



# 1.1- Introduction to Charles St Green Roof (GR) Renovation Project

## Explanation of My Project Plan

**Stage One:** Initial research stage of my project. Information I will gather at this stage will be more generalised and not be focused on the Charles St buildings itself. This is so I can gain a broad range of knowledge and then adapt it to my project during my design stage. Analysing existing GRs will provide me with fresh ideas and inspiration.

**Stage Two:** This stage is a review of the current conditions of the Charles St GR. Collecting as much information about the GR as possible will help me specify my design to be the most transferrable to Charles St.

**Stage Three:** I will use this stage to review research points I have found in stage one. It is important to establish an expert panel as these individuals can provide technical feedback to me during the design process. This especially applies to the financial details of GRs and their materials. A large general opinion poll with aid me in deciding which GR features are in demand at SHU and therefore attract the most visitors.

**Stage Four:** A draft design is important to find improvements in my draft, and also gives me an opportunity to gain more opinions of the GR design. During my conclusion I will compare my final designs to my project aims and also review my entire project process.

## Project Aims:

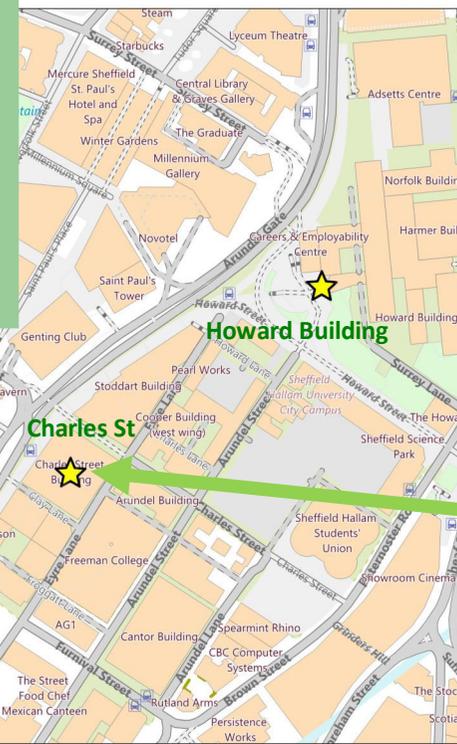
- Create a pleasant environment that is open to SHU students.
- Keep sustainability and ecosystem services at the core of my design.
- Ensure my final renovation design is financially viable.

The Charles St Buildings green roof space has great potential, with the building itself being very large and multifunctional. The building receives high foot traffic with many students having classes in the building, as well as being incredibly close to the main entrance to the city campus buildings.

Currently, the green roof has little to no use, which could be seen as a wasted opportunity, especially as it is overall cheaper to renovate an already existing green roof, rather than retro fitting a completely new green roof from a regular roof.

Instead, this green roof could be renovated to accommodate public access, with appropriate safety features. This area could be used as a social space, a learning space, a quiet space, or even include features for income including a garden or cafe. This would increase the financial viability of the renovation.

Sheffield Hallam City Campus



Charles St Building Roof Area: 2036.1 m<sup>2</sup>

Distance from SHU main entrance (Howard Building): 230 m (>3minute walk)

(Source: <https://digimap.edina.ac.uk/>)





UONST, 2021

# 1.2- Analysis of Existing GRs

University Of Nottingham– Overall the university has an impressive 12 GRs (UONST, 2021). The GR on UON campuses are mainly extensive, meaning a shallow soil depth limits vegetation but eases maintenance. Environmental benefits are the main reasons and function of this universities GRs. These benefits include flood mitigation, reducing the urban heat island effect, absorbing sound pollution, increasing biodiversity, and improving air quality (Hui, 2013). These points are also especially important at a city campus university.



TGRC, 2018

University Of Melbourne– The GR space at this university was proven in a study to improve students concentration and energy. The city has over 50 GRs, providing positive benefits for both the environment and to individual wellbeing.

## Sheffield Green Roofs:



TGRC, 2018

West One– This GR was a particularly early, and therefore innovative, GR development for Sheffield, with the 4,000 M<sup>2</sup> GR being completed in July 2004 (TGRC, 2018). The Contractors for this GR were a large company called BriggsAmasco, who also developed Birmingham New Street Station, as well as many other GR projects around the UK. West One is mainly a residential building, there are also some shops, therefore its courtyard areas allow for both public and private access.

TG

Bus Shelter– As a quirky edition to Sheffield's City centre, there is a bus shelter with a 6m<sup>2</sup> green roof on Leopold St. The project was carried out by Groundworks Sheffield and the Sheffield Green Roof Forum (TGRC, 2018). This links to a city wide collaborative programme to increase GRs across Sheffield with the initiative of sustainable and environmentally conscious infrastructure (Dunnett, 2006).



TGRC, 2018

Sharrow Primary School– Limited ground space was the main force behind retrofitting Sharrow Primary School with a GR. It is made up of three levels; a play area, an outdoor classroom, and a nature preserve. This means the GR serves both the community and the ecosystem, within its area of 2,044 M<sup>2</sup> (TGRC, 2018). There are 700 plant species and a pond made from recycled materials, accommodating a range of local wildlife. In fact, this is the first GR in the country to be granted local nature reserve status (Making Lewes, 2018).



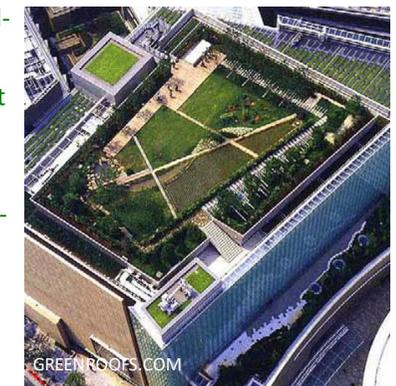
Making Lewes, 2018



Belilios Public School, 2021

Belilios Public School– This 800M<sup>2</sup> GR in Hong Kong was completed in 2010, although the development was disrupted by the need for additional safety features such as railings and rainwater control systems, due to the public access of the roof (Hui, 2013). This shows mean that I need to ensure there are more than enough safety features for my project, to avoid this situation.

Roppongi Hills– This is a large 13,000 M<sup>2</sup> residential GR development in Tokyo (Hui, 2013). Sense of community is brought to the GR through a vegetable garden, and expansive green space, inside a dense city. Environmental benefits such as reducing the urban heat island effect are especially important benefits of the infrastructure.



GREENROOFS.COM

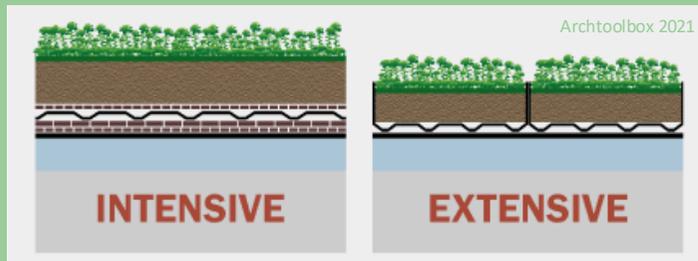
# 1.3.1- GR Feature Research

## Practical Considerations

- **Public Access:** Important for the success of my design, but also vital for maintenance. Forms of appropriate access to the roof include an elevator, or stairwell, either from inside the building, or round the outside with safe railing in place. Security is also important when public access is in place. Plenty of lighting is another important design feature, would public access be permitted after sunset?
- **Roof Capacity:** Material weight is important to consider, an extreme example of this is that a building structure wouldn't be able to withstand the weight of a fully grown oak tree! I should consider vegetation, building materials (e.g. bricks, gravel), along with any other infrastructure included on the roof (e.g. tables), and the human capacity of the roof.
- **Materials:** Sustainability is at the core of my design, and therefore my selected building materials should reflect this. This can include using recycled material for new infrastructure. High wind levels can cause uplift and erosion so materials on roof need to be durable and plant species need to be chosen well (Hui, 2013). Wind levels are also highest at the corners and sides of the roof, effecting where I may put plant boxes in my final design.
- **Roof Type:** As my aim is to make the Charles St GR accessible to SHU students, therefore the GR type will need to be intensive. This roof type has a deeper soil depth, also allowing for a larger range of vegetation on the roof, therefore increasing my options for potential plant species (Hui, 2013).



Pinterest.com



## Social Features

- **Accessibility:** It is important that the features are made available to everyone. As it is a roof, stairs are most likely used for access, but this prevents disabled accessibility. I will need to find out if an elevator is accessible to the roof.
- **Wellbeing:** On top of being a climatic regulator, GR contribute to the universities shared leisure space, overall improving the socialisation of students (Chan, 2013). This will reflect positively upon students mental wellbeing and sense of social cohesion, strengthening the community. The space could also be used for exercise, which highly improves wellbeing.
- **Potential Income:** If the GR is somewhere people enjoy spending large periods of time, it would make sense to make available refreshments through either a cafe, smoothie bar, small shop, or even restaurant. This would bring more people to the GR and bring in income.
- **Education:** As the GR is situated on SHU city campus, space could be made for an outdoor learning area, where students can meet with lecturers, study, or work on group projects. There is also opportunity to provide education surrounding agriculture, sustainable living, and renewables, through the facilities on the GR.



Kaylem Bolleau



Pinterest.com

www.potinc.ca



metmuseum/instagram.com

## 1.3.2- GR Feature Research

### Renewable Features

- **Photovoltaic Solar Panels:** Depends on surrounding buildings, orientation, and exposure to sunlight. Energy from this can be used to power facilities on the roof, including lighting, entertainment, coffee machines, water pumps etc. GRs actually increase solar panel efficiency due to high exposure and evaporation having a cooling effect. A negative is that solar panels are usually installed on extensive roofs due to their large surface area (Hui, 2013).
- **Wind Turbines:** Depends on its exposure to wind, and general direction and slope. Energy from this can be used to power facilities on the roof, including lighting, entertainment, coffee machines, water pumps etc. A wall of mini turbines is one of the most efficient ways to collect wind energy as wind level are highest at the edges and corners of a GR (Kitcher, 2012).



### Vegetation Features

- **Garden:** Intensive roofs allow for increased root penetration volume, nutrients and water supply, meaning a wider range of plants can be supported on the roof. Although higher wind and solar radiation levels will need to be considered (Hui, 2013). It is important that the GR is full of plants native to south Yorkshire area in order to accommodate local wildlife, influencing biodiversity. The GR could even be set up similar to an allotment where students can grow food and herbs. Beehives could even be kept!
- **Composting System:** A composting station that is accessible to students could inspire a sustainable lifestyle and sense of community among the alumni. This would also provide the rooftop garden with natural nutrient rich compost, rather than ordering artificial fertiliser. Waste from university kitchen could also be disposed of here.
- **Maintenance:** The GR could have a grass floor, although this would increase maintenance requirements due to cutting, whereas planters would not have this issue. Walk paths would also need to be established to ensure human access. Hopefully, garden maintenance could be carried out on a volunteer basis!



- **Rainwater Harvesting System (RHS):** RHS can be important features on GRs as they can store rainwater to ensure the garden will stay self-sufficient, even during dry periods. The irrigation system can be gravity fed, meaning there is no extra energy needed. Water collected will also prevent excess water run off during rainy periods, with the GR itself already reducing this to help prevent urban flooding.



# 2.1- Analysis of Charles St GR



The current state of Charles St GR is just sedum. This is because this vegetation require little to no maintenance, but still provides the building with GR benefits such as flood water mitigation. Giving Charles St GR a function will motivate more biodiversity on the roof due to a larger range of plants and therefore increase the need for maintenance.

There are some walls present around the structure of the GR. This will protect certain areas from high wind speeds, and also means that railing will not need to be put here. On top of this, there is also an opportunity to turn these walls into living walls, introducing more greenspace into my design.

Some of the roof space is at different levels as shown by the small staircase. This will need to be taken into account when designing pathways for my GR as well as when considering disabled access.



The red areas on this layout plan represent where the GR on Charles St actually is. Therefore, the two sections will need to be linked via a bridge to achieve accessibility for my design. The separation of the two sections could also mean I could have a different function for each half. For example, one half could be for quiet study, while the other is for study and recreation.

Photovoltaic Solar Panels are already present on the Charles St green roof, showing SHUs sustainable design focus. In my design I need to ensure not to shade this area, as this would massively reduce the efficiency of the solar panels. Surplus energy produced by these panels can be used to power lighting and any other facilities included in my final design which require energy.



Ian Jones (SHUs Building Condition and Design Manager) kindly provided me with these images of the Charles street Green Roof and a layout plan!

Drawing title  
CHARLES STREET LEVEL 6

Drawn By/Scale	Date
1/250/AS	12/12/16
Drawing No.	Revision



Facilities Directorate Campus Creation  
City Campus, Peverell St, Sheffield  
S11 9BT Telephone 0114 226 6006

# 2.2- Establishing Target Consumers

## Key Topics to Cover in Opinion Poll Questions

As I was unable to gain access to a wide panel for my opinion polls, I will be using social media, specifically Instagram, to gain responses to my questions. This is positive as I will be able to gain a rather broad range of opinions, although it would be interesting for my to ask which respondents go to SHU, to see if they have any specific knowledge, without invading their privacy. To mirror my broad pool of respondents I will need my questions to also be broad.

### Hui (2013) divides a GRs function into four groups;

- i) *Ecological*– This is to design focusing on benefiting the surrounding biological communities and ecosystem. Example of these design features include: Flower beds, vegetable gardens, water fountains, beehives, trees, and green walls.
- ii) *Recreational*– This refers to any feature that provides leisure, and enjoyment. Example of these design features include: Spaces to socialise (benches), refreshment areas (Bar, cafe, restaurant), space for sport activities.
- iii) *Economic*– Any feature that brings income would be economically beneficial to my design. This could include providing services such as with a bar, cafe, or restaurant. Income can also be brought in by selling product grown on a GR garden, or renting space on the GR.
- iv) *Aesthetic*– These design features are more focused on beauty rather than functionality, although can link to recreation as a pleasant surrounding helps provide a pleasant experience. On top of this, aesthetically pleasing garden features will also serve ecological functions.

Before designing my GR in need to look into each function, as well its benefits and popularity with the rest of the university. If the GR was to be developed for an undesired function, its would remain an unused area and eventually general maintenance would decrease. Multiple functions could be combined in my design as there are two large separated sections to the GR.

As the GR is also a part of SHU city campus, it needs to be decided if the area will provide more of a educational or social function. Opinion polls would be a great way to find out which function would be more successful.

## Student Opinion via SHU Societies

Reaching out to different relevant societies would be a good way to gain an idea of the different groups within the university and their possible interest in the GR. Establishing these societies would also mean my design accommodates all types of students at SHU through the use of primary data to influence my design choices.

*Plantaholics*– This society could be interested in a roof top garden.

*Yoga Society*– Could the GR be a good space for yoga sessions to be held?

*Reading Society*– The GR could make a good peaceful reading spot.

*Disabled Student Committee*– The GR should be open to everyone, including the disabled community.

*GeoSoc*– May be interested in adding accessible green space to the campus.

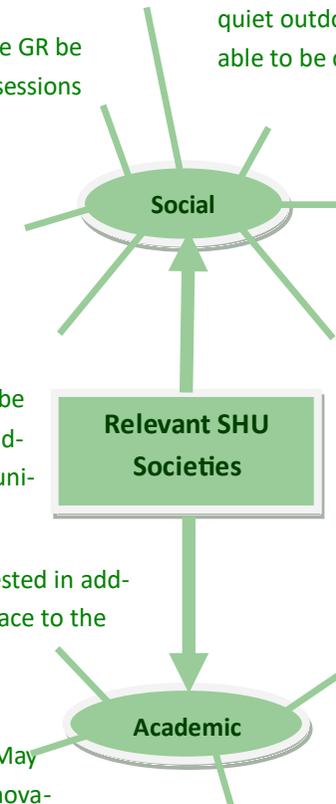
*Architecture Society*– May be interested in the renovation project.

*Fine Art Society & Kit Like Your Nana Society*– Would the GR be a suitable quiet outdoor space where people were able to be creative?

*Religious Societies*– GR could be a quiet peaceful place for prayer.

*Wine Society*– If the GR was to become a bar this could bring in income.

*Food & Nutrition Society*– Could the rooftop garden grow fruit, vegetables, or herbs?



*Events Management Society*– The GR could be a good space to hold and host events.

## 2.3- Financial Overview

### Timber Features:

- **Footbridge**– A timber beam footbridge will be required to link the two GR sections (I.T. Transport, 2004). It is important the bridge is wide enough for disabled access and is structurally sound with railing for safety reasons. For this reason approximately 8 timber beams in total would be required for a bridge of our required size. One beam is around £10 so the materials for this bridge will be **£80**.
- **Railing**– This will be needed for the entire perimeter of the GR area to ensure safe public access. Timber will again be used for this feature to communicate a natural feel when on the GR. With one beam at £10 I just need to know the overall perimeter of GR to find full cost.
- **Planters**- Plant boxes will also be made from timber as well as a composting station, creating a continuous style of design across the whole GR. The amount of planters is dependent upon my final design, and therefore also the cost of timber.
- **Seating**– Tables, chairs, and benches need to be provided so students and staff can use the GR as a rest stop and enjoy their time as well as any available refreshments. These seating areas can be used for either quiet working or for socialising. Timber increases design value. Timber huts may also be erected to protect people from rain meaning the space is still usable on Sheffield's many rainy days. One of these huts could also be turned into a cafe.



### Pebble Features:

- **Fire Breaks**– Government guidance for GR fire safety suggests firebreaks that are 500mm in diameter should be applied in intervals around the side of the GR, especially around any vertical features (DCLG, 2013). A pebble boarder is a good fire break and also aid filtration, therefore this material will be a common feature in my design. A 102kg bag of pebbles costs **£36** (Sedum Supply, 2021).
- **Paths**- Pebbles will also be used for the pathways, once I have designed my GR and know the area of path I will need, I will then be able to work out the amount of pebble bags I will need to order at the price of **£36**.

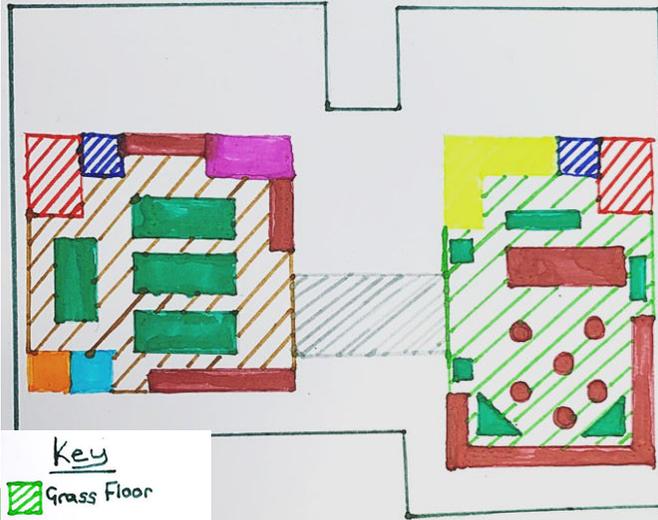


### Additional Features:

- **Rainwater Irrigation system**– This is a vital feature in ensuring the GR remains self-sustainable. The irrigation system can be gravity fed therefore not required any energy to function (Waterfall, 2004). The cost of this feature ranges from **£2000-£3000** according to the UK Rainwater Harvesting Association.
- **Lighting**– A range of lighting at different brightness will be required. Whether these are small lights, bright lights, fairy lights, or solar lights, a range of styles will add to the design of my roof. Lights4fun.com prices commercial lighting for around **£200**.
- **Maintenance**– Costs could be kept to a minimum by running a garden volunteer programme with students within the university, and also by getting societies involved. This will also have a positive effect on students sense of community and wellbeing. Maintenance includes weeding, pruning, and fertilising.
- **Roof type**- Does the roof type need to be converted from extensive to intensive? Overall CheckATrade.com estimates an intensive roof average cost to be £130 per m<sup>2</sup>. As this project is just a redevelopment and not an entire retrofit, their low estimation cost of £60 per m<sup>2</sup> is more applicable to my project.



# 3.1- Draft GR Designs



- Key**
- Grass Floor
  - Gravel Floor
  - Foot Bridge
  - Stairwell
  - Elevator
  - Seating Area
  - Planters
  - Cafe/Bar
  - Gardening Shed
  - Compost area
  - Water Harvesting System

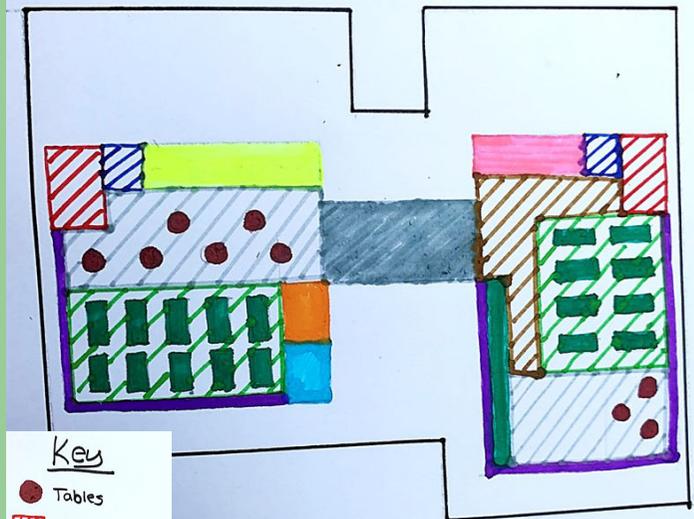
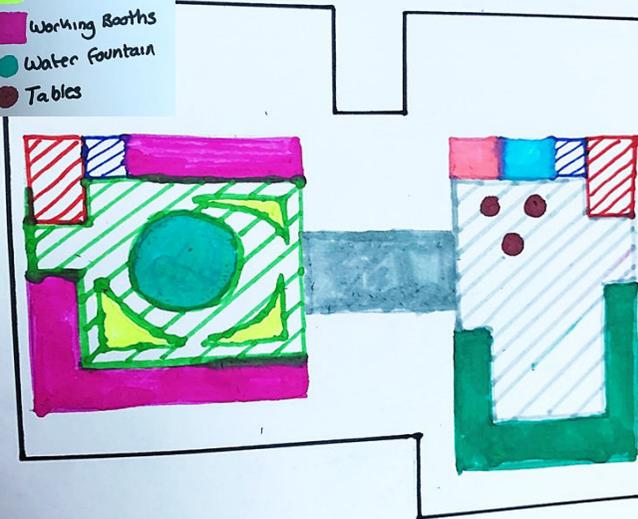
## Draft Design One

I have focused design 1 more on social and recreational functions. The left roof area is the gardening area, with the large planters representing a community effort to grow crops, also with plenty of seating giving students an opportunity to relax. The crops could be sold or used in the cafe/ bar, or they could just be pretty flower beds! All my designs have the Compost, WHS, and accessible wooden bridge connecting the two side of the GR. The right side of design 1 has plenty of seating meaning there is plenty of space for students to socialise. The cafe/bar would be student run—although I am unsure of the limitation around serving alcohol! This would require further research, but could be a popular option among students.

## Draft Design Two

Design two covers mainly educational functions, which would apply to a city university campus. This is created on the left area of my GR design through quiet working stations, of which surround the perimeter. This leaves spaces for a grass floor, multiple flowers beds, and a central focus of a water fountain- which is self-sustained with the water harvesting system. This means ecological functions are also covered. On the right side of my design, planters around the edge create a green wall for a central clearing on the roof. Having a large clearing with removable seating leaves the space open to be used for lots of different functions such as sports classes (such as yoga) or gallery showing. For this reason, I have made the floors wooden timber which provide a natural feel and matches the green walls.

- Key**
- Stairwell
  - Elevator
  - Grass floor
  - Wooden floor
  - Foot Bridge
  - Planters
  - Water Harvesting System
  - Multi-use shed
  - Flower beds
  - Working Booths
  - Water Fountain
  - Tables



- Key**
- Tables
  - Stairwell
  - Elevator
  - Grass floor
  - Gravel floor
  - Wooden floor
  - Foot bridge
  - Planters
  - Pebble Boards
  - Mixed-Use Shed
  - Cafe
  - Water Harvesting System
  - Compost Area

## Draft Design Three

Design 3 combines many functions but is ultimately the most economically viable, but this may come at some consequence to the tranquillity and possibly the overall aesthetics of the GR. There are lots of small planters scattered throughout the both sides of the GR, these would be a part of a university allotment style program where students would be able to rent planters for a year. This would encourage a sustainable lifestyle among students as well as bring in income. The cafe also does this on top of encouraging socialisation, with plenty of seating. The seating can also be removed to make space for activities the space could be rented for. The inclusion of gravel is also a good design aspect that double as fire breaks, which they are included both as a path and as borders. This is because pebble as a material is resistant to fire therefore providing protection.

# 3.2- Opinion Poll of GR Features



## Intro

I decided it would be a good idea to begin my questionnaire with a short definition of GRs due to the broad range of participants I may receive. This is also accompanied with images in order for the public to gain a visual idea. As my social media is followed by people of my similar age, most questions will apply and relatable to respondents.



## Question One:

My first question covered Hui's four functions of a GR. To limit the amount of slides people will need to go through, I have also included images of Charles St GR in the background, as well as a small explanation of my project. This communicates to my participants what my project includes, offering more understanding when answering the first question.

Do you think a green roof allotment programme work on a university city campus ?

YES NO

## Question Two:

This is a general question that will not only help me decide the input of a feature in draft design 3, but also see if it would be successful. It is also a simple closed question, easy for participants to answer and simple for me to review and compare.

Would you rather have a rooftop bar or cafe on your university campus?

BAR CAFE

## Question Three:

Another simple question which will help me decided between two similar features that are both economically positive. If The popular vote is a Bar I will conduct further research into alcohol on campus to see if this design feature would be suitable in reality.

What sort of atmosphere would you prefer for a Green Roof space?

QUIET AND RELAXING FUN AND SOCIAL

## Question Four:

This question is general, applying to any university. Therefore my non-specific participant pool will not negatively effect my results and are still applicable to my project. Maintenance for the garden is an important topic to cover because the predicted upkeep will effect the size/ intensity of the garden.

Do you think a volunteer scheme for garden maintenance would work?

YES NO

## Question Five:

My draft designs all explored different types of atmospheres, with different functions, space, and greenery. This question offers a nice way summarising these differences, of which I can combine with results from other questions to help decide my final design features.

Just one more question...

Are you a student at SHU?

YES NO

Thank you so much for taking part in my poll! Appreciate you :)

## Question Six:

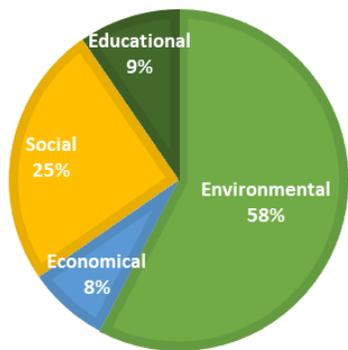
I saved this question for last as I feel a fellow Hallam student will hopefully help me by completing the poll! While this question wont influence my design choices at all, it is just helpful in review of my answers overall, as they are the most applicable answers.

# 3.3- Opinion Poll Answers and Analysis

Overall 48 people responded to my poll, with some questions even receiving 53 responses. Therefore my sample size is not consistent meaning comparisons between different results may not be fully accurate, although this does not mean they are not useful. Additionally, the different sample sizes mean that percentages on a pie chart, rather than raw data, would be the best way to visually present this data.

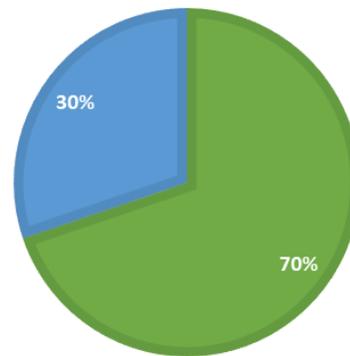
QUESTION 1

■ Environmental ■ Economical ■ Social ■ Educational ■ Quiet and Relaxing ■ Fun and Social



Environmental functions are a clear popular focus for my design. I will convey this through plenty of green features such as grass floor, green walls, and planters. The second most popular is social meaning I should provide plenty of seating.

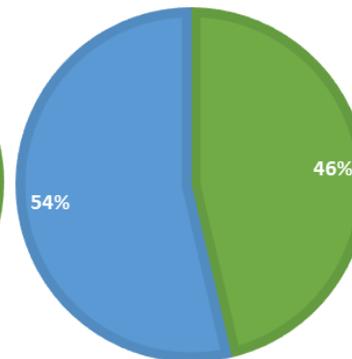
QUESTION 2



A quiet environment is the most appealing to people of my age group. This directly relates to the popular vote on question one meaning green space and relaxation space will be useful to combine.

QUESTION 3

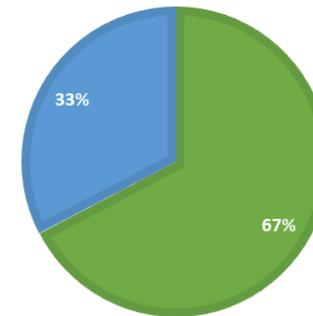
■ Bar ■ Cafe



A rooftop cafe is just 4% more popular than a bar, I believe this may be because of the similarities of the businesses. Due to the clear popular answer in question two, a cafe would be best to maintain a peaceful and relaxing atmosphere on the roof.

QUESTION 4

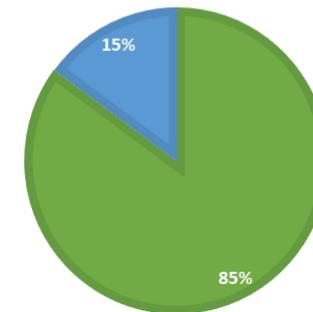
■ Yes ■ No



This question referred to a potential volunteer scheme on the green roof. More people than I expected like the idea of a volunteer scheme, although it is hard to tell if this would be the case in real life. There is also opportunity to hire cafe workers on a voluntary basis.

QUESTION 5

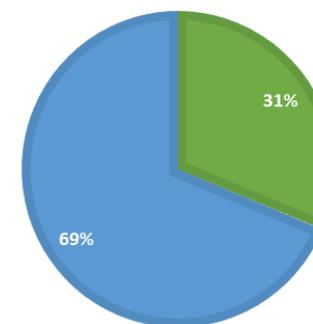
■ Yes ■ No



Question five shows that people would very much be in favour of an allotment scheme on a green roof. Due to the interest for this plan, I will definitely make this a key feature in my final design.

QUESTION 6

■ Yes ■ No



The final question was important in reflecting how much knowledge my participants may know about SHU campus. While this figure shows that under half are SHU students, almost all respondents were of a similar age group to a student— therefore meaning my results still apply to my project

# 4.1- Final Design

There is a large seating area in the corner designed in mind for society meet ups. The surrounding flowers and green wall make the area aesthetically pleasing as well as separating the table from the main cafe seating area. This ensures the main area can remain quiet and peaceful, as determined desirable through my opinion polls.

Using flower beds as a boarder to the seating area is aesthetically pleasing, but also acts a wind barrier as wind levels are highest at the edge of the roof.

The cafe is a great way to attract more people to the green roof. On top of that will provide jobs to students. There is also a green wall behind the cafe bar, making it aesthetically pleasing.

The wooden footbridge will be made from reclaimed timber and successfully allow mobility between the left and right side of the green roof. It is also wide enough to allow for disable access.

The water harvesting system is placed in the top corner so the can easily link the water fountain on the parallel green roof. Water can also be fed to the harvesting system round the edge of the roof.

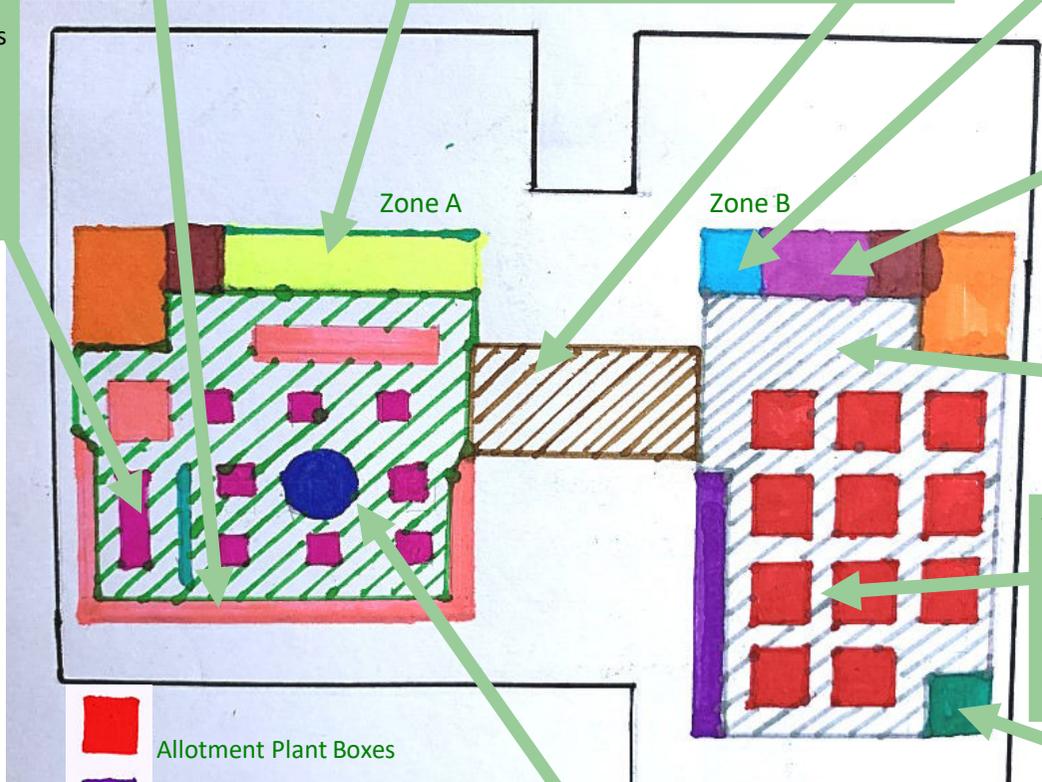
There is a large communal gardening shed as it makes renting an allotment space more accessible to student, as buying gardening equipment can be expensive. Therefore, use of this equipment is included when students rent an allotment space.

Gravel Flooring makes a good base for gardening, whereas grass flooring would easily be destroyed by the transporting of gardening equipment. It is also a very fire resistant material.

There are benches on the side to encourage the allotment work to be a community activity. Students could rent an allotment space for a year with their housemates. These benches offer more comfort to the activity. The benches are made from the same timber as the wooden footbridge.

The compost bin has been strategically placed in the corner of the roof, away from the bridge, stairs, and elevator. This is because customers from the cafe may walk through this way, who may put other rubbish in the bin, rather than waste from the allotment. It also limits the smell, but is still close enough to all allotment spaces.

The seating layout for the cafe allows for a reasonable amount of customers to sit in, without overcrowding the roof. The central water feature is visible to all guests, as well as flower beds near every table, overall making for a tranquil experience on the green roof. The grass floor will also give the customer the feeling they are in a garden, which is hard to find on a university city campus!



### Key:

-  Wooden Foot Bridge
-  Grass Floor
-  Gravel Floor
-  Stairs
-  Elevator
-  Flower Beds
-  Cafe
-  Picnic Tables
-  Green Wall
-  Water Fountain

-  Allotment Plant Boxes
-  Garden Equipment Shed
-  Water Harvesting System
-  Compost Bin
-  Benches

# 4.2- Conclusion for Final Design And Project

## Aims Review:

- 1. Create a pleasant environment that is open to SHU students.:** All students and staff at SHU will be allowed access the green roof, but on top of this the designated seating area for society socials gives the GR and student run cafe an additional function. A sense of community among student may also be felt through the allotment scheme, on top of the vegetation and water features making for pleasant surrounding.
- 2. Keep sustainability and ecosystem services at the core of my design:** Solar panels already present on roof could power cafe, making the space sustainable through renewable energy. The compost space means garden is self sustaining, and the water harvesting system means that water fountain is self-sustaining. Overall the GR teaches students a healthy, sustainable lifestyle. Building materials sourced will also be eco friendly such as reclaimed, recycled, or reused materials.
- 3. Ensure my final renovation design is financially viable:** The cafe brings in more money as it offers a unique selling point, on top of having space to hold events outside of opening hours. The Allotment space renting scheme will also ensure a steady income.

## Project Review:

Sourcing contacts and establishing an expert panel proved very difficult during this project, leading to a very different result from my expected Gantt chart plan. This was because my only method of contact within the university was via email (due to COVID restrictions) making it a struggle to find the right person to email, as well as guaranteeing a response.

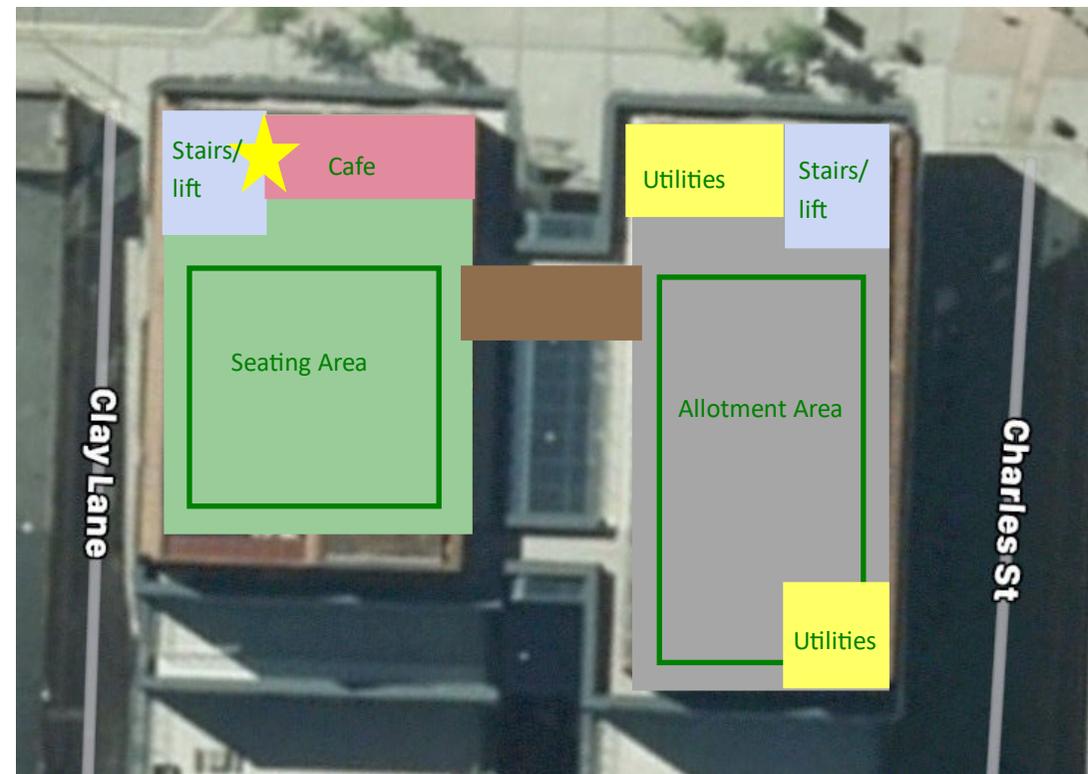
My original, and possibly optimistic, plan going into this project was to go on a visit to the Charles St Building GR, in order to conduct various solar and wind test, as well as measurements. This unfortunately did not go to plan, although reasoning for this could be COVID, and struggling to find correct contacts.

Due to these reasons the solar panels were not drawn into my final design, as I was not 100% sure where they were, and where they would be most efficient. In this image I have marked with a star where the solar panels appear to be via GoogleEarth. Therefore they would be moved on top of the cafe and elevator infrastructure.

## Financial Review:

As I do not have exact measurements of the roof I am unable to come up with a specific cost analysis for the materials required to renovate the Charles St GR.

Therefore my project has been more focused on making my final design transferrable and financially viable through establishing key source of income once construction is completed.





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