.91	Pass
45	38.5	35.1	0.91	Pass
46	37.8	34	0.9	Pass
47	38.5	34.6	0.9	Pass
48	38.3	34.5	0.9	Pass
49	38.4	35.3	0.92	Pass
50	38.5	35.2	0.92	Pass
51	38.5	34.9	0.91	Pass
52	38.5	34.9	0.91	Pass
53	38.5	34.6	0.9	Pass
54	38.6	34.7	0.9	Pass
55	38.5	34.5	0.89	Pass
56	38.5	34.6	0.9	Pass
57	38.3	34.8	0.91	Pass
58	38.4	34.5	0.9	Pass
59	38.5	34.6	0.9	Pass
60	37.3	33.8	0.9	Pass
61	38.5	34.9	0.91	Pass
62	38.3	34.9	0.91	Pass
63	38.3	35.4	0.93	Pass
64	38.4	35.5	0.93	Pass
65	38.4	35.4	0.92	Pass
66	38.5	35.7	0.93	Pass
67	38.4	36	0.94	Pass
68	38.4	35.8	0.93	Pass
69	38.3	36.1	0.94	Pass
70	38.4	36.1	0.94	Pass
71	38.4	36.2	0.94	Pass
72	38.5	36.1	0.94	Pass
73	38.5	36.5	0.95	Pass
74	38.4	36.5	0.95	Pass
75	38.6	36.9	0.96	Pass
76	38.7	36.9	0.95	Pass
77	38.8	37.3	0.96	Pass
78	39	37.4	0.96	Pass
79	38.9	37.7	0.97	Pass
80	38.9	37.7	0.97	Pass
81	39	38.1	0.98	Pass
82	39	38	0.98	Pass
83	38.9	37.7	0.97	Pass
84	38.8	37.7	0.97	Pass
85	38.8	37.5	0.97	Pass
86	38.8	37	0.95	Pass
87	38.7	36.8	0.95	Pass
88	38.6	36.8	0.95	Pass
89	38.8	36.9	0.95	Pass
90	38.6	36.5	0.94	Pass
91	38.6	36.1	0.94	Pass
92	38.6	35.7	0.92	Pass
93	37.6	34.6	0.92	Pass
94	37.6	35.3	0.94	Pass
95	37.5	35.6	0.95	Pass
96	37.9	36	0.95	Pass
97	38.8	37	0.95	Pass
98	38.8	36.5	0.94	Pass
99	38.6	36.2	0.94	Pass
100	38.4	35.8	0.93	Pass
101	38.9	37.1	0.95	Pass
102	38.9	36.9	0.95	Pass
103	38.7	36.7	0.95	Pass
104	38.6	36.2	0.94	Pass
105	39	37	0.95	Pass
106	38.9	36.9	0.95	Pass
107	38.8	36.7	0.95	Pass
108	38.7	36.3	0.94	Pass
109	38.9	37.2	0.95	Pass
110	38.8	37.1	0.95	Pass
111	38.7	36.6	0.95	Pass
112	38.8	36.2	0.93	Pass
113	38.9	37.3	0.96	Pass
114	39	36.9	0.95	Pass
115	38.7	36.6	0.95	Pass
116	38.8	36.1	0.93	Pass
117	39.1	37.3	0.95	Pass
118	39	37	0.95	Pass
119	38.6	36.3	0.94	Pass
120	38.5	36	0.93	Pass
121	39.1	36.8	0.94	Pass
122	39	36.7	0.94	Pass
123	38.5	36.3	0.94	Pass
124	38.2	35.8	0.94	Pass
125	39	36.9	0.95	Pass
126	38.9	36.6	0.94	Pass
127	38.8	36.2	0.93	Pass
128	38.7	35.8	0.92	Pass
129	38.7	36	0.93	Pass
130	38.7	36	0.93	Pass
131	38.7	36	0.93	Pass
132	38.8	36	0.93	Pass
133	38.9	36.9	0.95	Pass
134	38.8	36.8	0.95	Pass
135	38.8	36.4	0.94	Pass
136	38.9	37	0.95	Pass
137	38.8	36.7	0.95	Pass
138	38.8	36.5	0.94	Pass
139	38.6	36	0.93	Pass
140	38.8	36.9	0.95	Pass
141	38.9	36.8	0.95	Pass
142	38.7	36.4	0.94	Pass
143	38.7	35.9	0.93	Pass
144	38.9	36.9	0.95	Pass
145	38.7	37	0.95	Pass
146	38.7	36.3	0.94	Pass
147	38.5	35.8	0.93	Pass
148	38.4	36.7	0.96	Pass
149	38.3	36.3	0.95	Pass
150	38.2	35.9	0.94	Pass
151	38.1	35.5	0.93	Pass
152	38.9	37.3	0.96	Pass
153	38.9	37	0.95	Pass
154	38.8	36.7	0.94	Pass
155	38.8	36.4	0.94	Pass
156	38.6	35.8	0.93	Pass

157	38.9	37.3	0.96	Pass
158	38.9	36.9	0.95	Pass
159	38.8	36.6	0.94	Pass
160	38.6	36.4	0.94	Pass
161	38.7	35.8	0.93	Pass
162	38.9	37	0.95	Pass
163	38.4	36.7	0.96	Pass
164	38.4	36.5	0.95	Pass
165	38.4	36.3	0.95	Pass
166	38.5	35.4	0.92	Pass
167	38.5	36.9	0.96	Pass
168	38.1	36.5	0.96	Pass
169	38.2	36.2	0.95	Pass
170	38.1	36.2	0.95	Pass
171	38.2	35.3	0.93	Pass
172	38.9	37.5	0.96	Pass
173	38.8	37.2	0.96	Pass
174	38.8	36.6	0.94	Pass
175	38.5	36.3	0.94	Pass
176	38.4	35.8	0.93	Pass
177	39	37.5	0.96	Pass
178	38.9	37	0.95	Pass
179	38.7	36.7	0.95	Pass
180	38.6	36.3	0.94	Pass
181	38.6	35.8	0.93	Pass
182	38.6	37	0.96	Pass
183	38.6	36.8	0.95	Pass
184	38.3	36.4	0.95	Pass
185	38.4	35.7	0.93	Pass
186	39	37.2	0.95	Pass
187	38.8	36.7	0.95	Pass
188	38.8	36.4	0.94	Pass
189	38.5	36.1	0.94	Pass
190	38.8	37.1	0.96	Pass
191	38.9	36.9	0.95	Pass
192	38.8	36.7	0.95	Pass
193	38.5	36.4	0.94	Pass
194	38.9	37.2	0.96	Pass
195	38.8	36.8	0.95	Pass
196	38.7	36.6	0.95	Pass
197	38.8	36.3	0.94	Pass
198	38.6	36.9	0.95	Pass
199	38.5	36.4	0.95	Pass
200	38.5	36.3	0.94	Pass
201	38.4	36.2	0.94	Pass
202	38.5	36.5	0.95	Pass
203	38.3	36.4	0.95	Pass
204	37.9	35.9	0.95	Pass
205	38.7	37	0.96	Pass
206	38.8	36.6	0.94	Pass
207	38.4	36.4	0.95	Pass
208	38.4	36	0.94	Pass
209	38.9	36.7	0.94	Pass
210	38.3	36.4	0.95	Pass
211	38.2	36.2	0.95	Pass
212	38	35.7	0.94	Pass
213	38.9	37.6	0.97	Pass
214	38.7	37.6	0.97	Pass
215	38.7	37.1	0.96	Pass
216	38.7	37	0.96	Pass
217	38.5	36.8	0.96	Pass
218	38.4	36.3	0.95	Pass
219	39.1	37.8	0.97	Pass
220	38.9	37.6	0.97	Pass
221	38.7	37.3	0.96	Pass
222	38.9	37.2	0.96	Pass
223	38.8	36.8	0.95	Pass
224	38.5	36.6	0.95	Pass
225	39.1	37.7	0.96	Pass
226	38.9	37.5	0.96	Pass
227	38.9	37.5	0.96	Pass
228	38.8	37.2	0.96	Pass
229	38.8	36.8	0.95	Pass
230	38.6	36.5	0.95	Pass
231	39	37.7	0.97	Pass
232	38.9	37.4	0.96	Pass
233	38.9	37.3	0.96	Pass
234	38.8	37	0.95	Pass
235	38.8	36.8	0.95	Pass
236	38.7	36.6	0.95	Pass
237	38.9	37.4	0.96	Pass
238	39	37.1	0.95	Pass
239	38.8	36.9	0.95	Pass
240	38.8	36.7	0.95	Pass
241	38.6	36.4	0.94	Pass
242	38.6	35.9	0.93	Pass
243	39	37.3	0.96	Pass
244	38.9	37.1	0.95	Pass
245	38.8	36.8	0.95	Pass
246	38.7	36.4	0.94	Pass
247	38.7	36.1	0.93	Pass
248	38.5	36	0.93	Pass
249	39	37.3	0.96	Pass
250	38.9	37.1	0.95	Pass
251	38.8	36.8	0.95	Pass
252	38.8	36.5	0.94	Pass
253	38.7	36.1	0.93	Pass
254	38.6	35.8	0.93	Pass
255	39	37.1	0.95	Pass
256	38.9	36.8	0.95	Pass
257	38.8	36.6	0.94	Pass
258	38.9	36.3	0.94	Pass
259	38.8	36	0.93	Pass
260	38.6	35.7	0.93	Pass
261	39	37	0.95	Pass
262	38.9	36.7	0.94	Pass
263	38.6	36.5	0.94	Pass
264	38.6	36.2	0.94	Pass
265	38.8	35.7	0.92	Pass
266	38.3	35.2	0.92	Pass
267	38.3	36.4	0.95	Pass
268	37.9	35.9	0.95	Pass
269	38.1	35.7	0.94	Pass
270	37.8	35	0.93	Pass
271	37.7	34.7	0.92	Pass
272	37.3	34.4	0.92	Pass
273	38.9	36.6	0.94	Pass
274	38.8	36.2	0.93	Pass
275	38.8	36	0.93	Pass
276	38.7	35.7	0.92	Pass
277	38.7	35.5	0.92	Pass
278	39	37	0.95	Pass
279	38.9	36.6	0.94	Pass
280	38.9	36.4	0.94	Pass
281	38.8	35.9	0.93	Pass
282	38.7	35.7	0.92	Pass
283	38.6	36	0.93	Pass
284	38.7	36.3	0.94	Pass
285	38.7	36.6	0.95	Pass
286	38.9	36.9	0.95	Pass
287	38.9	37.2	0.96	Pass
288	39	37.3	0.96	Pass
289	39	37.6	0.96	Pass
290	38.6	36.5	0.95	Pass
291	38.6	36.6	0.95	Pass
292	38.7	36.8	0.95	Pass
293	38.9	36.9	0.95	Pass
294	38.9	37.3	0.96	Pass
295	39	37.5	0.96	Pass
296	39	37.8	0.97	Pass
297	38.6	35.3	0.91	Pass

298	38.7	35.4	0.91	Pass
299	38.8	36.1	0.93	Pass
300	38.9	36.2	0.93	Pass
301	38.9	36.4	0.94	Pass
302	38.6	35.2	0.91	Pass
303	38.7	35.4	0.92	Pass
304	38.8	35.9	0.93	Pass
305	38.8	36.2	0.93	Pass
306	38.9	36.6	0.94	Pass
307	38.7	35.1	0.91	Pass
308	38.7	35.4	0.91	Pass
309	38.9	35.9	0.92	Pass
310	39	36.2	0.93	Pass
311	38.9	36.6	0.94	Pass
312	38.7	35.1	0.91	Pass
313	38.7	35.5	0.92	Pass
314	38.9	36	0.92	Pass
315	39	36.3	0.93	Pass
316	39	36.6	0.94	Pass
317	38.6	35.1	0.91	Pass
318	38.8	35.4	0.91	Pass
319	38.8	35.9	0.93	Pass
320	38.9	36	0.93	Pass
321	39	36.5	0.94	Pass
322	38.7	35.9	0.93	Pass
323	38.9	36.5	0.94	Pass
324	38.8	36.9	0.95	Pass
325	39	37.1	0.95	Pass
326	38.8	36.1	0.93	Pass
327	38.9	36.7	0.95	Pass
328	39	36.8	0.94	Pass
329	38.9	37.2	0.96	Pass
330	39.1	37.4	0.96	Pass
331	38.7	36.2	0.93	Pass
332	38.9	36.7	0.94	Pass
333	39	37	0.95	Pass
334	39.1	37.4	0.96	Pass
335	38.7	36.4	0.94	Pass
336	38.8	37	0.95	Pass
337	39	36.9	0.95	Pass
338	39	37.3	0.96	Pass
339	38.8	36.3	0.94	Pass
340	39	36.9	0.95	Pass
341	39.1	36.9	0.95	Pass
342	39	37.2	0.95	Pass
343	39	38	0.97	Pass
344	39.1	38	0.97	Pass
345	39.1	37.9	0.97	Pass
346	39.1	38	0.97	Pass
347	36.1	35.4	0.98	Pass
348	37.5	36.1	0.96	Pass
349	37.5	36.3	0.97	Pass
350	82.3	81.2	0.99	Pass
351	87.7	86.7	0.99	Pass
352	88.4	87.4	0.99	Pass
353	88.3	87.3	0.99	Pass
354	89.5	88.4	0.99	Pass
355	85.1	84.2	0.99	Pass
356	89.5	88.3	0.99	Pass
357	86.1	85.1	0.99	Pass
358	88.8	87.7	0.99	Pass
359	88	86.8	0.99	Pass
360	90.9	90.1	0.99	Pass
361	92	91.4	0.99	Pass
362	90.7	89.8	0.99	Pass
363	91.8	90.4	0.99	Pass
364	89.5	88.6	0.99	Pass
365	89.3	88.4	0.99	Pass
366	91.5	90.6	0.99	Pass
367	90.4	89.6	0.99	Pass
368	93.4	92.9	0.99	Pass
369	88.2	87.4	0.99	Pass
370	88	86.9	0.99	Pass
371	88.8	87.5	0.99	Pass
372	89.1	87.8	0.99	Pass
373	89	87.8	0.99	Pass
374	92.5	91.3	0.99	Pass
375	39	36.5	0.94	Pass
376	38.9	36.1	0.93	Pass
377	38.8	35.7	0.92	Pass
378	38.8	35.2	0.91	Pass
379	38.5	34.9	0.91	Pass
380	38.8	36.6	0.94	Pass
381	38.8	36.3	0.94	Pass
382	38.8	36	0.93	Pass
383	38.7	35.6	0.92	Pass
384	38.7	34.9	0.9	Pass
385	37.8	34.4	0.91	Pass
386	38.7	34.5	0.89	Pass
387	38	35	0.92	Pass
388	38.1	35.6	0.93	Pass
389	38.5	36.2	0.94	Pass
390	38.7	35.4	0.92	Pass
391	38.6	35.7	0.92	Pass
392	38.8	36	0.93	Pass
393	38.9	36.4	0.94	Pass
394	38.9	36.5	0.94	Pass
395	38.5	35.1	0.91	Pass
396	38.5	35.5	0.92	Pass
397	38.9	35.9	0.92	Pass
398	38.9	36.3	0.93	Pass
399	39	36.6	0.94	Pass
400	38.7	35.7	0.92	Pass
401	38.9	36	0.93	Pass
402	39.1	36.5	0.93	Pass
403	39	36.8	0.95	Pass
404	39.1	37	0.95	Pass
405	38.7	35.5	0.92	Pass
406	38.8	36.2	0.93	Pass
407	38.9	36.4	0.94	Pass
408	39	36.8	0.94	Pass
409	39	37.2	0.95	Pass
410	38.6	35.6	0.92	Pass
411	38.8	35.9	0.93	Pass
412	38.9	36.4	0.94	Pass
413	39	36.5	0.94	Pass
414	39	36.9	0.95	Pass
415	38.7	35.6	0.92	Pass
416	38.8	36	0.93	Pass
417	38.8	36.2	0.93	Pass
418	38.8	36.5	0.94	Pass
419	38.9	36.8	0.95	Pass
420	38.8	36.4	0.94	Pass
421	38.8	36.4	0.94	Pass
422	38.9	37	0.95	Pass
423	38.8	36.3	0.93	Pass
424	38.8	36.7	0.95	Pass
425	38.9	36.8	0.95	Pass
426	38.8	36.4	0.94	Pass
427	38.8	36.6	0.94	Pass
428	38.9	36.8	0.95	Pass
429	38.6	36.1	0.94	Pass
430	38.7	36.3	0.94	Pass
431	38.7	36.7	0.95	Pass
432	38.8	36.9	0.95	Pass
433	38.9	37.2	0.96	Pass
434	39	37.4	0.96	Pass
435	39	37.7	0.97	Pass

MAX FORDHAM

APSH – Table of Results

In the table, subscript “e” refers to the existing scenario, whereas the subscript “p” is with the proposed development in place. Subscript “rf” stands for reduction factor and “ar” stands for the absolute reduction (proposed minus existing).

Win_ref	*APSH_e*	*APSH_p*	*APSH_rf*	*APSH_ar*	*WPSH_e*	*WPSH_p*	*WPSH_rf*	*Pass/Fail*
0	49.44	43.90	0.89	-5.54	16.79	16.79	1.00	Pass
1	47.15	39.17	0.83	-7.98	16.54	16.54	1.00	Pass
2	52.49	44.43	0.85	-8.06	17.98	17.98	1.00	Pass
3	52.00	43.19	0.83	-8.82	17.81	17.81	1.00	Pass
4	52.57	47.10	0.90	-5.47	18.05	18.05	1.00	Pass
5	40.67	32.63	0.80	-8.04	10.34	10.34	1.00	Pass
6	52.57	45.64	0.87	-6.92	18.05	18.05	1.00	Pass
7	52.56	45.61	0.87	-6.95	18.05	18.05	1.00	Pass
8	52.07	43.66	0.84	-8.41	17.87	17.87	1.00	Pass
9	52.38	47.63	0.91	-4.74	19.55	17.99	0.92	Pass
10	52.53	48.05	0.91	-4.48	19.55	18.28	0.94	Pass
11	52.58	48.22	0.92	-4.36	19.55	18.28	0.94	Pass
12	52.26	47.72	0.91	-4.54	19.55	17.44	0.89	Pass
13	51.76	48.51	0.94	-3.25	19.55	17.55	0.90	Pass
14	51.87	48.08	0.93	-3.79	19.46	17.34	0.89	Pass
15	51.14	47.48	0.93	-3.66	18.60	16.43	0.88	Pass
16	49.97	46.50	0.93	-3.46	18.12	16.17	0.89	Pass
17	44.49	40.83	0.92	-3.65	15.97	14.00	0.88	Pass
18	51.96	47.97	0.92	-3.99	19.55	16.79	0.86	Pass
19	49.64	45.04	0.91	-4.60	17.93	15.06	0.84	Pass
20	44.81	40.11	0.90	-4.70	15.97	13.02	0.82	Pass
21	52.54	46.33	0.88	-6.21	19.55	15.16	0.78	Pass
22	52.07	44.17	0.85	-7.90	18.78	13.48	0.72	Pass
23	51.55	43.65	0.85	-7.90	18.27	13.09	0.72	Pass
24	49.50	41.43	0.84	-8.07	17.85	12.22	0.68	Pass
25	44.94	36.99	0.82	-7.95	15.97	10.10	0.63	Pass
26	53.32	45.25	0.85	-8.07	19.55	14.01	0.72	Pass
27	53.27	45.59	0.86	-7.68	19.55	14.40	0.74	Pass
28	53.11	45.46	0.86	-7.65	19.55	14.35	0.73	Pass
29	53.45	45.04	0.84	-8.41	19.55	13.72	0.70	Pass
30	52.39	41.25	0.79	-11.13	18.57	12.32	0.66	Pass
31	50.85	40.03	0.79	-10.82	18.09	11.83	0.65	Pass
32	45.51	35.21	0.77	-10.30	15.97	9.93	0.62	Pass
33	53.41	42.15	0.79	-11.26	19.55	13.39	0.68	Pass
34	53.46	43.20	0.81	-10.26	19.55	13.47	0.69	Pass
35	53.25	43.73	0.82	-9.52	19.55	13.77	0.70	Pass
36	52.02	42.12	0.81	-9.90	18.26	12.52	0.69	Pass
37	49.84	41.52	0.83	-8.32	17.83	12.69	0.71	Pass
38	45.61	36.84	0.81	-8.77	15.97	10.52	0.66	Pass
39	53.20	43.35	0.81	-9.85	19.55	14.07	0.72	Pass
40	53.19	44.05	0.83	-9.14	19.55	14.75	0.75	Pass
41	53.13	44.07	0.83	-9.07	19.55	14.54	0.74	Pass
42	53.15	44.09	0.83	-9.07	19.55	14.44	0.74	Pass
43	53.17	43.89	0.83	-9.28	19.55	14.37	0.74	Pass
44	52.51	44.82	0.85	-7.69	19.55	15.67	0.80	Pass
45	52.82	44.22	0.84	-8.60	19.55	15.88	0.81	Pass
46	52.59	43.87	0.83	-8.72	19.55	14.92	0.76	Pass
47	52.47	43.55	0.83	-8.92	19.55	14.66	0.75	Pass
48	52.62	43.83	0.83	-8.79	19.55	14.77	0.76	Pass
49	53.11	44.41	0.84	-8.70	19.55	15.58	0.80	Pass
50	52.96	43.89	0.83	-9.07	19.55	15.72	0.80	Pass
51	52.68	44.06	0.84	-8.63	19.55	15.97	0.82	Pass
52	52.67	44.14	0.84	-8.53	19.55	15.77	0.81	Pass
53	52.69	44.14	0.84	-8.55	19.55	14.18	0.73	Pass
54	52.67	43.76	0.83	-8.91	19.55	14.52	0.74	Pass
55	53.09	44.86	0.84	-8.23	19.55	13.43	0.69	Pass
56	53.10	45.19	0.85	-7.92	19.55	13.31	0.68	Pass
57	53.12	45.43	0.86	-7.69	19.55	13.34	0.68	Pass
58	51.82	43.96	0.85	-7.86	18.56	13.46	0.73	Pass
59	52.87	44.61	0.84	-8.26	19.55	13.74	0.70	Pass
60	53.07	46.31	0.87	-6.76	19.55	13.74	0.70	Pass
61	53.19	45.10	0.85	-8.09	19.55	12.45	0.64	Pass
62	49.24	41.17	0.84	-8.07	17.69	10.61	0.60	Pass
63	53.05	45.32	0.85	-7.73	19.55	12.63	0.65	Pass
64	53.11	45.13	0.85	-7.99	19.55	12.39	0.63	Pass
65	53.17	45.19	0.85	-7.98	19.55	12.44	0.64	Pass
66	53.28	45.63	0.86	-7.65	19.55	12.59	0.64	Pass
67	53.45	46.44	0.87	-7.01	19.55	12.73	0.65	Pass
68	53.35	45.90	0.86	-7.45	19.55	12.60	0.64	Pass
69	53.42	46.37	0.87	-7.05	19.47	12.42	0.64	Pass
70	53.43	46.15	0.86	-7.28	19.55	12.27	0.63	Pass
71	53.41	45.69	0.86	-7.72	19.55	11.88	0.61	Pass
72	53.50	46.16	0.86	-7.33	19.55	12.33	0.63	Pass
73	52.39	45.44	0.87	-6.94	18.38	11.44	0.62	Pass
74	53.37	46.46	0.87	-6.91	19.43	12.52	0.64	Pass
75	53.53	46.99	0.88	-6.54	19.46	12.92	0.66	Pass
76	53.72	47.48	0.88	-6.24	19.51	13.26	0.68	Pass
77	53.82	47.81	0.89	-6.02	19.55	13.53	0.69	Pass
78	53.84	48.14	0.89	-5.70	19.55	13.85	0.71	Pass
79	53.84	48.61	0.90	-5.23	19.55	14.32	0.73	Pass
80	53.85	49.16	0.91	-4.69	19.55	14.86	0.76	Pass
81	53.85	50.07	0.93	-3.78	19.55	15.77	0.81	Pass
82	52.85	48.91	0.93	-3.94	18.56	14.62	0.79	Pass
83	52.85	48.16	0.91	-4.70	18.56	13.87	0.75	Pass
84	52.85	47.59	0.90	-5.27	18.56	13.29	0.72	Pass
85	52.85	47.16	0.89	-5.70	18.56	12.86	0.69	Pass
86	52.84	46.87	0.89	-5.97	18.56	12.59	0.68	Pass
87	52.75	46.51	0.88	-6.24	18.52	12.29	0.66	Pass
88	52.62	46.12	0.88	-6.49	18.48	11.98	0.65	Pass
89	53.86	46.70	0.87	-7.16	19.55	17.09	0.87	Pass
90	53.86	45.78	0.85	-8.08	19.55	16.17	0.83	Pass
91	53.85	44.94	0.83	-8.91	19.55	15.76	0.81	Pass
92	53.77	43.95	0.82	-9.82	19.55	15.02	0.77	Pass
93	53.82	45.13	0.84	-8.69	19.55	14.95	0.76	Pass
94	53.90	46.84	0.87	-7.06	19.55	16.13	0.83	Pass
95	53.91	47.43	0.88	-6.47	19.55	16.52	0.85	Pass
96	53.91	47.98	0.89	-5.93	19.55	17.07	0.87	Pass
97	52.83	50.58	0.96	-2.25	19.55	17.99	0.92	Pass
98	52.83	49.93	0.95	-2.90	19.55	17.99	0.92	Pass
99	52.76	49.59	0.94	-3.17	19.55	17.99	0.92	Pass
100	52.61	48.85	0.93	-3.76	19.55	17.99	0.92	Pass
101	52.98	50.81	0.96	-2.17	19.55	18.28	0.94	Pass
102	52.98	50.44	0.95	-2.54	19.55	18.28	0.94	Pass
103	52.91	50.02	0.95	-2.89	19.55	18.28	0.94	Pass
104	52.76	49.42	0.94	-3.34	19.55	18.28	0.94	Pass
105	53.03	50.99	0.96	-2.04	19.55	18.28	0.94	Pass
106	53.03	50.82	0.96	-2.21	19.55	18.28	0.94	Pass
107	52.96	50.29	0.95	-2.67	19.55	18.28	0.94	Pass
108	52.81	49.60	0.94	-3.20	19.55	18.28	0.94	Pass
109	53.11	48.41	0.91	-4.70	19.55	16.35	0.84	Pass
110	53.09	47.91	0.90	-5.18	19.55	15.99	0.82	Pass
111	52.50	47.10	0.90	-5.40	19.02	15.24	0.80	Pass
112	52.19	46.26	0.89	-5.93	18.78	14.44	0.77	Pass
113	53.10	48.11	0.91	-4.99	19.55	16.05	0.82	Pass
114	52.49	46.99	0.90	-5.50	18.95	15.08	0.80	Pass
115	51.82	46.06	0.89	-5.77	18.35	14.21	0.77	Pass
116	51.67	45.29	0.88	-6.38	18.27	13.56	0.74	Pass
117	52.05	47.23	0.91	-4.82	18.52	15.12	0.82	Pass
118	51.36	45.84	0.89	-5.52	17.85	13.89	0.78	Pass
119	51.04	44.97	0.88	-6.06	17.85	13.34	0.75	Pass
120	50.44	43.95	0.87	-6.49	17.85	12.86	0.72	Pass
121	49.11	44.22	0.90	-4.89	16.64	13.14	0.79	Pass
122	45.38	39.93	0.88	-5.45	15.97	11.91	0.75	Pass
123	45.16	39.31	0.87	-5.84	15.97	11.55	0.72	Pass
124	45.04	38.54	0.86	-6.50	15.97	10.93	0.68	Pass
125	53.87	47.71	0.89	-6.16	19.55	17.83	0.91	Pass
126	53.83	47.33	0.88	-6.50	19.55	17.49	0.89	Pass
127	53.72	47.00	0.87	-6.72	19.55	17.18	0.88	Pass
128	53.49	46.13	0.86	-7.35	19.55	16.54	0.85	Pass
129	53.44	46.00	0.86	-7.44	19.55	16.17	0.83	Pass
130	53.53	45.89	0.86	-7.64	19.55	15.93	0.82	Pass
131	53.62	45.83	0.85	-7.79	19.55	15.88	0.81	Pass

132	53.68	45.74	0.85	-7.94	19.55	15.68	0.80	Pass
133	54.18	48.41	0.89	-5.78	19.55	17.73	0.91	Pass
134	54.18	47.83	0.88	-6.35	19.55	17.39	0.89	Pass
135	54.08	47.01	0.87	-7.07	19.55	16.91	0.86	Pass
136	54.18	47.95	0.88	-6.24	19.55	17.73	0.91	Pass
137	54.18	47.40	0.87	-6.78	19.55	17.20	0.88	Pass
138	54.17	47.14	0.87	-7.04	19.55	16.95	0.87	Pass
139	53.86	45.08	0.84	-8.78	19.55	15.54	0.80	Pass
140	54.18	48.39	0.89	-5.80	19.55	17.69	0.91	Pass
141	53.32	47.29	0.89	-6.03	18.69	16.59	0.89	Pass
142	52.88	46.64	0.88	-6.24	18.26	15.95	0.87	Pass
143	52.57	44.49	0.85	-8.08	18.26	14.42	0.79	Pass
144	52.89	48.34	0.91	-4.55	18.32	16.96	0.93	Pass
145	52.40	47.59	0.91	-4.81	17.83	16.21	0.91	Pass
146	51.91	46.94	0.90	-4.97	17.83	16.05	0.90	Pass
147	50.99	44.51	0.87	-6.48	17.83	14.54	0.82	Pass
148	48.63	43.44	0.89	-5.19	15.97	13.89	0.87	Pass
149	46.32	40.98	0.88	-5.35	15.97	13.74	0.86	Pass
150	46.16	40.37	0.87	-5.80	15.97	13.29	0.83	Pass
151	46.06	38.70	0.84	-7.36	15.97	11.92	0.75	Pass
152	53.70	47.16	0.88	-6.54	19.55	17.08	0.87	Pass
153	53.07	45.84	0.86	-7.24	18.93	15.76	0.83	Pass
154	52.72	44.69	0.85	-8.03	18.57	14.91	0.80	Pass
155	52.71	43.98	0.83	-8.73	18.57	14.49	0.78	Pass
156	52.64	43.26	0.82	-9.38	18.57	13.92	0.75	Pass
157	52.70	46.64	0.88	-6.06	18.60	16.17	0.87	Pass
158	52.25	45.37	0.87	-6.89	18.15	14.90	0.82	Pass
159	51.92	44.19	0.85	-7.73	18.09	14.26	0.79	Pass
160	51.71	43.12	0.83	-8.59	18.09	13.82	0.76	Pass
161	51.03	41.83	0.82	-9.20	18.09	13.28	0.73	Pass
162	49.84	44.17	0.89	-5.67	16.81	14.44	0.86	Pass
163	46.56	40.08	0.86	-6.48	15.97	12.79	0.80	Pass
164	46.06	38.84	0.84	-7.23	15.97	12.18	0.76	Pass
165	45.82	37.94	0.83	-7.88	15.97	11.70	0.73	Pass
166	45.69	37.12	0.81	-8.57	15.97	11.12	0.70	Pass
167	53.50	48.98	0.92	-4.52	19.55	16.80	0.86	Pass
168	53.49	48.68	0.91	-4.81	19.55	16.52	0.84	Pass
169	53.47	48.44	0.91	-5.03	19.55	16.30	0.83	Pass
170	53.40	47.99	0.90	-5.41	19.55	15.91	0.81	Pass
171	53.39	47.57	0.89	-5.82	19.55	15.56	0.80	Pass
172	53.45	48.69	0.91	-4.75	19.55	16.57	0.85	Pass
173	53.43	48.55	0.91	-4.88	19.55	16.45	0.84	Pass
174	53.41	48.24	0.90	-5.17	19.55	16.15	0.83	Pass
175	53.34	47.88	0.90	-5.46	19.55	15.86	0.81	Pass
176	53.33	47.37	0.89	-5.96	19.55	15.41	0.79	Pass
177	53.29	48.58	0.91	-4.71	19.55	16.54	0.85	Pass
178	53.28	48.43	0.91	-4.85	19.55	16.41	0.84	Pass
179	53.26	48.03	0.90	-5.22	19.55	16.04	0.82	Pass
180	53.19	47.60	0.90	-5.58	19.55	15.67	0.80	Pass
181	53.18	46.85	0.88	-6.33	19.55	14.99	0.77	Pass
182	52.21	50.23	0.96	-1.98	19.55	17.61	0.90	Pass
183	52.13	50.08	0.96	-2.05	19.55	17.56	0.90	Pass
184	52.00	49.87	0.96	-2.13	19.55	17.56	0.90	Pass
185	51.83	49.48	0.95	-2.35	19.55	17.56	0.90	Pass
186	52.41	50.22	0.96	-2.18	19.55	17.42	0.89	Pass
187	52.32	49.76	0.95	-2.56	19.55	17.42	0.89	Pass
188	52.11	49.27	0.95	-2.84	19.46	17.34	0.89	Pass
189	51.94	48.88	0.94	-3.06	19.46	17.34	0.89	Pass
190	52.30	49.76	0.95	-2.54	19.31	17.14	0.89	Pass
191	51.79	48.80	0.94	-2.99	18.89	16.72	0.89	Pass
192	51.38	48.34	0.94	-3.04	18.60	16.43	0.88	Pass
193	51.21	47.98	0.94	-3.23	18.60	16.43	0.88	Pass
194	51.37	48.88	0.95	-2.50	18.27	16.31	0.89	Pass
195	51.18	48.23	0.94	-2.95	18.12	16.17	0.89	Pass
196	50.82	47.72	0.94	-3.10	18.12	16.17	0.89	Pass
197	50.56	47.30	0.94	-3.26	18.12	16.17	0.89	Pass
198	47.68	45.24	0.95	-2.44	15.97	14.09	0.88	Pass
199	44.94	42.07	0.94	-2.87	15.97	14.00	0.88	Pass
200	44.73	41.67	0.93	-3.06	15.97	14.00	0.88	Pass
201	44.62	41.29	0.93	-3.33	15.97	14.00	0.88	Pass
202	52.99	49.40	0.93	-3.59	19.37	16.95	0.87	Pass
203	52.38	48.66	0.93	-3.72	18.80	16.24	0.86	Pass
204	51.77	47.93	0.93	-3.84	18.42	15.73	0.85	Pass
205	51.91	48.40	0.93	-3.51	18.33	15.93	0.87	Pass
206	51.50	47.74	0.93	-3.76	17.93	15.28	0.85	Pass
207	50.98	47.10	0.92	-3.88	17.93	15.16	0.85	Pass
208	50.47	46.47	0.92	-4.01	17.93	15.12	0.84	Pass
209	47.96	44.74	0.93	-3.22	15.97	13.78	0.86	Pass
210	45.33	41.74	0.92	-3.59	15.97	13.42	0.84	Pass
211	45.12	41.26	0.91	-3.85	15.97	13.24	0.83	Pass
212	44.95	40.62	0.90	-4.32	15.97	13.12	0.82	Pass
213	53.71	49.35	0.92	-4.35	19.55	15.20	0.78	Pass
214	53.71	48.60	0.90	-5.11	19.55	14.44	0.74	Pass
215	53.71	48.00	0.89	-5.71	19.55	13.84	0.71	Pass
216	53.71	47.69	0.89	-6.02	19.55	13.53	0.69	Pass
217	53.70	47.39	0.88	-6.30	19.55	13.24	0.68	Pass
218	53.60	46.89	0.87	-6.71	19.50	12.79	0.66	Pass
219	53.63	49.08	0.92	-4.55	19.55	14.99	0.77	Pass
220	53.63	48.30	0.90	-5.33	19.55	14.22	0.73	Pass
221	53.63	47.72	0.89	-5.91	19.55	13.64	0.70	Pass
222	53.63	47.44	0.88	-6.19	19.55	13.36	0.68	Pass
223	53.63	47.13	0.88	-6.50	19.55	13.04	0.67	Pass
224	53.58	46.62	0.87	-6.96	19.55	12.58	0.64	Pass
225	53.56	48.58	0.91	-4.98	19.55	14.56	0.75	Pass
226	53.56	47.88	0.89	-5.68	19.55	13.87	0.71	Pass
227	53.56	47.33	0.88	-6.24	19.55	13.31	0.68	Pass
228	53.56	46.96	0.88	-6.60	19.55	12.95	0.66	Pass
229	53.56	46.61	0.87	-6.95	19.55	12.59	0.64	Pass
230	53.56	46.26	0.86	-7.31	19.55	12.24	0.63	Pass
231	53.50	48.42	0.91	-5.08	19.55	14.47	0.74	Pass
232	53.50	47.70	0.89	-5.80	19.55	13.75	0.70	Pass
233	53.50	47.44	0.89	-6.05	19.55	13.49	0.69	Pass
234	53.50	47.27	0.88	-6.23	19.55	13.32	0.68	Pass
235	53.50	46.97	0.88	-6.52	19.55	13.02	0.67	Pass
236	53.50	46.55	0.87	-6.94	19.55	12.60	0.64	Pass
237	53.47	49.07	0.92	-4.40	19.55	15.15	0.77	Pass
238	53.45	48.59	0.91	-4.86	19.55	14.69	0.75	Pass
239	53.45	48.41	0.91	-5.04	19.55	14.52	0.74	Pass
240	53.44	47.92	0.90	-5.52	19.55	14.22	0.73	Pass
241	53.30	47.46	0.89	-5.84	19.55	14.01	0.72	Pass
242	53.28	46.72	0.88	-6.57	19.55	13.59	0.70	Pass
243	53.55	48.71	0.91	-4.84	19.55	14.71	0.75	Pass
244	53.53	48.42	0.90	-5.12	19.55	14.43	0.74	Pass
245	53.53	48.28	0.90	-5.25	19.55	14.37	0.74	Pass
246	53.52	47.87	0.89	-5.65	19.55	14.09	0.72	Pass
247	53.39	47.18	0.88	-6.21	19.55	13.77	0.70	Pass
248	53.30	46.38	0.87	-6.92	19.55	13.35	0.68	Pass
249	53.66	48.77	0.91	-4.89	19.55	14.66	0.75	Pass
250	53.64	48.25	0.90	-5.39	19.55	14.18	0.73	Pass
251	53.64	48.06	0.90	-5.58	19.55	14.09	0.72	Pass
252	53.63	47.77	0.89	-5.86	19.55	14.01	0.72	Pass
253	53.50	47.18	0.88	-6.31	19.55	13.76	0.70	Pass
254	53.41	46.45	0.87	-6.96	19.55	13.36	0.68	Pass
255	53.66	48.94	0.91	-4.71	19.55	14.88	0.76	Pass
256	53.64	48.41	0.90	-5.23	19.55	14.36	0.73	Pass
257	53.64	47.99	0.89	-5.65	19.55	14.17	0.73	Pass
258	53.63	47.45	0.88	-6.18	19.55	13.95	0.71	Pass
259	53.50	46.85	0.88	-6.65	19.55	13.58	0.69	Pass
260	53.43	46.16	0.86	-7.27	19.55	13.14	0.67	Pass
261	51.19	46.36	0.91	-4.83	17.69	13.01	0.74	Pass
262	49.68	44.21	0.89	-5.47	17.69	12.59	0.71	Pass
263	49.68	43.78	0.88	-5.90	17.69	12.36	0.70	Pass
264	49.67	43.45	0.87	-6.22	17.69	12.17	0.69	Pass
265	49.54	42.73	0.86	-6.81	17.69	11.69	0.66	Pass
266	49.46	42.09	0.85	-7.37	17.69	11.18	0.63	Pass
267	53.60	49.42	0.92	-4.18	19.55	15.90	0.81	Pass
268	53.60	49.00	0.91	-4.60	19.55	15.70	0.80	Pass
269	53.59	48.78	0.91	-4.81	19.55	15.52	0.79	Pass
270	53.50	48.30	0.90	-5.20	19.55	15.18	0.78	Pass
271	53.45	47.71	0.89	-5.74	19.55	14.74	0.75	Pass
272	53.29	46.89	0.88	-6.41	19.55	14.10	0.72	Pass

273	53.16	48.34	0.91	-4.82	19.55	17.91	0.92	Pass
274	53.01	47.96	0.90	-5.05	19.55	17.77	0.91	Pass
275	52.90	46.82	0.89	-6.08	19.55	16.90	0.86	Pass
276	52.77	46.23	0.88	-6.54	19.55	16.44	0.84	Pass
277	52.64	45.78	0.87	-6.87	19.55	16.11	0.82	Pass
278	53.57	49.09	0.92	-4.49	19.55	18.23	0.93	Pass
279	53.45	47.26	0.88	-6.19	19.55	17.91	0.92	Pass
280	53.30	46.81	0.88	-6.49	19.55	17.80	0.91	Pass
281	53.15	46.05	0.87	-7.11	19.55	17.40	0.89	Pass
282	52.97	45.62	0.86	-7.34	19.55	17.15	0.88	Pass
283	53.29	46.63	0.87	-6.67	19.55	13.29	0.68	Pass
284	53.30	47.10	0.88	-6.21	19.55	13.53	0.69	Pass
285	53.35	47.38	0.89	-5.97	19.55	13.70	0.70	Pass
286	53.44	47.84	0.90	-5.59	19.55	13.95	0.71	Pass
287	53.45	48.03	0.90	-5.42	19.55	14.12	0.72	Pass
288	53.45	48.42	0.91	-5.03	19.55	14.52	0.74	Pass
289	53.47	48.90	0.91	-4.57	19.55	14.98	0.77	Pass
290	53.45	46.83	0.88	-6.62	19.55	13.11	0.67	Pass
291	53.45	47.11	0.88	-6.34	19.55	13.25	0.68	Pass
292	53.45	47.33	0.89	-6.12	19.55	13.43	0.69	Pass
293	53.45	47.53	0.89	-5.92	19.55	13.63	0.70	Pass
294	53.45	47.76	0.89	-5.69	19.55	13.86	0.71	Pass
295	53.45	48.18	0.90	-5.27	19.55	14.28	0.73	Pass
296	53.47	48.64	0.91	-4.83	19.55	14.72	0.75	Pass
297	53.23	46.36	0.87	-6.87	19.55	14.33	0.73	Pass
298	53.33	47.74	0.90	-5.59	19.55	15.55	0.80	Pass
299	53.35	47.96	0.90	-5.39	19.55	15.67	0.80	Pass
300	53.49	48.36	0.90	-5.13	19.55	15.84	0.81	Pass
301	53.50	48.61	0.91	-4.89	19.55	15.99	0.82	Pass
302	53.24	46.49	0.87	-6.75	19.55	14.27	0.73	Pass
303	53.34	47.71	0.89	-5.63	19.55	15.32	0.78	Pass
304	53.36	48.06	0.90	-5.30	19.55	15.58	0.80	Pass
305	53.50	48.53	0.91	-4.96	19.55	15.70	0.80	Pass
306	53.50	48.70	0.91	-4.80	19.55	15.81	0.81	Pass
307	53.27	46.58	0.87	-6.68	19.55	14.09	0.72	Pass
308	53.37	47.55	0.89	-5.82	19.55	14.81	0.76	Pass
309	53.39	47.93	0.90	-5.46	19.55	15.06	0.77	Pass
310	53.52	48.65	0.91	-4.88	19.55	15.63	0.80	Pass
311	53.53	48.82	0.91	-4.71	19.55	15.76	0.81	Pass
312	52.72	45.03	0.85	-7.69	19.55	15.01	0.77	Pass
313	52.82	46.04	0.87	-6.78	19.55	15.52	0.79	Pass
314	52.96	47.14	0.89	-5.82	19.55	16.10	0.82	Pass
315	53.02	48.66	0.92	-4.36	19.55	16.90	0.86	Pass
316	53.06	49.33	0.93	-3.73	19.55	17.06	0.87	Pass
317	52.75	45.42	0.86	-7.33	19.55	15.03	0.77	Pass
318	52.98	46.47	0.88	-6.51	19.55	15.60	0.80	Pass
319	53.00	47.31	0.89	-5.69	19.55	16.05	0.82	Pass
320	53.05	48.44	0.91	-4.61	19.55	16.52	0.84	Pass
321	53.10	48.85	0.92	-4.26	19.55	16.57	0.85	Pass
322	53.91	45.59	0.85	-8.32	19.55	15.12	0.77	Pass
323	53.98	47.56	0.88	-6.43	19.55	16.52	0.85	Pass
324	53.98	48.04	0.89	-5.94	19.55	16.93	0.87	Pass
325	53.98	48.29	0.89	-5.69	19.55	17.18	0.88	Pass
326	53.45	47.24	0.88	-6.21	19.55	15.17	0.78	Pass
327	53.46	47.74	0.89	-5.72	19.55	15.61	0.80	Pass
328	53.52	48.13	0.90	-5.39	19.55	15.93	0.82	Pass
329	53.54	48.42	0.90	-5.13	19.55	16.20	0.83	Pass
330	53.56	49.35	0.92	-4.21	19.55	17.12	0.88	Pass
331	52.74	47.58	0.90	-5.16	19.55	15.60	0.80	Pass
332	52.94	48.22	0.91	-4.72	19.55	16.04	0.82	Pass
333	53.09	48.72	0.92	-4.37	19.55	16.39	0.84	Pass
334	53.11	48.99	0.92	-4.12	19.55	16.64	0.85	Pass
335	52.09	48.75	0.94	-3.34	19.55	16.94	0.87	Pass
336	52.26	49.64	0.95	-2.62	19.55	17.20	0.88	Pass
337	52.41	50.40	0.96	-2.01	19.55	17.54	0.90	Pass
338	52.41	50.61	0.97	-1.80	19.55	17.75	0.91	Pass
339	52.50	48.73	0.93	-3.77	19.55	17.44	0.89	Pass
340	52.80	49.55	0.94	-3.25	19.55	17.44	0.89	Pass
341	52.80	49.92	0.95	-2.88	19.55	17.44	0.89	Pass
342	52.80	50.26	0.95	-2.53	19.55	17.44	0.89	Pass
343	53.50	50.03	0.94	-3.46	19.55	16.08	0.82	Pass
344	53.50	50.05	0.94	-3.44	19.55	16.10	0.82	Pass
345	53.58	50.20	0.94	-3.39	19.55	16.16	0.83	Pass
346	53.69	50.22	0.94	-3.47	19.55	16.08	0.82	Pass
347	42.81	40.84	0.95	-1.97	10.08	8.19	0.81	Pass
348	50.72	46.80	0.92	-3.92	18.56	14.64	0.79	Pass
349	46.84	42.90	0.92	-3.94	12.90	8.96	0.69	Pass
350	73.94	69.66	0.94	-4.28	25.57	22.17	0.87	Pass
351	72.73	68.85	0.95	-3.87	25.02	21.14	0.85	Pass
352	72.19	68.32	0.95	-3.87	25.31	21.44	0.85	Pass
353	72.33	68.50	0.95	-3.83	25.31	21.48	0.85	Pass
354	72.03	68.16	0.95	-3.87	25.05	21.18	0.85	Pass
355	70.51	66.60	0.94	-3.91	24.56	20.65	0.84	Pass
356	75.52	71.29	0.94	-4.23	25.95	22.68	0.87	Pass
357	71.89	67.88	0.94	-4.02	24.60	21.54	0.88	Pass
358	72.65	68.82	0.95	-3.83	24.42	21.55	0.88	Pass
359	70.94	67.29	0.95	-3.65	23.09	20.39	0.88	Pass
360	68.46	64.74	0.95	-3.72	18.13	15.36	0.85	Pass
361	69.21	65.91	0.95	-3.30	19.35	16.80	0.87	Pass
362	75.54	72.37	0.96	-3.17	26.20	24.42	0.93	Pass
363	75.70	72.27	0.95	-3.43	26.20	24.94	0.95	Pass
364	72.93	71.66	0.98	-1.26	25.49	24.25	0.95	Pass
365	72.29	70.35	0.97	-1.93	25.49	23.55	0.92	Pass
366	75.30	72.55	0.96	-2.74	26.12	24.45	0.94	Pass
367	74.04	71.99	0.97	-2.05	25.94	24.21	0.93	Pass
368	76.87	75.26	0.98	-1.61	26.67	25.14	0.94	Pass
369	72.21	70.64	0.98	-1.57	25.31	23.74	0.94	Pass
370	72.49	68.53	0.95	-3.96	25.16	23.90	0.95	Pass
371	73.04	68.91	0.94	-4.13	25.33	24.20	0.96	Pass
372	73.44	69.87	0.95	-3.58	25.39	24.62	0.97	Pass
373	73.54	69.51	0.95	-4.03	25.27	24.14	0.95	Pass
374	76.64	73.74	0.96	-2.90	26.30	25.49	0.97	Pass
375	53.23	48.89	0.92	-4.34	19.55	16.51	0.84	Pass
376	52.56	47.82	0.91	-4.73	18.93	15.78	0.83	Pass
377	52.14	46.76	0.90	-5.37	18.56	15.12	0.81	Pass
378	52.11	45.98	0.88	-6.13	18.56	14.57	0.79	Pass
379	51.96	45.09	0.87	-6.87	18.56	14.06	0.76	Pass
380	53.33	48.99	0.92	-4.34	19.55	16.60	0.85	Pass
381	53.30	48.41	0.91	-4.90	19.55	16.34	0.84	Pass
382	53.13	47.80	0.90	-5.34	19.55	16.07	0.82	Pass
383	53.11	46.98	0.88	-6.13	19.55	15.39	0.79	Pass
384	53.01	45.86	0.87	-7.14	19.55	14.57	0.75	Pass
385	52.63	45.06	0.86	-7.57	19.55	15.27	0.78	Pass
386	52.73	46.36	0.88	-6.37	19.55	15.87	0.81	Pass
387	52.87	47.36	0.90	-5.52	19.55	16.50	0.84	Pass
388	52.93	48.82	0.92	-4.11	19.55	17.31	0.89	Pass
389	52.97	49.51	0.93	-3.46	19.55	17.57	0.90	Pass
390	52.53	44.98	0.86	-7.55	19.55	15.25	0.78	Pass
391	52.63	46.31	0.88	-6.32	19.55	16.08	0.82	Pass
392	52.82	47.38	0.90	-5.43	19.55	16.80	0.86	Pass
393	52.94	48.28	0.91	-4.66	19.55	17.58	0.90	Pass
394	53.03	48.54	0.92	-4.49	19.55	17.75	0.91	Pass
395	52.65	45.19	0.86	-7.46	19.55	15.39	0.79	Pass
396	52.76	46.73	0.89	-6.02	19.55	16.21	0.83	Pass
397	52.90	47.80	0.90	-5.11	19.55	16.84	0.86	Pass
398	52.96	48.81	0.92	-4.15	19.55	17.69	0.91	Pass
399	53.00	49.26	0.93	-3.74	19.55	17.84	0.91	Pass
400	53.45	46.28	0.87	-7.16	19.55	16.77	0.86	Pass
401	53.60	46.90	0.87	-6.70	19.55	16.99	0.87	Pass
402	53.71	48.19	0.90	-5.52	19.55	17.52	0.90	Pass
403	53.74	48.76	0.91	-4.98	19.55	17.87	0.91	Pass
404	53.86	49.00	0.91	-4.86	19.55	18.00	0.92	Pass
405	53.27	45.66	0.86	-7.60	19.55	16.96	0.87	Pass
406	53.44	46.58	0.87	-6.86	19.55	17.19	0.88	Pass
407	53.60	47.29	0.88	-6.31	19.55	17.66	0.90	Pass
408	53.65	47.94	0.89	-5.71	19.55	17.89	0.92	Pass
409	53.76	48.98	0.91	-4.78	19.55	18.08	0.93	Pass
410	52.84	45.28	0.86	-7.55	19.55	17.05	0.87	Pass
411	52.93	45.90	0.87	-7.03	19.55	17.59	0.90	Pass
412	53.16	46.37	0.87	-6.79	19.55	17.91	0.92	Pass
413	53.27	47.25	0.89	-6.02	19.55	18.15	0.93	Pass

414	53.42	48.13	0.90	-5.29	19.55	18.40	0.94	Pass
415	52.74	45.17	0.86	-7.57	19.55	16.74	0.86	Pass
416	52.84	45.55	0.86	-7.29	19.55	17.03	0.87	Pass
417	53.06	46.30	0.87	-6.76	19.55	17.64	0.90	Pass
418	53.17	47.37	0.89	-5.80	19.55	17.92	0.92	Pass
419	53.32	47.98	0.90	-5.35	19.55	18.10	0.93	Pass
420	53.90	47.22	0.88	-6.67	19.55	16.90	0.86	Pass
421	54.00	47.89	0.89	-6.11	19.55	17.46	0.89	Pass
422	54.09	48.26	0.89	-5.82	19.55	17.75	0.91	Pass
423	53.94	47.41	0.88	-6.52	19.55	17.06	0.87	Pass
424	54.03	47.94	0.89	-6.09	19.55	17.49	0.89	Pass
425	54.12	48.21	0.89	-5.91	19.55	17.67	0.90	Pass
426	53.75	47.20	0.88	-6.55	19.55	17.02	0.87	Pass
427	53.86	47.66	0.88	-6.20	19.55	17.46	0.89	Pass
428	53.90	47.99	0.89	-5.91	19.55	17.75	0.91	Pass
429	53.35	46.69	0.88	-6.67	19.55	13.07	0.67	Pass
430	53.35	46.85	0.88	-6.50	19.55	13.23	0.68	Pass
431	53.44	47.29	0.88	-6.15	19.55	13.40	0.69	Pass
432	53.44	47.60	0.89	-5.83	19.55	13.71	0.70	Pass
433	53.45	47.71	0.89	-5.74	19.55	13.81	0.71	Pass
434	53.45	48.10	0.90	-5.35	19.55	14.20	0.73	Pass
435	53.47	48.58	0.91	-4.89	19.55	14.66	0.75	Pass

7.5 Appendix E: Royal Conservatoire of Scotland – Wallace Studios

RCS Window Locations
A total of nineteen window locations were analysed, these are shown in the figure below.

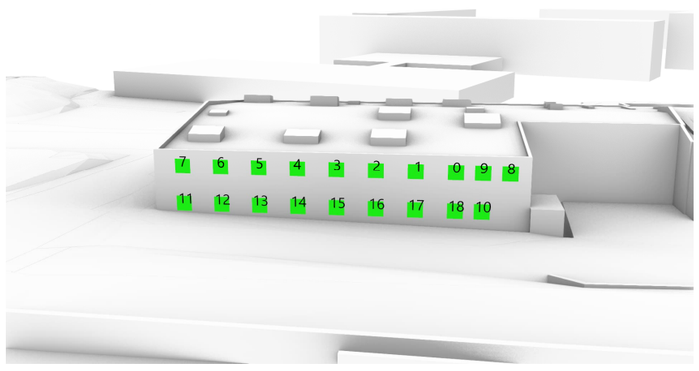


Figure 6: Royal Conservatoire of Scotland - Windows

RCS VSC Results

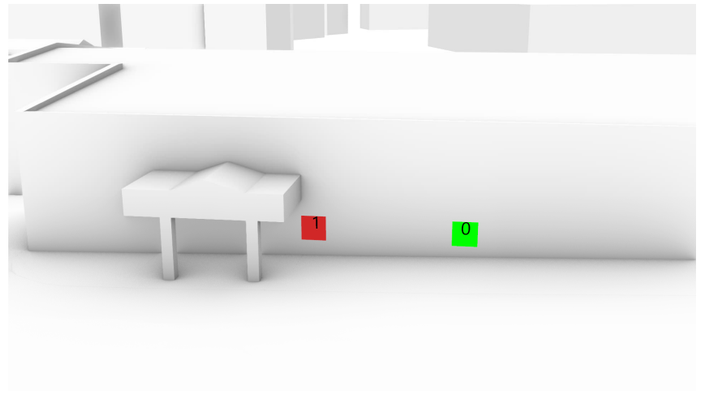
W_ref:	*VSC_E:*	*VSC_P:*	*P/E:*	*Pass/Fail*
0	35.2	29.8	0.85	Pass
1	35.2	30.2	0.86	Pass
2	35.2	30.2	0.86	Pass
3	35.4	30.7	0.87	Pass
4	35.3	30.6	0.87	Pass
5	35.3	31	0.88	Pass
6	35.3	31	0.88	Pass
7	35.2	31.1	0.88	Pass
8	35.3	29.4	0.83	Pass
9	35.4	29.7	0.84	Pass
10	34.3	29.1	0.85	Pass
11	34.4	30.1	0.88	Pass
12	34.3	29.9	0.87	Pass
13	34.6	29.8	0.86	Pass
14	34.4	29.9	0.87	Pass
15	34.7	29.4	0.85	Pass
16	34.4	29.2	0.85	Pass
17	34.5	29.1	0.84	Pass
18	34.4	28.8	0.84	Pass

RCS APSH Results

Win_ref	*APSH_e*	*APSH_p*	*APSH_rf*	*APSH_ar*	*WPSH_e*	*WPSH_p*	*WPSH_rf*	*Pass/Fail*
0	33.60	26.47	0.79	-7.13	9.57	9.57	1.00	Pass
1	33.48	26.76	0.80	-6.72	9.46	9.46	1.00	Pass
2	33.06	27.75	0.84	-5.31	9.27	9.27	1.00	Pass
3	32.89	28.33	0.86	-4.56	9.11	9.11	1.00	Pass
4	32.64	29.38	0.90	-3.26	9.01	9.01	1.00	Pass
5	32.66	29.36	0.90	-3.30	9.01	9.01	1.00	Pass
6	32.67	29.61	0.91	-3.06	8.98	8.98	1.00	Pass
7	32.41	29.97	0.92	-2.44	8.67	8.67	1.00	Pass
8	33.79	25.97	0.77	-7.81	9.61	9.57	1.00	Pass
9	33.69	26.40	0.78	-7.29	9.60	9.60	1.00	Pass
10	32.44	25.52	0.79	-6.91	8.78	8.78	1.00	Pass
11	30.47	28.13	0.92	-2.33	6.87	6.87	1.00	Pass
12	31.25	28.23	0.90	-3.02	7.56	7.56	1.00	Pass
13	31.56	28.37	0.90	-3.18	7.97	7.97	1.00	Pass
14	31.79	28.38	0.89	-3.40	8.08	8.08	1.00	Pass
15	31.68	27.12	0.86	-4.56	8.16	8.16	1.00	Pass
16	32.10	26.56	0.83	-5.55	8.31	8.31	1.00	Pass
17	32.17	25.49	0.79	-6.68	8.42	8.42	1.00	Pass
18	32.53	25.49	0.78	-7.05	8.77	8.77	1.00	Pass

7.6 Appendix F: Garscube Road

Two window locations were analysed, these are shown in the figure below.



VSC Results

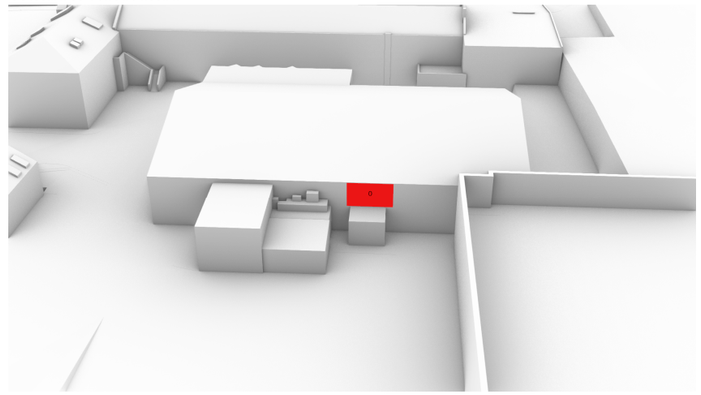
W_ref	*VSC_E*	*VSC_P*	*P/E*	*Pass/Fail*
0	33.8	29.0	0.86	Pass
1	22.3	17.4	0.78	Fail

APSH Results

Win_ref	*APSH_e*	*APSH_p*	*APSH_rf*	*APSH_ar*	*WPSH_e*	*WPSH_p*	*WPSH_rf*	*Pass/Fail*
0	27.34	23.25	0.85	-4.09	5.02	4.52	0.90	Pass
1	6.21	1.62	0.26	-4.59	1.36	0.15	0.11	Fail

7.7 Appendix G: 12 Burns Street

Window Reference



VSC Results

W_ref:	*VSC_E:*	*VSC_P:*	*P/E:*	*Pass/Fail*
0	35	21.9	0.63	Fail

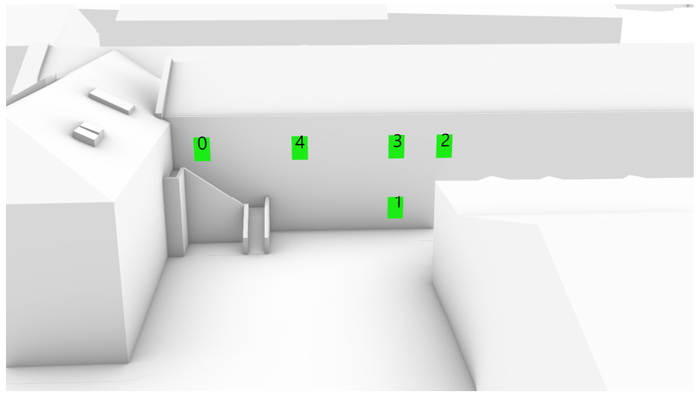
MAX FORDHAM

APSH Results

Win_ref	APSH_e	APSH_p	APSH_rf	APSH_ar	WPSH_e	WPSH_p	WPSH_rf	Pass/Fail
0	62.9	47.7	0.76	-15.2	24.2	13.5	0.56	Pass

7.8 Appendix H: 22 Farnell Street

Five window locations were analysed, these are shown in the figure below.



VSC Results

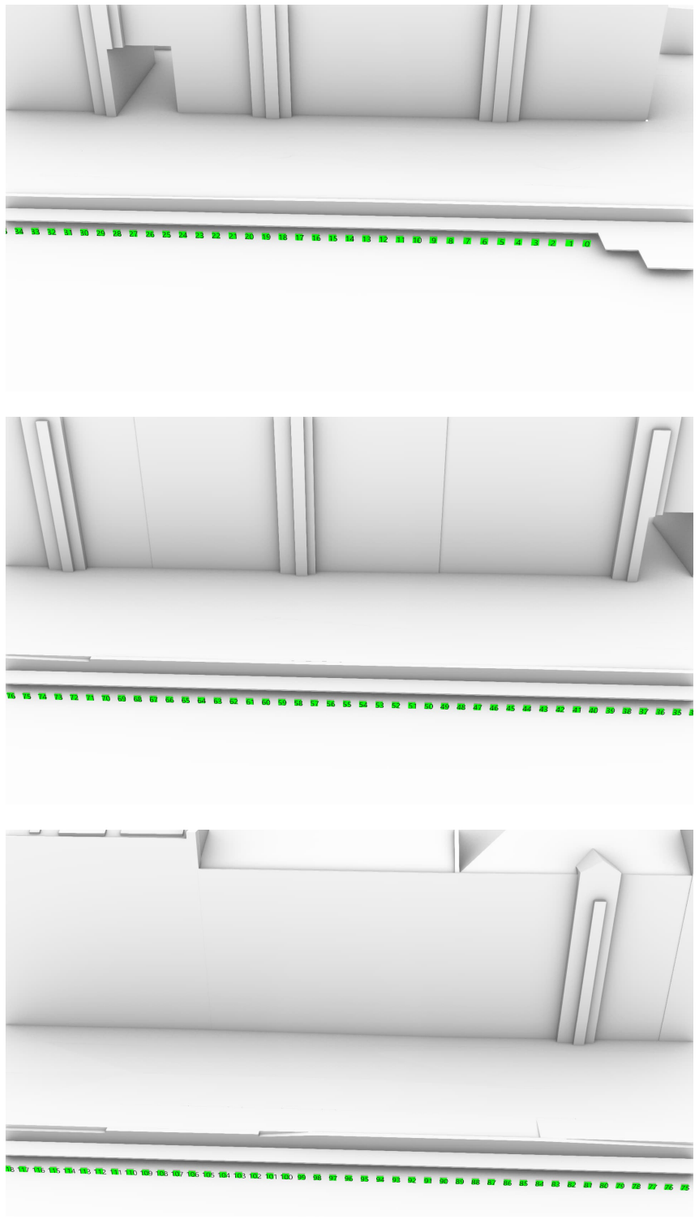
W_ref:	VSC_E:	VSC_P:	P/E:	Pass/Fail
0	30.1	26.1	0.86	Pass
1	30.2	28.6	0.95	Pass
2	35.7	31.3	0.88	Pass
3	35.8	31.6	0.88	Pass
4	35	30.9	0.88	Pass

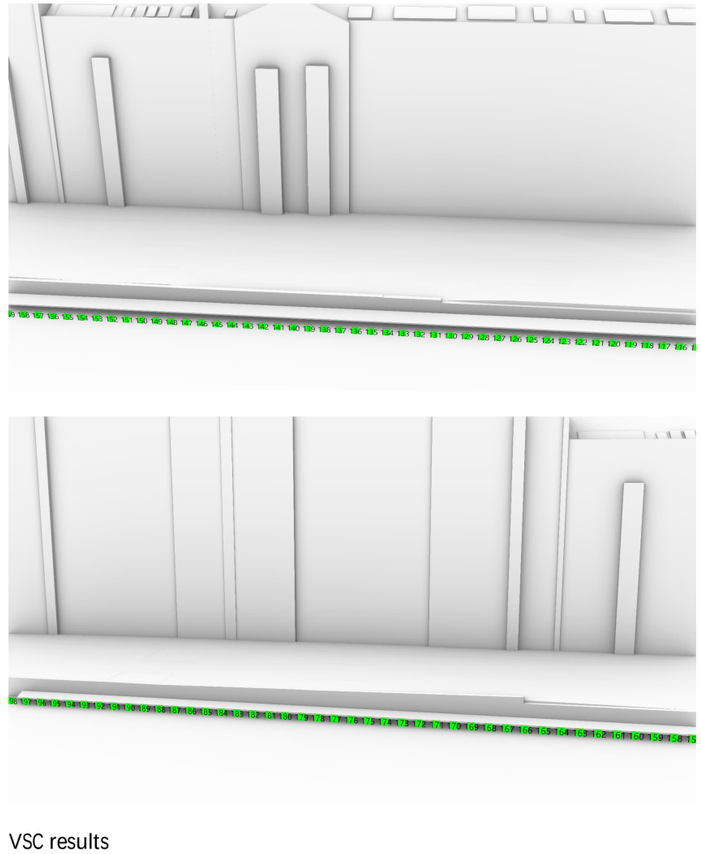
APSH Results

Win_ref	APSH_e	APSH_p	APSH_rf	APSH_ar	WPSH_e	WPSH_p	WPSH_rf	Pass/Fail
0	46.62	41.80	0.90	-4.82	13.99	9.33	0.67	Pass
1	53.78	51.60	0.96	-2.18	14.34	12.78	0.89	Pass
2	64.41	57.21	0.89	-7.20	23.62	16.67	0.71	Pass
3	63.89	57.96	0.91	-5.93	22.97	17.30	0.75	Pass
4	60.49	55.35	0.92	-5.14	20.02	15.07	0.75	Pass

7.9 Appendix J: Canal Boat Window Test

Test Locations
Window 0 is the most southernly window, window 198 is the most northernly.





VSC results

W_ref:	VSC_E:	VSC_P:	P/E:	Pass/Fail
0	38.6	33.6	0.87	Pass
1	38.6	33.6	0.87	Pass
2	38.6	33.6	0.87	Pass
3	38.5	33.7	0.87	Pass
4	38.5	33.6	0.87	Pass
5	38.5	33.6	0.87	Pass
6	38.5	33.7	0.87	Pass
7	38.5	33.7	0.87	Pass
8	38.6	33.9	0.88	Pass
9	38.6	33.8	0.88	Pass
10	38.6	33.7	0.87	Pass
11	38.6	33.6	0.87	Pass
12	38.6	33.6	0.87	Pass
13	38.6	33.6	0.87	Pass
14	38.6	33.5	0.87	Pass
15	38.6	33.5	0.87	Pass
16	38.6	33.3	0.86	Pass
17	38.6	33.3	0.86	Pass
18	38.6	33.6	0.87	Pass

19	38.7	33.5	0.87	Pass
20	38.7	33.5	0.87	Pass
21	38.6	33.5	0.87	Pass
22	38.6	33.3	0.86	Pass
23	38.5	33.3	0.86	Pass
24	38.5	33.2	0.86	Pass
25	38.5	33.2	0.86	Pass
26	38.5	33.1	0.86	Pass
27	38.5	33.1	0.86	Pass
28	38.6	33.4	0.87	Pass
29	38.6	33.4	0.86	Pass
30	38.6	33.4	0.87	Pass
31	38.6	33.4	0.87	Pass
32	38.4	33.6	0.87	Pass
33	38.4	33.6	0.87	Pass
34	38.4	33.4	0.87	Pass
35	38.6	33.4	0.86	Pass
36	38.6	33.2	0.86	Pass
37	38.4	33.2	0.86	Pass
38	38.4	33.4	0.87	Pass
39	38.4	33.4	0.87	Pass
40	38.5	33.1	0.86	Pass
41	38.5	33.1	0.86	Pass
42	38.5	33.3	0.87	Pass
43	38.5	33.3	0.86	Pass
44	38.5	33.3	0.87	Pass
45	38.5	33.3	0.87	Pass
46	38.4	33.1	0.86	Pass
47	38.4	33.1	0.86	Pass
48	38.5	33.2	0.86	Pass
49	38.5	33.2	0.86	Pass
50	38.4	32.8	0.85	Pass
51	38.4	32.8	0.85	Pass
52	38.5	33	0.86	Pass
53	38.5	33	0.86	Pass
54	38.5	33.1	0.86	Pass
55	38.5	33.1	0.86	Pass
56	38.6	32.9	0.85	Pass
57	38.6	32.9	0.85	Pass
58	38.5	32.9	0.86	Pass
59	38.5	32.9	0.86	Pass
60	38.5	32.9	0.85	Pass
61	38.5	32.9	0.85	Pass
62	38.4	33	0.86	Pass
63	38.4	33	0.86	Pass
64	38.4	32.9	0.86	Pass
65	38.4	32.9	0.86	Pass
66	38.6	32.9	0.85	Pass
67	38.6	32.9	0.85	Pass
68	38.4	32.9	0.86	Pass
69	38.4	32.9	0.86	Pass
70	38.4	32.6	0.85	Pass
71	38.4	32.6	0.85	Pass
72	38.6	32.9	0.85	Pass
73	38.6	32.9	0.85	Pass
74	38.5	33	0.86	Pass
75	38.5	33.1	0.86	Pass
76	38.5	32.8	0.85	Pass
77	38.5	32.8	0.85	Pass
78	38.5	32.6	0.85	Pass
79	38.5	32.6	0.85	Pass
80	38.5	32.8	0.85	Pass
81	38.5	32.8	0.85	Pass
82	38.5	32.7	0.85	Pass
83	38.5	32.7	0.85	Pass
84	38.5	32.7	0.85	Pass
85	38.5	32.7	0.85	Pass
86	38.5	32.7	0.85	Pass
87	38.5	32.7	0.85	Pass
88	38.3	32.9	0.86	Pass
89	38.3	32.9	0.86	Pass
90	38.4	32.6	0.85	Pass
91	38.4	32.6	0.85	Pass
92	38.4	32.7	0.85	Pass
93	38.4	32.8	0.85	Pass
94	38.4	32.8	0.85	Pass
95	38.4	32.8	0.85	Pass
96	38.5	33	0.86	Pass
97	38.5	33	0.86	Pass
98	38.4	32.8	0.85	Pass
99	38.4	32.8	0.85	Pass
100	38.5	33	0.86	Pass
101	38.5	33.1	0.86	Pass
102	38.4	33.1	0.86	Pass
103	38.4	33.2	0.86	Pass
104	38.4	33.1	0.86	Pass
105	38.4	33.2	0.86	Pass
106	38.4	33.1	0.86	Pass
107	38.4	33.2	0.86	Pass
108	38.4	33.2	0.86	Pass
109	38.4	33.2	0.86	Pass
110	38.3	33.2	0.87	Pass
111	38.3	33	0.86	Pass
112	38.3	33.1	0.86	Pass
113	38.3	33	0.86	Pass
114	38.3	32.9	0.86	Pass
115	38.3	32.6	0.85	Pass
116	38.4	32.5	0.85	Pass
117	38.4	32.7	0.85	Pass
118	38.3	32.6	0.85	Pass
119	38.3	32.4	0.84	Pass
120	38.2	32.2	0.84	Pass
121	38.2	32.1	0.84	Pass
122	38.3	31.8	0.83	Pass
123	38.3	31.7	0.83	Pass
124	38.3	31.6	0.83	Pass
125	38.3	31.5	0.82	Pass
126	38.2	31.5	0.82	Pass
127	38.2	31.4	0.82	Pass
128	38.3	31.4	0.82	Pass
129	38.3	31.3	0.82	Pass
130	38.2	31.2	0.82	Pass
131	38.2	31.2	0.82	Pass
132	38.3	31.4	0.82	Pass
133	38.3	31.4	0.82	Pass
134	38.1	31.3	0.82	Pass
135	38.1	31.3	0.82	Pass
136	38.1	31.2	0.82	Pass
137	38.1	31.2	0.82	Pass
138	38.2	31.2	0.82	Pass
139	38.2	31.3	0.82	Pass
140	38.3	31.4	0.82	Pass
141	38.3	31.4	0.82	Pass
142	38.1	31.2	0.82	Pass
143	38.1	31.2	0.82	Pass
144	38.2	31.2	0.82	Pass
145	38.2	31.3	0.82	Pass
146	38.1	31.2	0.82	Pass
147	38.2	31.3	0.82	Pass
148	38.2	31.4	0.82	Pass
149	38	31.4	0.83	Pass
150	38	31.5	0.83	Pass
151	38	31.5	0.83	Pass
152	38	31.7	0.83	Pass
153	38	31.8	0.83	Pass
154	38	31.9	0.84	Pass
155	38	31.9	0.84	Pass
156	38	31.8	0.84	Pass
157	38	31.9	0.84	Pass
158	38	31.9	0.84	Pass
159	38	32.2	0.85	Pass

160	38	32.3	0.85	Pass
161	37.9	32.3	0.85	Pass
162	37.9	32.4	0.86	Pass
163	38	32.5	0.86	Pass
164	38	32.6	0.86	Pass
165	37.8	32.6	0.86	Pass
166	37.8	32.9	0.87	Pass
167	38	32.9	0.87	Pass
168	37.9	32.9	0.87	Pass
169	37.9	33	0.87	Pass
170	37.9	33	0.87	Pass
171	37.8	33.1	0.87	Pass
172	37.8	33.3	0.88	Pass
173	37.8	33.4	0.88	Pass
174	37.9	33.6	0.89	Pass
175	37.9	33.7	0.89	Pass
176	37.9	33.8	0.89	Pass
177	37.8	33.9	0.9	Pass
178	37.8	33.8	0.89	Pass
179	37.9	33.8	0.89	Pass
180	37.9	33.9	0.9	Pass
181	37.8	34	0.9	Pass
182	37.8	33.9	0.9	Pass
183	37.9	34	0.9	Pass
184	37.9	34.1	0.9	Pass
185	38	34.2	0.9	Pass
186	38	34.5	0.91	Pass
187	37.8	34.5	0.91	Pass
188	37.8	34.6	0.91	Pass
189	38.1	34.7	0.91	Pass
190	38.1	34.7	0.91	Pass
191	38	34.8	0.92	Pass
192	38	35	0.92	Pass
193	38	35.1	0.92	Pass
194	38.1	35.1	0.92	Pass
195	38.1	35.2	0.92	Pass
196	38.1	35.4	0.93	Pass
197	38	35.5	0.93	Pass
198	38	35.2	0.92	Pass

APSH Results

Win_ref	APSH_e	APSH_p	APSH_rf	APSH_ar	WPSH_e	WPSH_p	WPSH_rf	Pass/Fail
0	53.3	43.4	0.81	-9.9	19.55	15.86	0.81	Pass
1	53.4	43.8	0.82	-9.6	19.55	15.87	0.81	Pass
2	53.5	43.9	0.82	-9.6	19.55	15.79	0.81	Pass
3	53.2	44.0	0.83	-9.2	19.55	15.75	0.81	Pass
4	52.9	44.1	0.83	-8.9	19.55	15.66	0.80	Pass
5	52.8	44.0	0.83	-8.8	19.55	15.54	0.80	Pass
6	52.6	43.6	0.83	-9.0	19.55	15.64	0.80	Pass
7	52.4	43.4	0.83	-9.0	19.55	15.65	0.80	Pass
8	52.4	43.3	0.83	-9.2	19.55	15.53	0.79	Pass
9	52.4	42.6	0.81	-9.8	19.55	15.33	0.78	Pass
10	52.3	42.0	0.80	-10.3	19.55	15.13	0.77	Pass
11	52.3	42.2	0.81	-10.1	19.55	14.78	0.76	Pass
12	52.2	42.7	0.82	-9.5	19.55	14.50	0.74	Pass
13	52.2	42.7	0.82	-9.6	19.55	14.35	0.73	Pass
14	52.1	42.4	0.81	-9.7	19.55	14.13	0.72	Pass
15	52.0	42.4	0.82	-9.5	19.55	13.81	0.71	Pass
16	52.0	42.2	0.81	-9.7	19.55	13.48	0.69	Pass
17	51.9	42.3	0.81	-9.6	19.55	13.50	0.69	Pass
18	51.9	42.3	0.82	-9.6	19.55	13.56	0.69	Pass
19	52.0	42.3	0.81	-9.7	19.55	13.44	0.69	Pass
20	52.0	42.2	0.81	-9.8	19.55	13.37	0.68	Pass
21	52.0	41.9	0.81	-10.1	19.55	13.05	0.67	Pass
22	52.0	42.0	0.81	-10.1	19.55	13.19	0.67	Pass
23	51.9	41.9	0.81	-10.1	19.55	12.93	0.66	Pass
24	51.9	41.9	0.81	-10.0	19.55	12.69	0.65	Pass
25	51.9	41.8	0.81	-10.1	19.55	12.50	0.64	Pass
26	51.8	41.9	0.81	-9.9	19.55	12.21	0.62	Pass
27	51.7	42.1	0.81	-9.6	19.55	12.12	0.62	Pass
28	51.7	42.1	0.82	-9.5	19.55	12.14	0.62	Pass
29	51.7	42.2	0.82	-9.4	19.55	12.11	0.62	Pass
30	51.6	42.0	0.81	-9.6	19.55	11.92	0.61	Pass
31	51.5	41.9	0.81	-9.6	19.55	11.86	0.61	Pass
32	51.4	41.3	0.80	-10.1	19.55	11.46	0.59	Pass
33	51.3	41.1	0.80	-10.2	19.55	11.29	0.58	Pass
34	51.3	41.0	0.80	-10.3	19.55	11.10	0.57	Pass
35	51.3	40.8	0.79	-10.5	19.55	10.89	0.56	Pass
36	51.2	40.7	0.79	-10.6	19.55	10.62	0.54	Pass
37	51.5	40.2	0.78	-11.3	19.55	9.89	0.51	Pass
38	51.7	40.0	0.77	-11.7	19.55	9.63	0.49	Pass
39	51.9	39.8	0.77	-12.1	19.55	9.71	0.50	Pass
40	52.1	39.8	0.76	-12.3	19.55	9.85	0.50	Pass
41	52.1	39.8	0.76	-12.3	19.55	10.06	0.51	Pass
42	52.2	39.7	0.76	-12.6	19.55	10.27	0.53	Pass
43	52.2	39.2	0.75	-13.0	19.55	10.31	0.53	Pass
44	52.3	39.1	0.75	-13.3	19.55	10.19	0.52	Pass
45	52.2	39.0	0.75	-13.2	19.55	10.10	0.52	Pass
46	52.3	39.1	0.75	-13.2	19.55	10.23	0.52	Pass
47	52.3	39.2	0.75	-13.1	19.55	10.32	0.53	Pass
48	52.3	39.2	0.75	-13.0	19.55	10.38	0.53	Pass
49	52.3	39.2	0.75	-13.1	19.55	10.38	0.53	Pass
50	52.5	39.3	0.75	-13.2	19.55	10.42	0.53	Pass
51	52.5	39.2	0.75	-13.4	19.55	10.29	0.53	Pass
52	52.5	39.0	0.74	-13.5	19.55	10.14	0.52	Pass
53	52.6	39.1	0.74	-13.6	19.55	10.21	0.52	Pass
54	52.6	39.1	0.74	-13.6	19.55	10.18	0.52	Pass
55	52.6	39.0	0.74	-13.6	19.55	10.15	0.52	Pass
56	52.7	39.3	0.75	-13.3	19.55	10.45	0.53	Pass
57	52.7	39.5	0.75	-13.2	19.55	10.62	0.54	Pass
58	52.7	39.4	0.75	-13.4	19.55	10.49	0.54	Pass
59	52.8	39.2	0.74	-13.6	19.55	10.46	0.54	Pass
60	52.8	39.0	0.74	-13.8	19.55	10.51	0.54	Pass
61	52.8	38.9	0.74	-13.9	19.55	10.60	0.54	Pass
62	52.9	38.6	0.73	-14.2	19.55	10.72	0.55	Pass
63	53.0	37.8	0.71	-15.2	19.55	10.68	0.55	Pass
64	53.0	37.5	0.71	-15.5	19.55	10.76	0.55	Pass
65	53.1	37.7	0.71	-15.4	19.55	10.87	0.56	Pass
66	53.2	38.3	0.72	-14.9	19.55	10.96	0.56	Pass
67	53.3	39.1	0.73	-14.1	19.55	10.92	0.56	Pass
68	53.4	39.7	0.74	-13.7	19.55	10.82	0.55	Pass
69	53.4	40.3	0.75	-13.1	19.55	10.93	0.56	Pass
70	53.5	40.8	0.76	-12.7	19.55	11.00	0.56	Pass
71	53.5	40.6	0.76	-12.9	19.55	11.13	0.57	Pass
72	53.5	40.2	0.75	-13.3	19.55	11.23	0.57	Pass
73	53.5	40.3	0.75	-13.3	19.55	11.35	0.58	Pass
74	53.6	39.9	0.74	-13.7	19.55	11.26	0.58	Pass
75	53.6	39.7	0.74	-13.9	19.55	11.24	0.57	Pass
76	53.6	39.7	0.74	-14.0	19.55	11.24	0.57	Pass
77	53.4	39.3	0.74	-14.1	19.55	11.17	0.57	Pass
78	53.2	38.9	0.73	-14.3	19.55	11.30	0.58	Pass
79	53.2	38.6	0.72	-14.6	19.55	11.27	0.58	Pass
80	53.2	38.4	0.72	-14.9	19.55	11.24	0.57	Pass
81	53.2	38.5	0.72	-14.8	19.55	11.27	0.58	Pass
82	53.2	39.1	0.73	-14.2	19.55	11.17	0.57	Pass
83	53.3	39.2	0.74	-14.1	19.55	11.18	0.57	Pass
84	53.3	39.5	0.74	-13.8	19.55	11.38	0.58	Pass
85	53.3	39.6	0.74	-13.7	19.55	11.43	0.58	Pass
86	53.4	39.7	0.74	-13.7	19.55	11.48	0.59	Pass
87	53.4	39.8	0.74	-13.7	19.55	11.57	0.59	Pass
88	53.4	39.8	0.74	-13.6	19.55	11.66	0.60	Pass
89	53.4	40.2	0.75	-13.2	19.55	11.57	0.59	Pass
90	53.3	40.2	0.75	-13.1	19.55	11.26	0.58	Pass
91	53.2	39.4	0.74	-13.8	19.55	11.16	0.57	Pass
92	53.1	39.4	0.74	-13.7	19.55	11.42	0.58	Pass
93	53.0	39.5	0.75	-13.5	19.55	11.40	0.58	Pass
94	53.0	39.8	0.75	-13.3	19.55	11.43	0.58	Pass
95	52.9	39.4	0.74	-13.5	19.55	11.38	0.58	Pass
96	52.9	39.0	0.74	-13.9	19.51	11.30	0.58	Pass
97	52.9	38.8	0.73	-14.1	19.55	11.35	0.58	Pass

98	52.9	38.6	0.73	-14.3	19.55	11.52	0.59	Pass
99	52.9	38.7	0.73	-14.2	19.55	11.78	0.60	Pass
100	52.8	38.7	0.73	-14.1	19.55	11.88	0.61	Pass
101	52.7	38.5	0.73	-14.2	19.55	11.97	0.61	Pass
102	52.6	38.8	0.74	-13.8	19.55	11.84	0.61	Pass
103	52.5	39.1	0.74	-13.4	19.55	11.81	0.60	Pass
104	52.6	39.4	0.75	-13.2	19.55	11.80	0.60	Pass
105	52.6	39.8	0.76	-12.8	19.55	11.96	0.61	Pass
106	52.5	40.3	0.77	-12.3	19.55	12.10	0.62	Pass
107	52.5	39.4	0.75	-13.1	19.55	12.27	0.63	Pass
108	52.5	39.6	0.76	-12.9	19.55	12.51	0.64	Pass
109	52.5	39.7	0.76	-12.8	19.55	12.71	0.65	Pass
110	52.3	39.6	0.76	-12.7	19.55	12.94	0.66	Pass
111	52.2	39.4	0.75	-12.8	19.55	13.18	0.67	Pass
112	52.1	38.9	0.75	-13.2	19.55	13.11	0.67	Pass
113	52.2	38.5	0.74	-13.7	19.55	12.92	0.66	Pass
114	52.1	38.6	0.74	-13.6	19.55	13.24	0.68	Pass
115	52.0	38.4	0.74	-13.6	19.51	13.28	0.68	Pass
116	52.0	39.1	0.75	-12.9	19.55	13.35	0.68	Pass
117	52.0	39.5	0.76	-12.5	19.55	13.47	0.69	Pass
118	52.0	39.5	0.76	-12.4	19.55	13.63	0.70	Pass
119	51.9	38.9	0.75	-12.9	19.55	13.73	0.70	Pass
120	51.8	38.1	0.74	-13.7	19.55	13.77	0.70	Pass
121	51.7	38.2	0.74	-13.5	19.55	14.15	0.72	Pass
122	51.6	38.2	0.74	-13.4	19.55	14.08	0.72	Pass
123	51.6	37.9	0.74	-13.7	19.55	14.06	0.72	Pass
124	51.5	37.5	0.73	-14.0	19.55	13.86	0.71	Pass
125	51.4	37.5	0.73	-13.9	19.55	13.94	0.71	Pass
126	51.3	37.2	0.72	-14.1	19.55	13.90	0.71	Pass
127	51.0	36.9	0.72	-14.1	19.55	13.93	0.71	Pass
128	50.8	36.2	0.71	-14.6	19.55	13.62	0.70	Pass
129	50.7	36.1	0.71	-14.5	19.55	13.24	0.68	Pass
130	50.7	36.0	0.71	-14.7	19.55	12.73	0.65	Pass
131	50.6	35.5	0.70	-15.2	19.55	12.26	0.63	Pass
132	50.7	35.6	0.70	-15.2	19.55	12.14	0.62	Pass
133	50.7	35.7	0.70	-15.0	19.55	12.27	0.63	Pass
134	50.6	35.2	0.70	-15.4	19.55	11.73	0.60	Pass
135	50.6	34.6	0.68	-15.9	19.55	11.20	0.57	Pass
136	50.4	34.4	0.68	-16.0	19.55	11.29	0.58	Pass
137	50.5	34.7	0.69	-15.8	19.55	11.54	0.59	Pass
138	50.6	34.8	0.69	-15.8	19.55	11.37	0.58	Pass
139	50.5	34.7	0.69	-15.9	19.55	11.12	0.57	Pass
140	50.4	34.5	0.68	-16.0	19.55	10.84	0.55	Pass
141	50.4	34.4	0.68	-16.1	19.55	10.64	0.54	Pass
142	50.4	34.4	0.68	-16.0	19.55	10.43	0.53	Pass
143	50.5	35.0	0.69	-15.5	19.55	10.18	0.52	Pass
144	50.6	35.9	0.71	-14.7	19.55	10.35	0.53	Pass
145	50.6	36.2	0.72	-14.3	19.55	10.18	0.52	Pass
146	50.5	36.0	0.71	-14.5	19.55	9.89	0.51	Pass
147	50.5	36.2	0.72	-14.4	19.55	9.79	0.50	Pass
148	50.6	36.6	0.72	-14.0	19.55	10.04	0.51	Pass
149	50.2	36.9	0.74	-13.3	19.20	10.19	0.53	Pass
150	50.2	36.6	0.73	-13.6	19.20	9.86	0.51	Pass
151	50.1	36.6	0.73	-13.5	19.20	10.01	0.52	Pass
152	50.7	37.2	0.73	-13.5	19.18	10.00	0.52	Pass
153	50.7	36.9	0.73	-13.8	19.04	9.44	0.50	Pass
154	50.5	36.9	0.73	-13.6	18.70	9.26	0.50	Pass
155	50.7	36.9	0.73	-13.8	18.70	9.15	0.49	Pass
156	50.8	36.9	0.73	-13.9	18.70	9.00	0.48	Pass
157	50.8	36.9	0.73	-13.9	18.70	8.99	0.48	Pass
158	50.8	37.0	0.73	-13.8	18.70	8.91	0.48	Pass
159	50.7	37.4	0.74	-13.4	18.56	8.81	0.47	Pass
160	50.6	37.7	0.74	-12.9	18.40	8.77	0.48	Pass
161	50.6	37.8	0.75	-12.9	18.40	8.76	0.48	Pass
162	50.7	37.8	0.75	-12.8	18.40	8.66	0.47	Pass
163	50.8	38.2	0.75	-12.6	18.40	8.69	0.47	Pass
164	50.9	38.4	0.75	-12.6	18.40	8.51	0.46	Pass
165	51.1	38.5	0.75	-12.5	18.40	8.24	0.45	Pass
166	50.8	38.9	0.77	-11.9	18.03	8.26	0.46	Pass
167	50.8	39.2	0.77	-11.6	18.03	8.25	0.46	Pass
168	50.9	39.4	0.77	-11.5	18.03	8.34	0.46	Pass
169	50.9	39.3	0.77	-11.6	18.03	8.15	0.45	Pass
170	50.9	38.8	0.76	-12.1	18.03	7.51	0.42	Pass
171	50.9	39.0	0.77	-11.9	18.03	7.66	0.42	Pass
172	50.9	39.3	0.77	-11.6	18.03	7.83	0.43	Pass
173	50.9	39.5	0.78	-11.4	18.01	7.98	0.44	Pass
174	50.8	39.7	0.78	-11.1	17.87	8.12	0.45	Pass
175	50.7	39.9	0.79	-10.8	17.78	8.21	0.46	Pass
176	50.4	40.0	0.79	-10.4	17.52	8.25	0.47	Pass
177	50.3	40.2	0.80	-10.1	17.36	8.34	0.48	Pass
178	50.0	40.5	0.81	-9.5	17.06	8.45	0.50	Pass
179	49.8	40.5	0.81	-9.3	16.83	8.47	0.50	Pass
180	49.8	40.6	0.82	-9.2	16.83	8.55	0.51	Pass
181	49.8	40.7	0.82	-9.0	16.76	8.61	0.51	Pass
182	49.8	41.1	0.82	-8.7	16.76	8.87	0.53	Pass
183	49.9	41.4	0.83	-8.5	16.76	9.08	0.54	Pass
184	49.9	41.1	0.82	-8.8	16.74	8.86	0.53	Pass
185	50.0	41.1	0.82	-8.9	16.76	8.77	0.52	Pass
186	50.4	41.4	0.82	-9.0	17.11	9.05	0.53	Pass
187	50.4	41.4	0.82	-9.0	17.11	9.03	0.53	Pass
188	50.4	41.4	0.82	-9.0	17.11	9.00	0.53	Pass
189	50.6	41.6	0.82	-8.9	17.18	9.03	0.53	Pass
190	51.0	42.2	0.83	-8.7	17.46	9.41	0.54	Pass
191	51.2	42.6	0.83	-8.5	17.61	9.65	0.55	Pass
192	51.2	43.0	0.84	-8.3	17.62	9.78	0.56	Pass
193	51.3	43.0	0.84	-8.3	17.62	9.69	0.55	Pass
194	51.3	43.2	0.84	-8.1	17.62	9.90	0.56	Pass
195	51.4	43.4	0.85	-8.0	17.64	10.05	0.57	Pass
196	51.6	43.8	0.85	-7.8	17.90	10.47	0.58	Pass
197	51.6	43.9	0.85	-7.7	17.90	10.48	0.59	Pass
198	51.6	44.0	0.85	-7.6	17.92	10.57	0.59	Pass