RIAI Rising Star in Architectural Technology Award 2020

3rd Year Synopsis

Word Count:2000 Words

Entry Number: 217

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2 Introduction

This is an overall synopsis of the work I have completed throughout my third year in architectural technology. I will integrate the following topics into my discussion and highlight the challenges I have encountered, and the solutions proposed in response to these.

- Technical response to a design brief.
- The integration of sustainability.
- The use of analytical and collaboration tools.

3 Technical Response to a Design Brief:

As part of the technical design studio module for this year, we were designated into small groups and provided with a competition design for a new urban primary school that has been produced by a firm of architects. I audited and tested the original proposal and produced sets of working drawings with all relevant specification based on the analysis. However, the main challenge was to change the proposals to incorporate new timber technologies and in turn developing and detailing, using these.

In comparison to other years this was a very different experience and did take some time to adjust. In other years, all of the students were usually presented with very similar or the exact same designs, meaning problems that presented themselves, could be resolved collectively sometimes in the course. Some students did experience some similar issues with their designs; however every single student would have to alter this solution to suit their own individual design, which could be very challenging in some instances. This year was a lot more individual and professional which really mirrored an office environment. Looking back now, I feel it really did benefit and prepare me for the office environment in second semester.

Having worked in a professional practice for the past 3 months, it has really highlighted the intensity that college has presented this year. The workload did initially seem very overwhelming and daunting, however in hindsight I can see that this has really developed my time management and work delegation which is essential in a professional setting.

The first task I had to tackle in response to the design brief was to develop an architectural audit to demonstrate an understanding of the architectural intentions on the designed building. This involved critically analysing the whole building and highlighting all items that were non-compliant or needed to be adjusted for convenience. I had to ensure that all aspects of the design complied with the TGD's and Dept. of Education Guidelines for Primary Schools. I determined all aspects which did not comply and needed to be revisited and adjusted. This all had to be developed while also acknowledging and maintaining the original architectural idea.

The Dept. of Education Guidelines for Primary Schools is another form of standardisation I was not familiar with coming into third year and I felt it was very beneficial to have some experience in deciphering these documents in relation to the school requirements. These standards do veer off from the original TGD's in some respects such as room sizes, heights and accessibility requirements. I found it particularly interesting how some of these standards were cultivated to adhere to the requirements of the people that would be occupying the building.

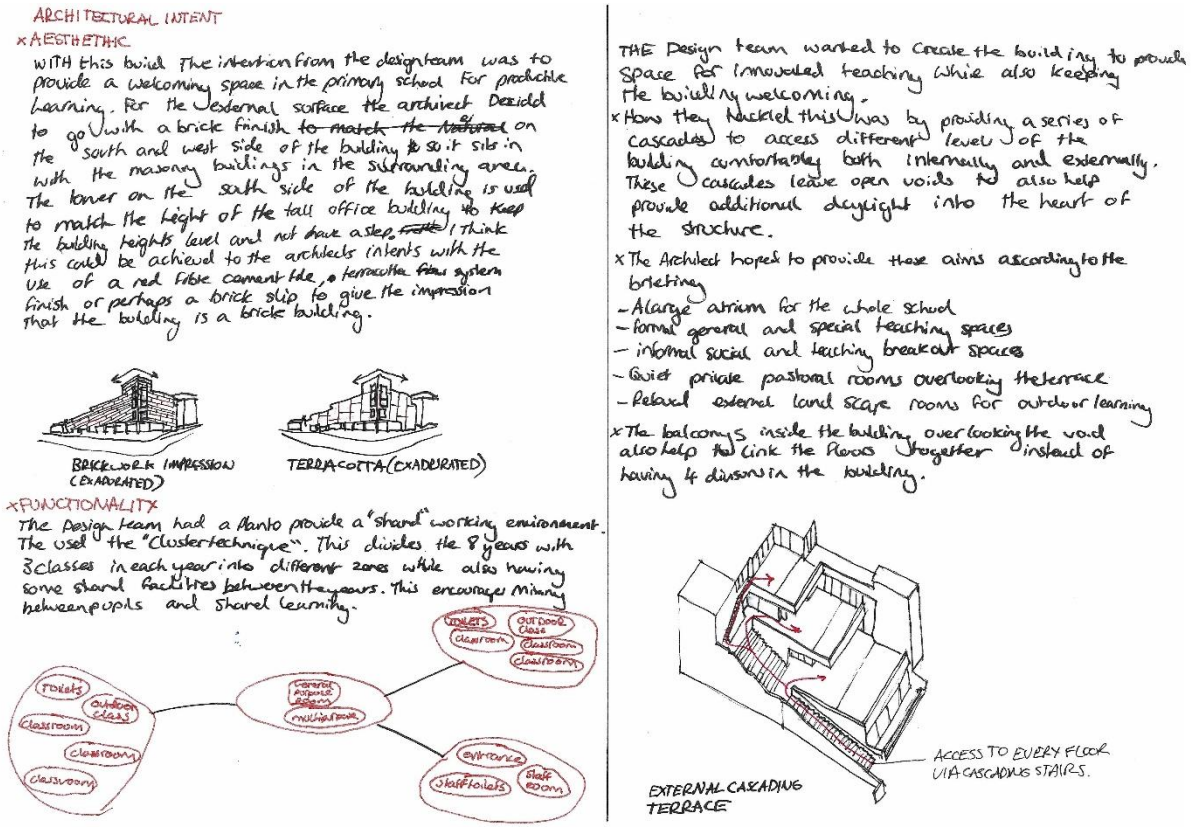

Fig 3.1- Investigation into the architectural intention

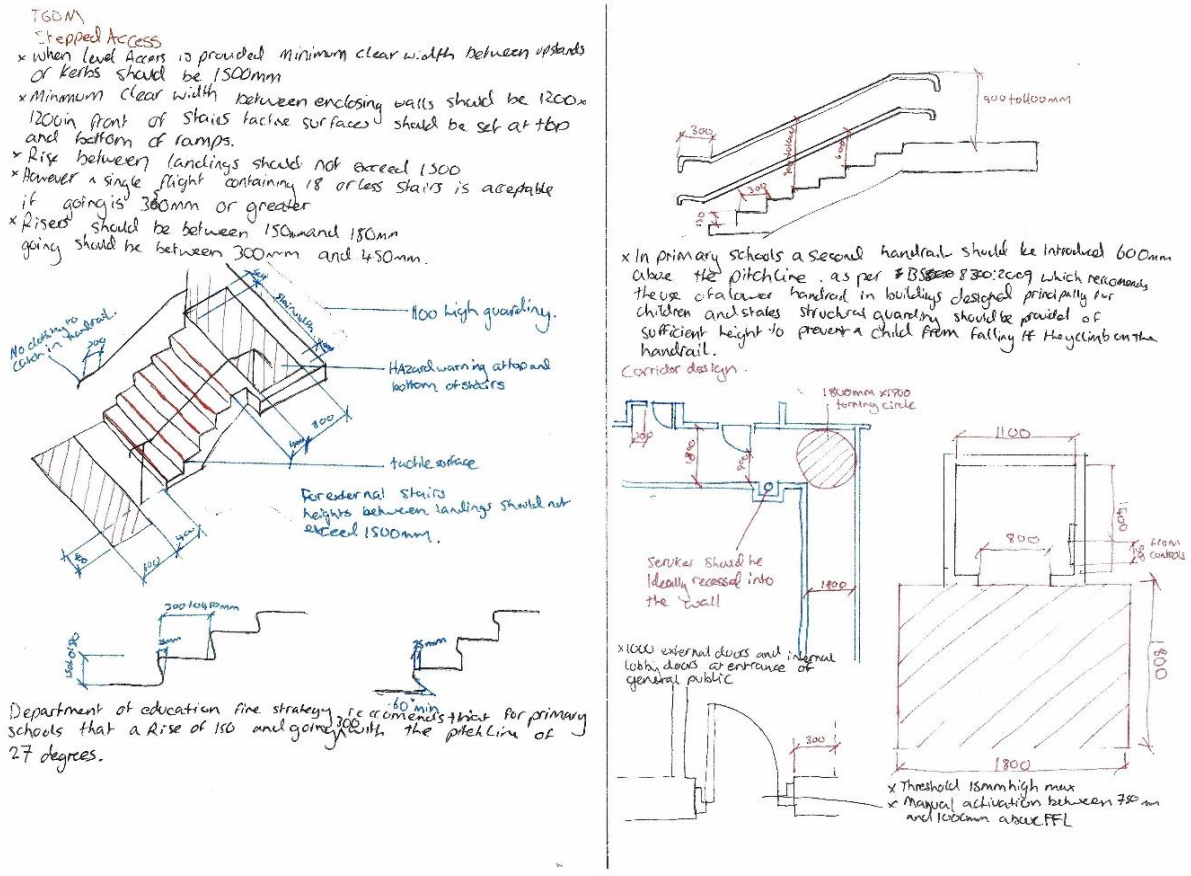

Fig 3.2- Investigation in relation to part M of the TGD's

With the design, some complications did arise with the structural integrity as there was a series of cascading external terraces, a concrete basement and an atrium space internally. All these architectural features had to be expressed to ensure the architectural intention was achieved while also working under dimensional limitations provided by the glulam and cross laminated timber manufactures. I also had to be very cautious in ensuring there was enough space for the integration of services. This was probably the most difficult task I have been presented with in architectural technology to date and I feel it will benefit me greatly in the future. From my technical analysis I derived a solution that involved a mixture of cross laminated timber walls and floor slabs along with glulam columns and beams with external insulation to ensure thermal continuity throughout, while also maintaining the architectural intent and abiding by the structural constraints.

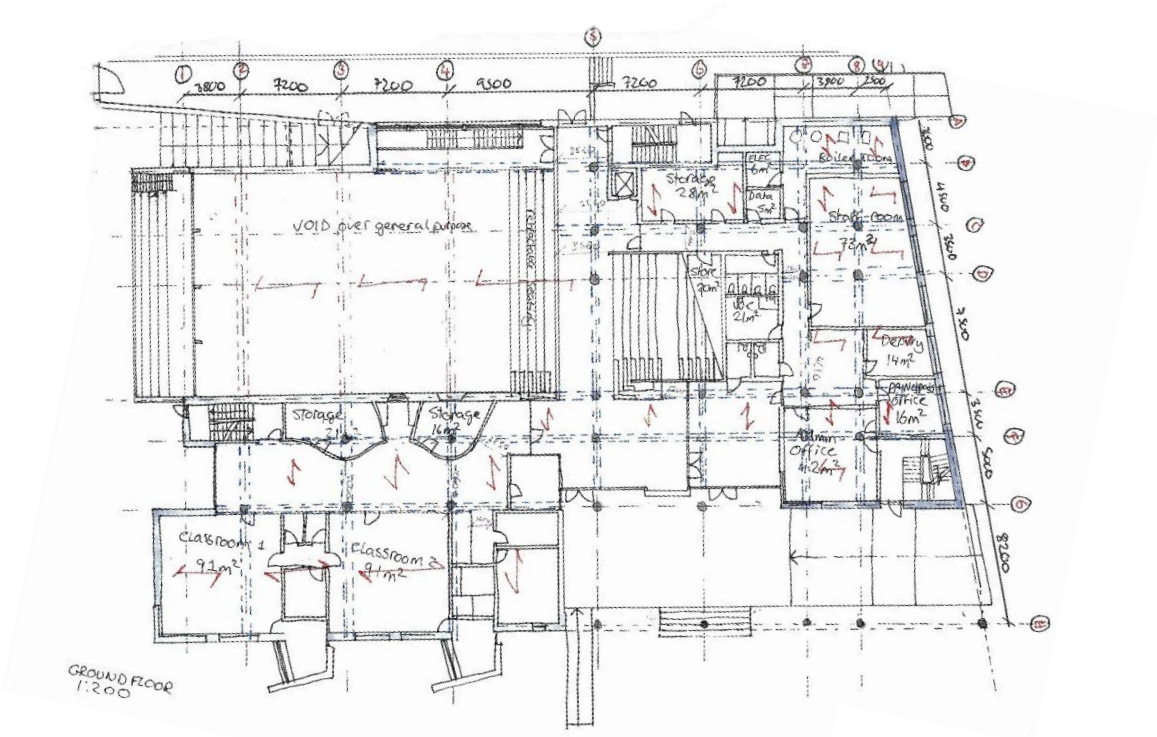

Fig 3.3- Sketched ground floor structural layout plan

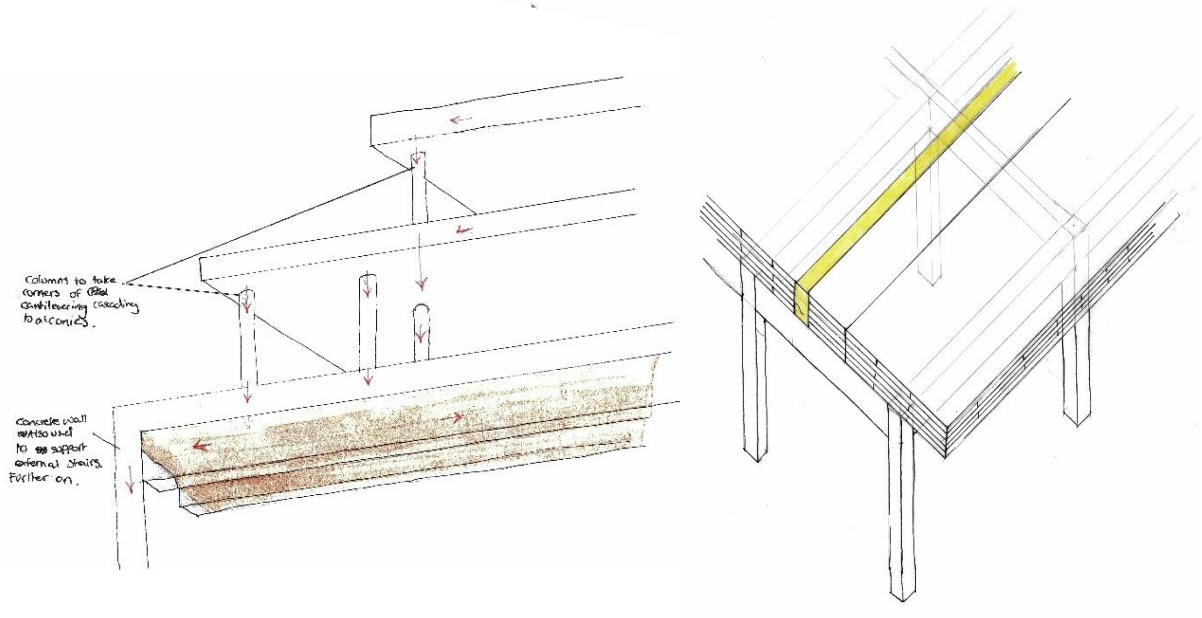

Fig 3.4- Structural technical analysis

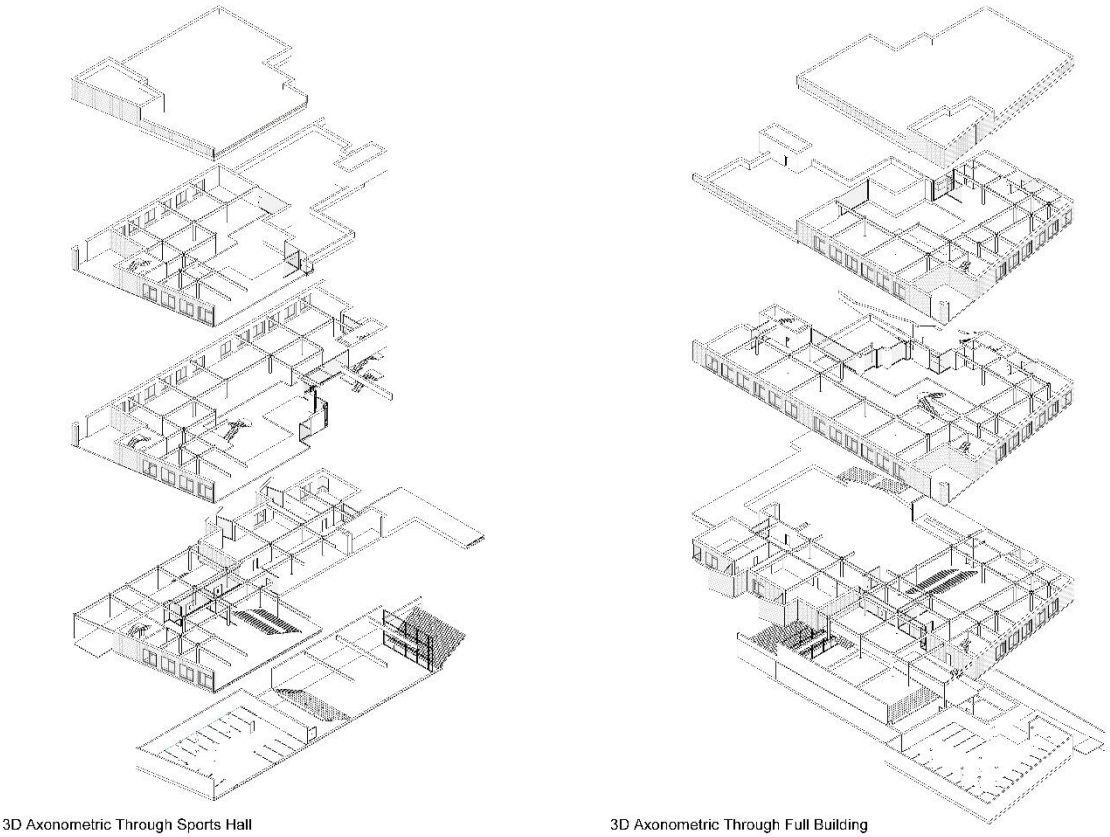

Fig 3.5- 3D Exploded structural axonometric views

I really feel that my ability to technically analyse, produce working drawings and competence to work alongside the TGD's and other standards has vastly improved in comparison to first and second year. This is due to more design specific problems but also my engagement in the course. This really provided me with a platform to excel in problem solving and will be very beneficial in my future endeavours as an architectural technologist.

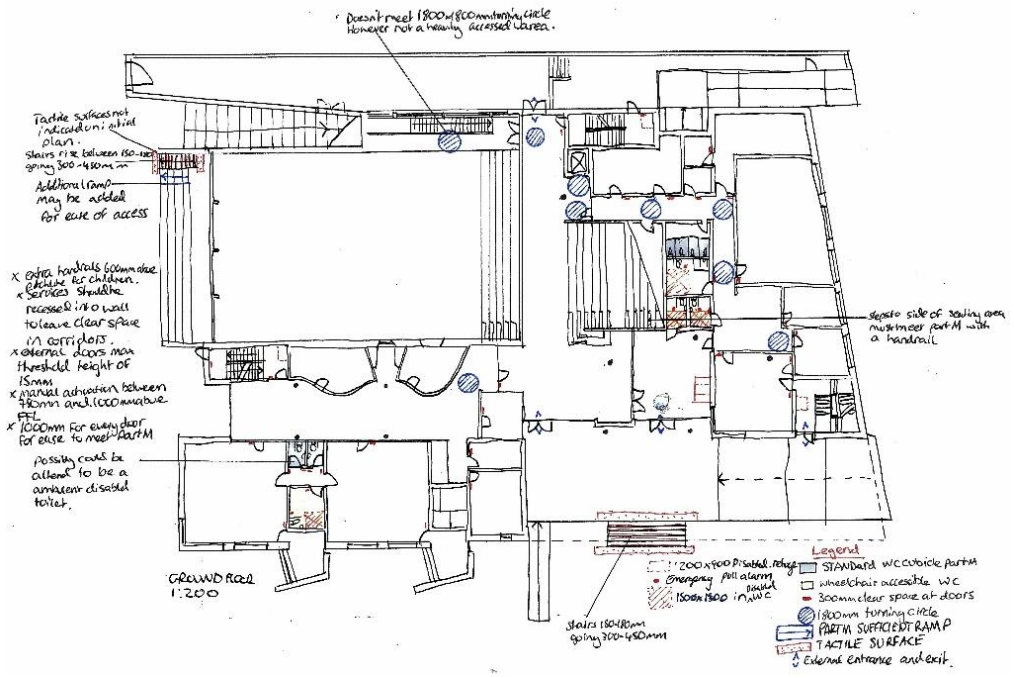

Fig 3.6- DAC accessibility assessment

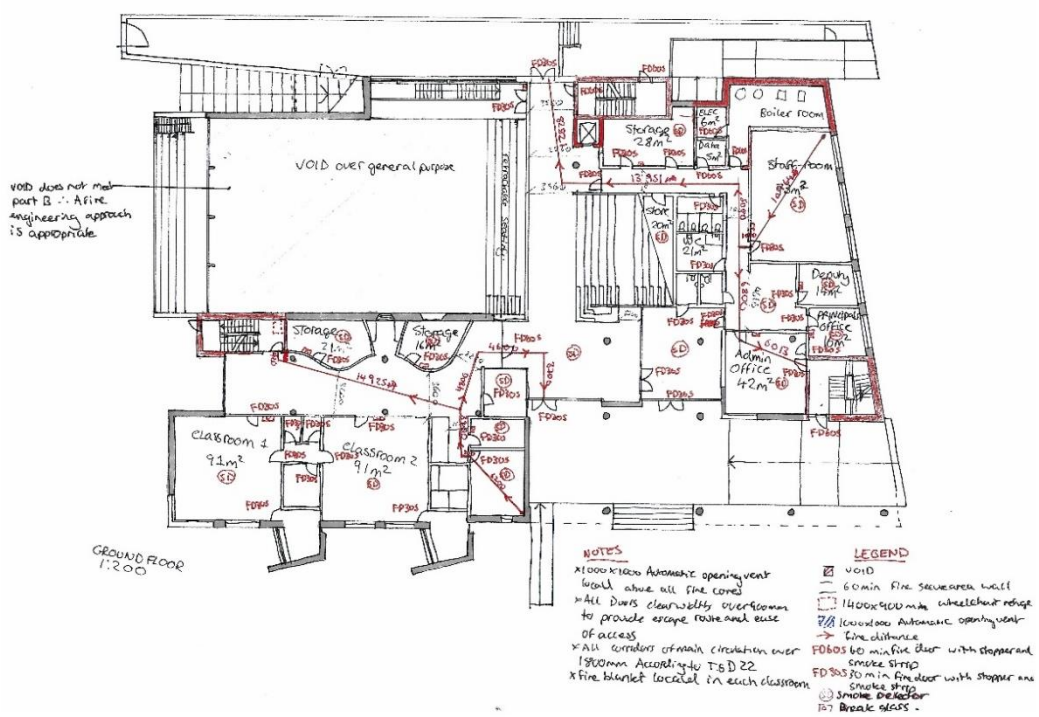

Fig 3.7- TGD part B fire assessment

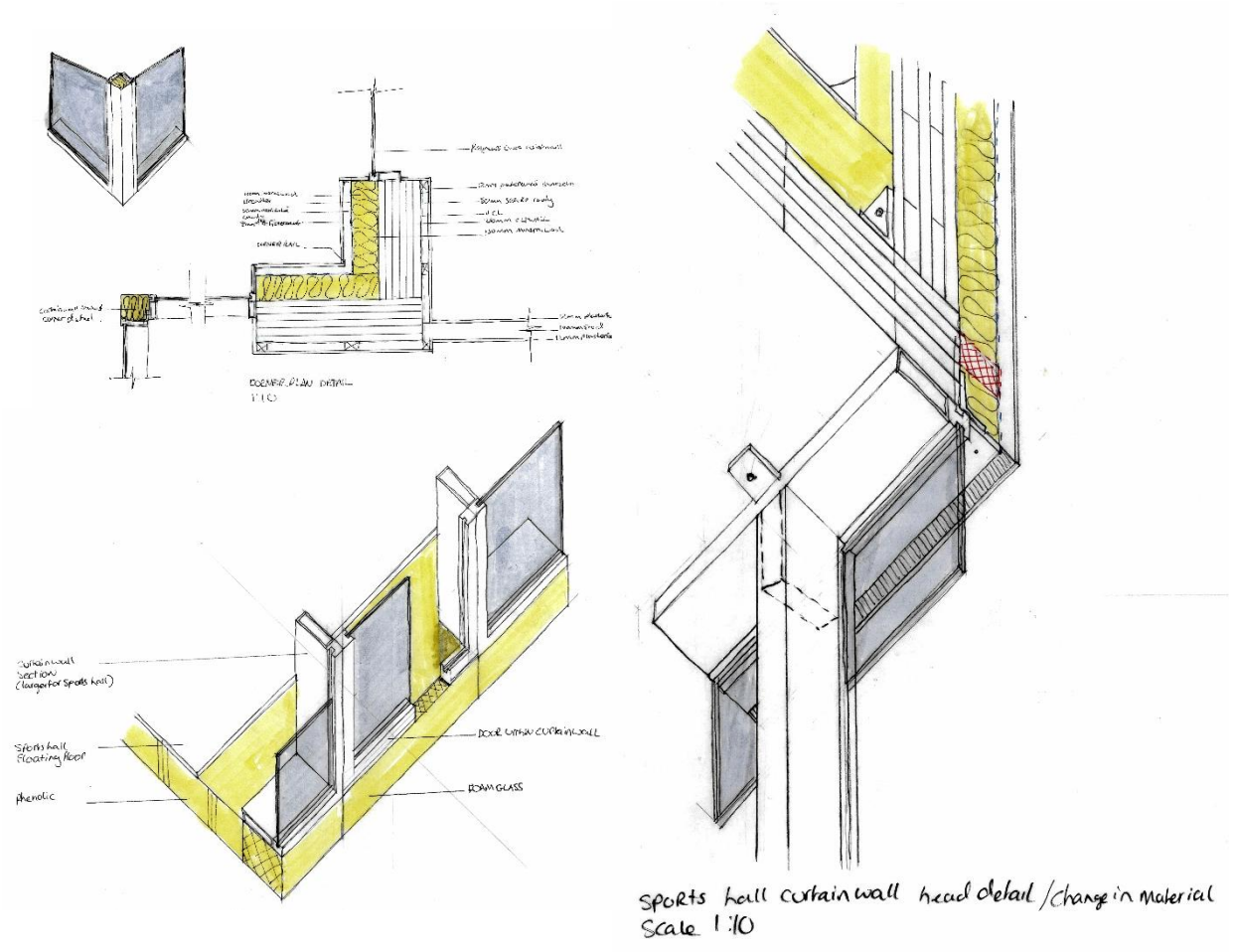

Fig 3.8- Investigation into critical junctions in the external envelope

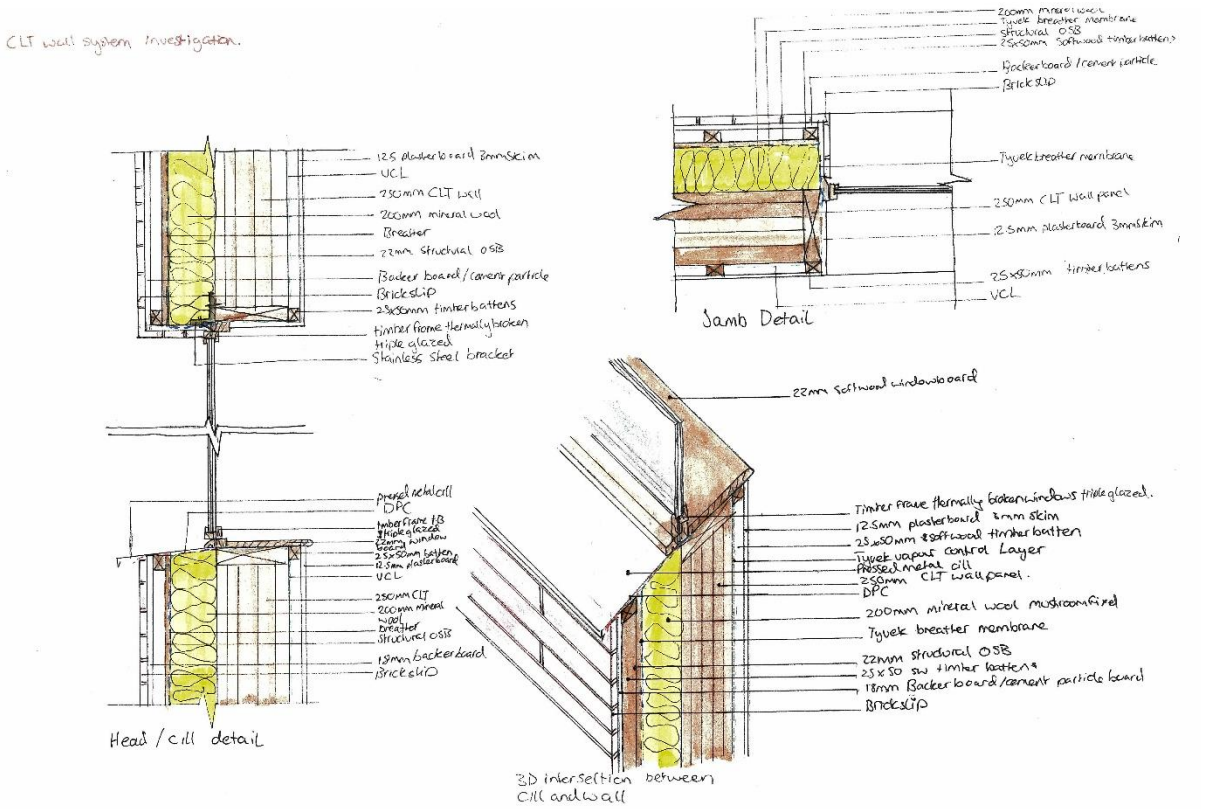

Fig 3.9- Window cill detail technical analysis

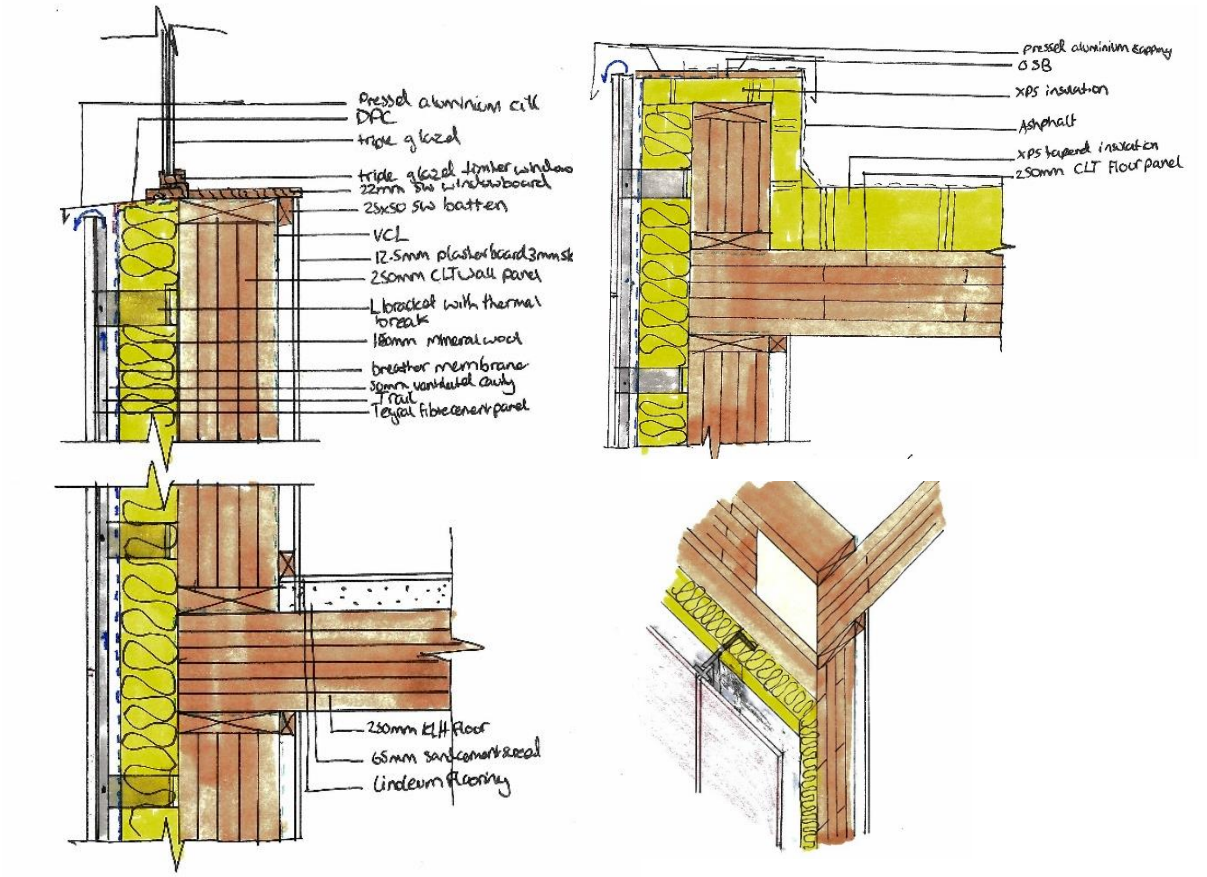

Fig 3.10- Intermediate floor, parapet and window cill details technical analysis

4 The Integration of Sustainability:

Environmental performance and sustainability were main factors to be incorporated in the development of the school building. Issues which I investigated as part of my analysis included areas such as the building form, building envelope, chosen method of construction, embedded energy, material selection, heating and ventilation strategy, buildings life cycle, passive heating and thermal mass.

Since the NZEB standard will apply to all new buildings occupied after the 31st of December 2020, we were required to base our design for the school on this. According to the SEAI a Nearly Zero Energy Building is defined as a building designed to incorporate optimal energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent from renewable resources.

Nearly Zero Energy Building Standard

As part of my environmental strategy I began by examining the buildings form in response to the surrounding elements on and off the site, identifying elements such as trees and a new neighbouring office building which could provide some potential shading to prevent overheating in the building. I also highlighted areas that may potentially present some issues regarding overheating and identified some potential access points which could be utilized along with pedestrian parking.

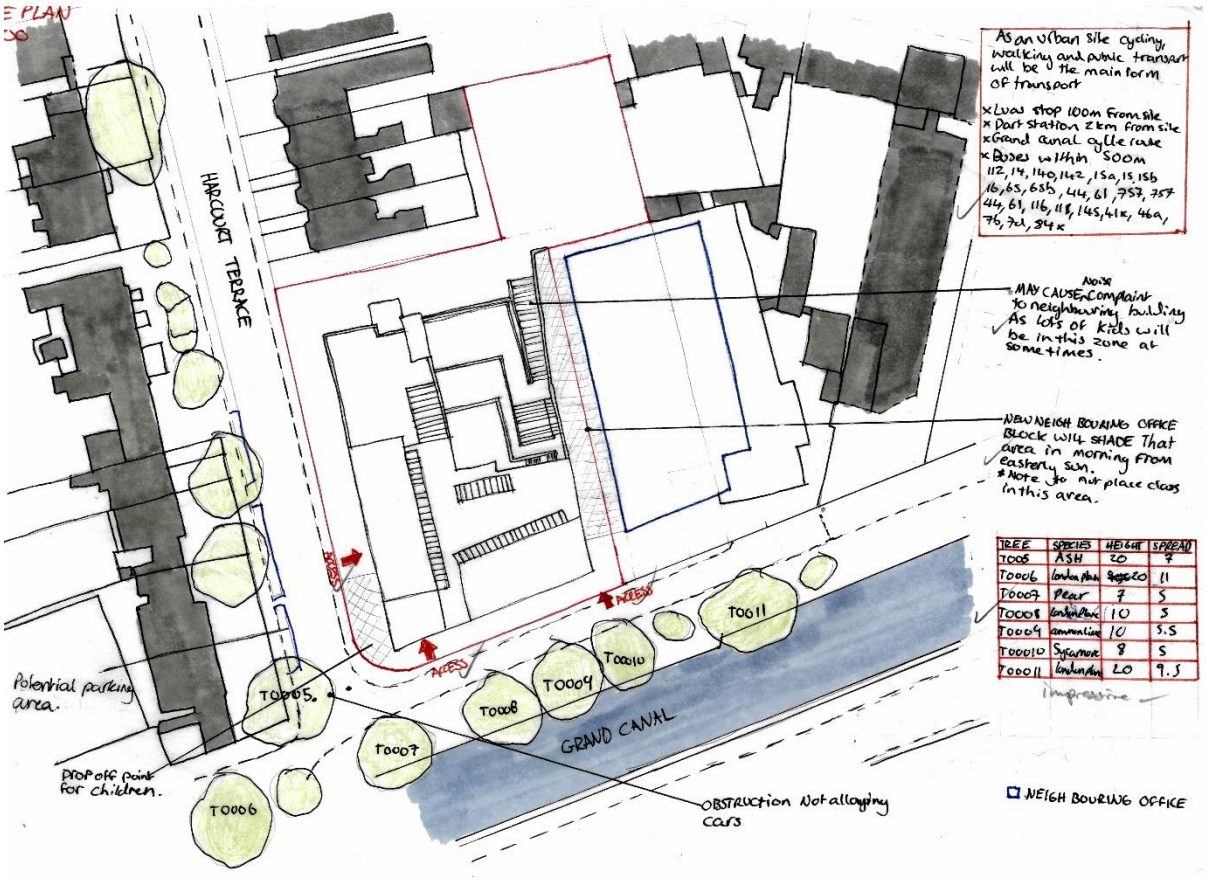

Fig 4.1- Initial site investigation

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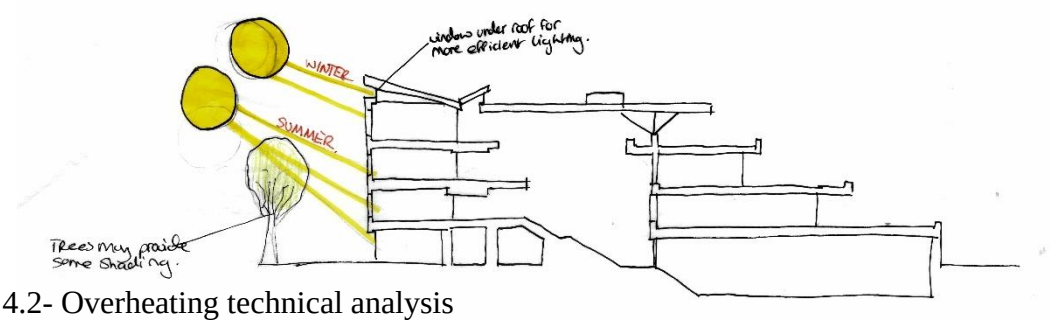

Fig 4.2- Overheating technical analysis

then began to provide some analysis on wall construction types in response to the building performance requirements highlighted in both part L of the TGD's and to achieve NZEB standards. Derived from the investigation I managed to achieve a thermal performance U-value of 0.14W/mk^2 for walls, roof and floor which did comply.

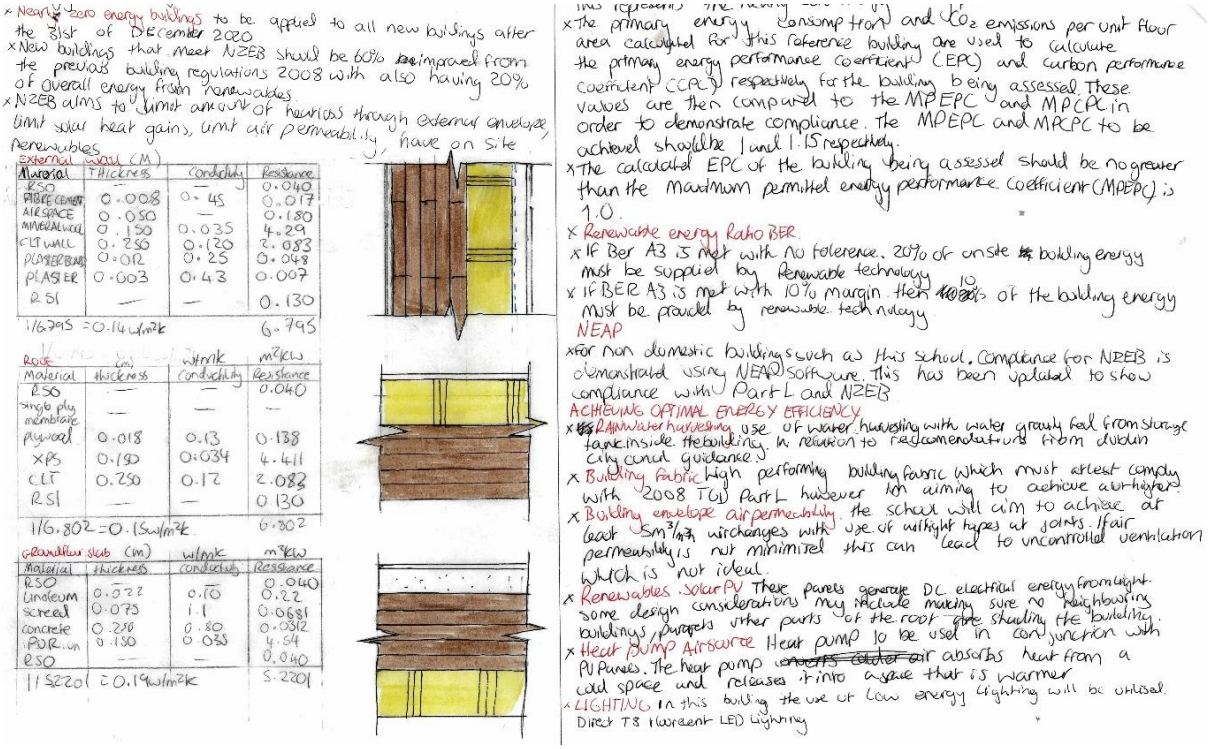

Fig 4.3- Investigation into the thermal envelope and TGD part L

To comply with NZEB standards I was required to introduce renewable energy technology to provide roughly 20% of the total building energy output. In my environmental strategy I investigated and utilised the use of solar PV to provide the energy for lighting. These were located on the roof but also as a brise soleil above some of the windows to provide some additional shading on sections of the building that were weaker due to no trees or additional shading sources. I also utilised a rainwater harvesting system which provides a system that will collect, store, and use rainwater from roof tops. This was used to gravity feed the water from the roof of the school to facilitate services such as flushing toilets, landscape irrigation or outside taps. I decided to use Sustainable Urban Drainage System along with this to collect and reuse surface water from the sites topography in correlation with the use of permeable paving around the site. For heating the building, I explored a series of renewable options such as a ground sourced heat pump, biomass, and a CHP system. However, due to the building purpose of a school and the limited space of the urban site I felt an air sourced heat

pump in conjunction with underfloor heating on the ground floor and low temperature radiators in some of the classrooms was the most appropriate approach. I also decided to use a gas-powered radiant ceiling heater in the sports hall as a viable option. The thermal envelope I have proposed has the purpose of providing excellent heat retention and unlike a dwelling the sports hall would not be occupied 24 hours a day. Therefore, there would be little need for heating the sports hall and the energy output would be very low. I felt this form of heating would be the most appropriate for the sports hall conditions in the event of large gatherings and indoor sports.

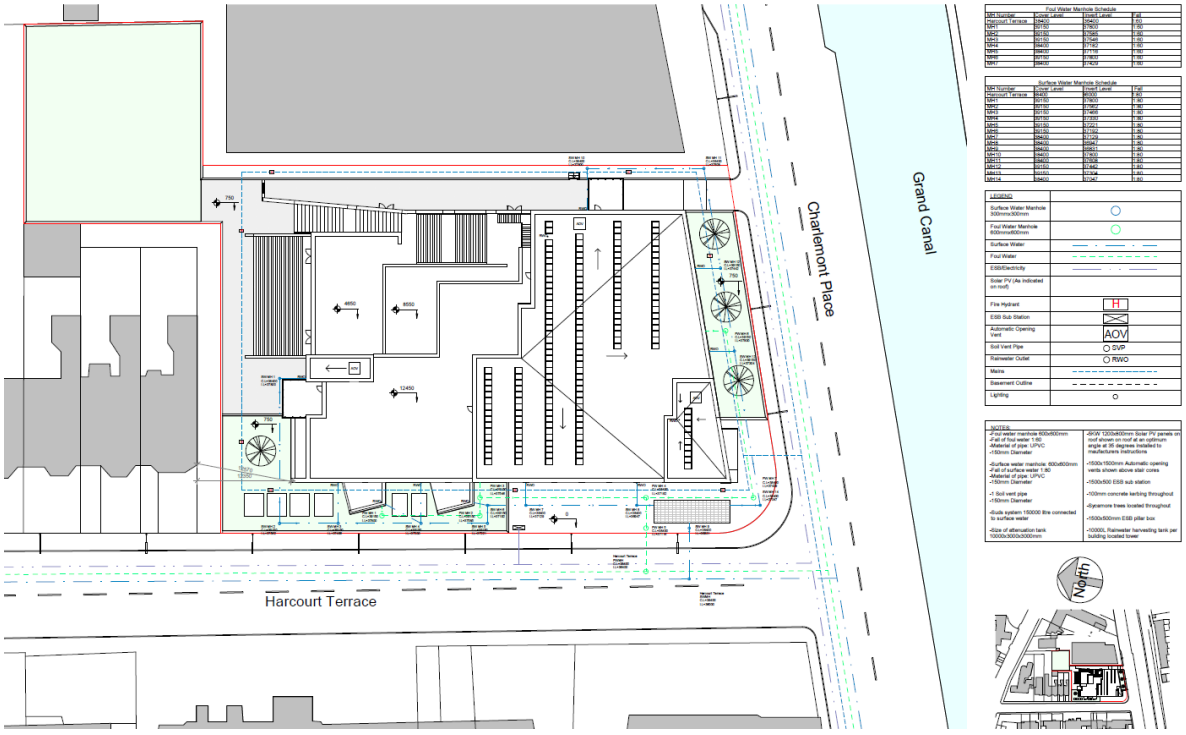

Fig 4.4- Site plan including all relevant drainage, landscaping and boundary treatment

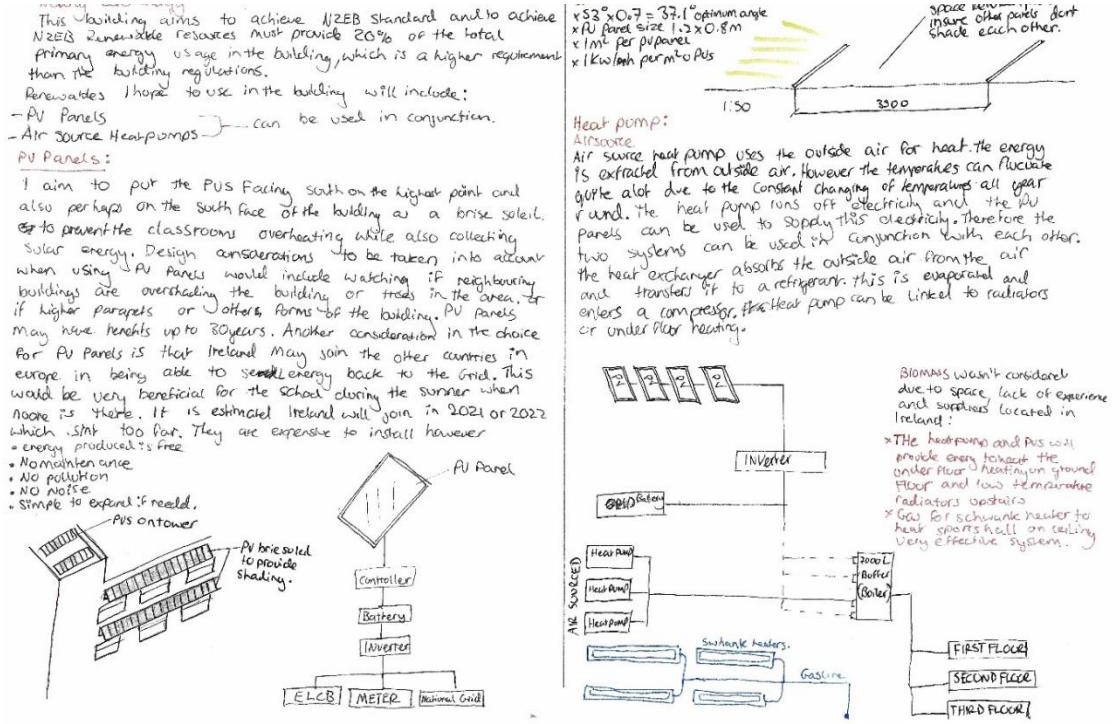

Fig 4.5- Investigation into renewable energy strategies

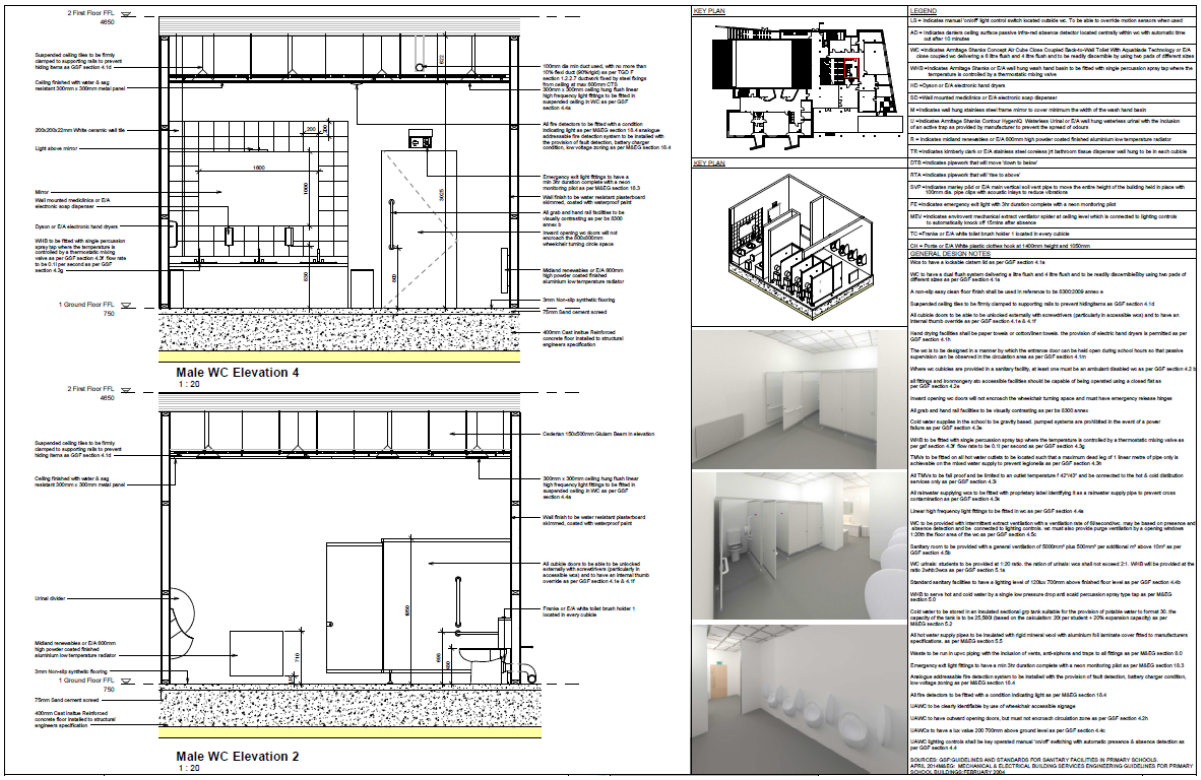

Fig 4.6- Ground floor toilet services layout

As part of my services strategy for the building I also examined the ventilation strategy I would utilise for the building. I calculated if all the rooms were applicable for single sided or cross ventilation and wanted to minimise the need for mechanical ventilation as much as possible. Following my investigation, I aimed to use automatic opening windows to optimise natural ventilation in the classrooms with security measures also considered. These would only be used during the day depending on temperature variation in the rooms. I also explored different mechanical ventilation methods in situations where natural ventilation was difficult to achieve

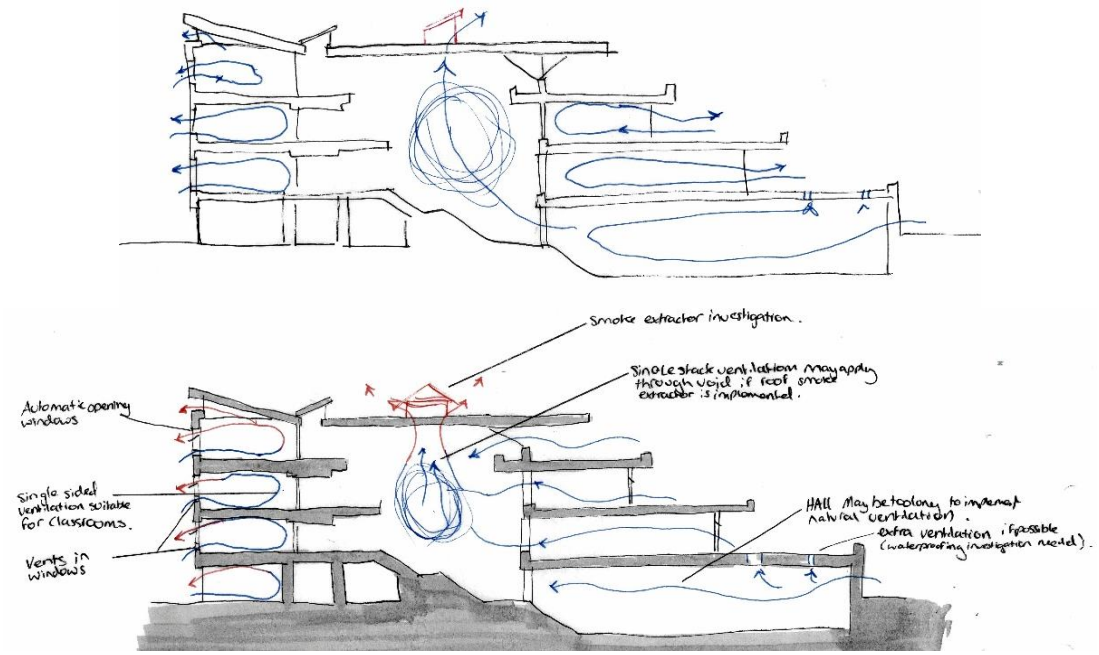

Fig 4.7- Initial investigation into natural ventilation strategy

5 The Use of Analytical and Collaboration Tools:

This served as a critical section of the BIM module for this semester. We were designated into a team and were to choose between a series of sketch designs and develop an industry standard work-sharing Revit Model from this information and produce sets of digital drawings to express the design and construction of the building from general arrangement drawing to a series of technical design details. This really gave me a feel for working through an applied cloud-based team on A360. I felt that these tools really enabled me to work to my highest potential in my upcoming work placement in semester 2 with the impending COVID-19 situation forcing me to work from home for a large majority.

As a team we had to collectively manage the Revit model. This included organising the project browser to include work in progress and published sections to allow us to keep progress on work to be completed, we incorporated a standardised naming convention for all of the files to be submitted according to BS/PAS 1192 standards and we also produced a separate excel spreadsheet in an attempt to manage work delegation and to ensure workflow.

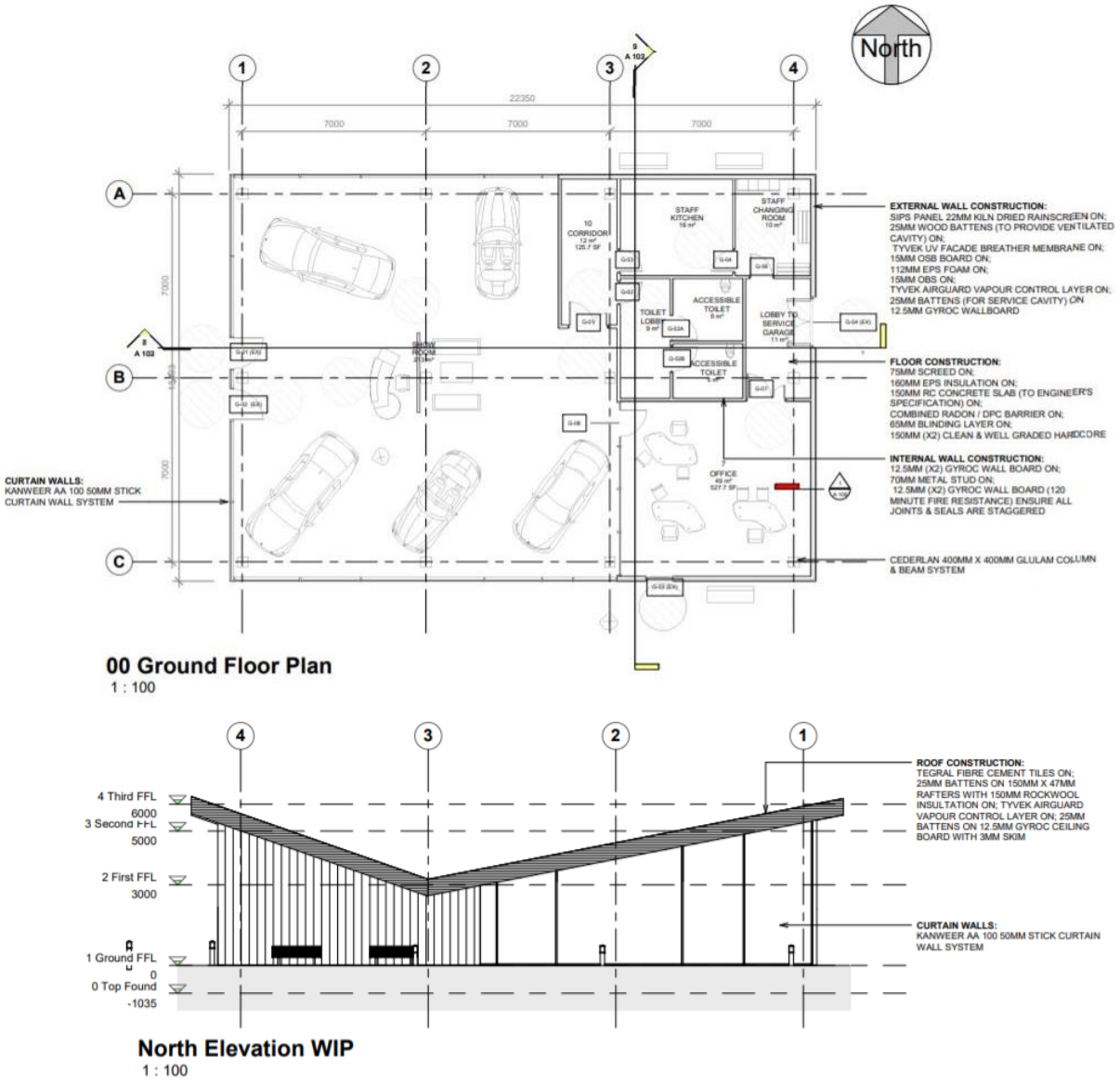

Fig 5.1- General arrangement drawings for collaborative project

Presentation is an aspect of my work I accredit very highly and this year I have really tried to apply myself in learning new techniques and tools to be more effective while also maintaining a high standard. Therefore, this year I have learned how to use SketchUp, Lumion, and Photoshop to a relatively high level to enable me to create realistic renders, walkthroughs, 3D details and demonstrations with context. In the BIM module as a team we collectively decided to create a car showroom. I felt it was essential to provide some realistic renders to provide some perspective to how the building would look upon creation and my newfound knowledge of Photoshop and Lumion enabled me to create these. I used SketchUp in TDS to enable me to create quick 3D visualisations of details to provide some insight into the assembly of the different elements included in the specific detail. I used Lumion to apply realistic textures to the SketchUp model to provide a visualization for how the.detail would be constructed in reality

Fig 5.2- Lumion, Revit and Photoshop generated car showroom external render

Fig 5.3- Lumion, Revit and Photoshop generated car showroom Internal render

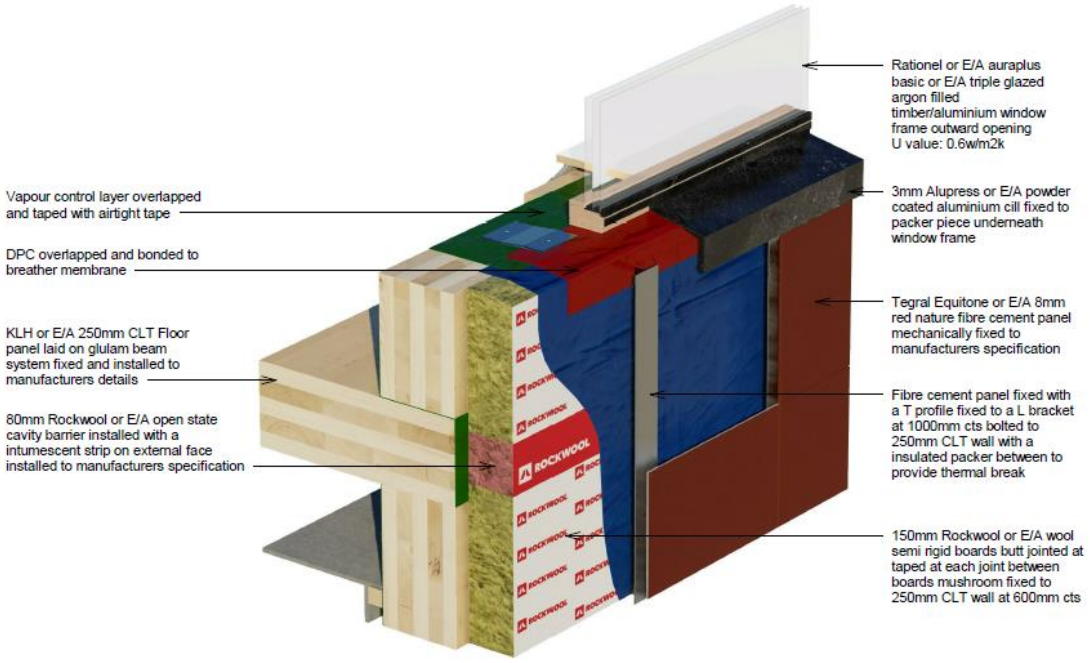

Fig 5.4- SketchUp and Lumion generated 3D intermediate floor/ window cill detail

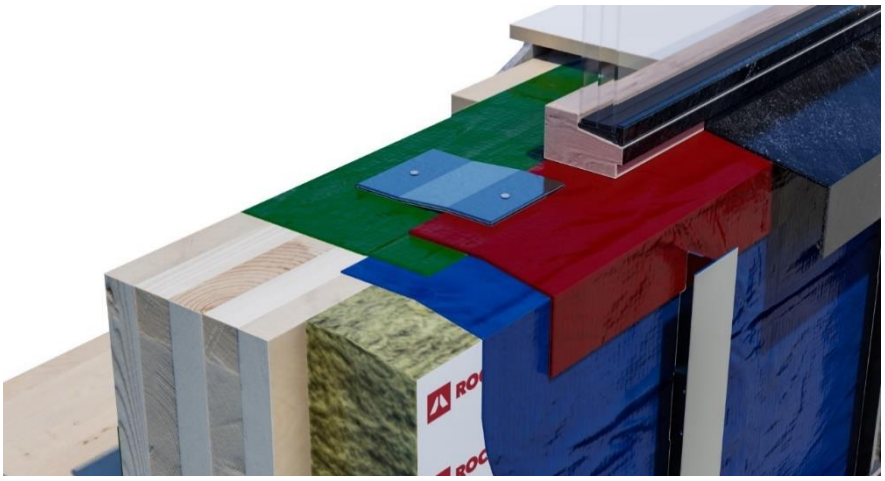

Fig 5.5- SketchUp and Lumion generated close up of membrane overlap

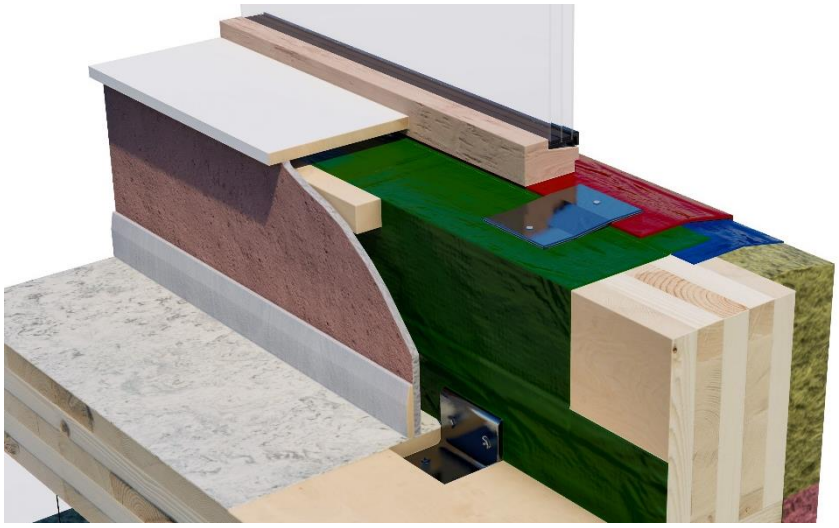

Fig 5.5- SketchUp and Lumion generated close up of window frame

The use of analytical tools was a very prominent factor throughout the BIM module for this year. I did not realise the true extent and power Revit possesses in the calculation and management of information until this year. One of the projects was based entirely on the effective management of information generated by Revit on a sample project. We used parameters and associated a proposed u-value with all the external wall's windows and doors, a fire rating to all doors and area tags to all the rooms. The analytical tools in Revit enabled me to schedule and manage all this information in effective and coherent manner.

6 Conclusion:

Overall, I feel this year has been a major advancement in my development as an architectural technologist and this year will serve to play an integral part of my life in a professional setting. Having competed this year, I have gained some very valuable professional experience that will be very beneficial in the future as I now recognise the standard and quality of professionalism that is needed in practice. I am very grateful for the platform I have been given to demonstrate my skills despite the concerns with the COVID-19 situation and I feel I have applied myself and adapted accordingly.