Life Cycle Assessment of the New Student Union Building (SUB) Project

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PROVISIO

This study has been completed by undergraduate students as part of their coursework at the University of British Columbia (UBC) and is also a contribution to a larger effort – the UBC LCA Project – which aims to support the development of the field of life cycle assessment (LCA).

The information and findings contained in this report have not been through a full critical review and should be considered preliminary.

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Abstract

The University of British Columbia's New Student Union Building is to be completed for use by September 2014. It's 222,000 square feet will cost approximately $103 million, 78% funded by UBC student fees. UBC aims for the New SUB to be LEED Platinum rated an example of UBC's commitment to sustainability, climate change action, and green building innovation.

This Life Cycle Assessment quantifies the environmental impacts associated with the building's materials and energy use as represented in the Issued for Construction drawings dated May 7, 2012. Specifically, we did material takeoffs of the foundations, columns & beams, floors, interior walls, exterior walls and roofs using OnCenter's Onscreen Take-off software. Environmental impacts were then estimated using Athena's Impact Estimator software for the following impact categories: acidification potential, eutrophication potential, fossil fuel consumption, global warming potential, human health criteria, ozone depletion potential, and smog potential.

Sensitivity analysis found that concrete played far and away the largest role in determining environmental impacts. Specifically the use of a 35% fly ash concrete mix, compared to a 9% mix (the minimum accepted for input by the Athena software), will reduce the whole building's associated CO2 emissions by 7.4%, an estimation which likely confirms the concrete supplier's claim of 35% vs 0% achieving a 10% reduction.

This LCA is a preliminary student analysis with rough estimations and not absent of assumptions. However it is intended to be useful both through material impact comparisons and as a baseline study for further evaluation.

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1.0 Introduction

In 1940, the University of British Columbia built Brock Hall to house and host the organizations and social events of its 3,339 strong student population at a cost of $80,000 ($1.6 million in today's dollar, adjusted for inflation), raised through student donations and a grant from the board of governors alongside the family of the recently deceased Dr. R.W. Brock, the former Dean of Applied Science.

In 1968, with UBC's student population raised to 28,000, the current Student Union Building was built. Cost: $5 million, $3.5 million of which was paid by a $15 dollar increase in alma mater society student fees (for some number of years, unknown). At that time the SUB included a bank, a barber shop and a bowling alley, but sadly perhaps, no pub, that would come later, partially spurred on by David Suzuki.

In 2008 with the student population approaching 45,000, UBC needed another student union building (SUB).

1.1 The New SUB Project

Canon Design was hired by the Alma Mater Society (AMS), representing UBC students, as renovation consultants. After study, they presented three options: *i*. completely renovate the current SUB, *ii*. partially renovate and partially expand, or *iii.* build a whole new SUB (accompanied by minor current SUB renovations), all at roughly the same price. The AMS council approved the third unanimously and in April 2008 students approved by referendum a fee starting at $20/year and increasing by $10/ year until 2016/2017 in order to raise $80 million of the total budget of $103 million for this New Student Union Building. In late April 2010, 2800 + students voted to hire Bing Thom Architects, Busby Perkins+Will, and Hotson Bakker Boniface Haden (now Dialog+BH) as the principal architects to draft the designs of the building. Those drawings were (mostly) completed in January 2012.

Construction began in February 2012 and expected completion is September 2014. UBC Properties Trust acts as the project manager (the land owners, privately owned by UBC) with the Alma Mater Society representing UBC students' stake ($80 mil of $103 mil) as the primary client. Bird Construction acts as the construction managers. The primary consultants are Reed Jones Christofferson (Structural) AME (Mechanical) and Applied Engineering Solutions (Electrical). The consulting team includes an additional 13 firms responsible for accessibility, acoustics, building

code, building envelope, civil, commissioning, costing, landscape, LEED, specifications, surveying and sustainability.

The primary functional areas include: 60,000 sq ft of social and recreation space, 10,000 sq ft of bookable space, 36,000 sq ft of club office space, and 20,000 sq ft of food and retail. Along with the secondary functional areas the total gross square foot area of the building is 222,000 sq ft, 150% of the size of the current SUB. In addition it will feature a brew pub, a two story climbing wall, a hanging nest theatre, and sustainability themed art installations.

1.2 Building Characteristics

The design of the New SUB incorporates numerous structural, envelope and aesthetic materials and assemblies. The general building characteristics are detailed in Table 1.

Table 1: Building Characteristics of the New SUB

Building System	Specific Building Characteristics
Structure	Cast in place concrete footings, columns and slab on grade. Glulam columns and beams. Structural steel columns and beams.
Floors	Cast in place concrete suspended slabs with slab bands. Composite metal deck with concrete topping.
Interior Walls	Light gauge steel stud framing with regular, moisture resistant, or Type X gypsum board. Light steel gauge steel stud framing with gypsum board and mineral wool or fiberglass acoustic insulation. Concrete block wall. Fire rated shaft wall system.
Exterior Walls	Below grade: Cast in place concrete walls with waterproof membrane. Above grade: Light gauge steel stud framing, exterior gypsum sheathing, peel and stick membrane, mineral fibre cavity wall insulation, air barrier and glass fibre reinforced concrete panels, aluminum cladding, zinc cladding, exterior insulation and stucco system or louvered wall.
Windows	Exterior: Aluminum framed curtain wall with double glazed low-E argon filled, or triple glazed argon filled glazing. Opaque glass spandrel panels. Interior: Aluminum store front with 6mm laminated glass or 13mm tempered glass panels.
Roof	Cast in place concrete, metal deck, composite metal deck, acoustical metal deck, or cross laminated timber panel with polyisocyanurate board insulation and SBS membrane.
Mechanical	Natural ventilation. Heat reclamation (from mechanical rooms and kitchen exhausts). Solar thermal panels. In slab hot water heating.

1.3 Sustainability Claims

From the beginning of the process, UBC, the AMS, and the New Sub Committee all pledged allegiance to sustainability in various forms. As cited by BC and UBC's current stated sustainability goals and mandates, new UBC buildings will:

- Achieve a minimum LEED gold standard as per the Province of BC's Energy Efficient Buildings Strategy (2008, with regards to new government buildings).
- Achieve 11 of those 60 mandated LEED credits through LEED's energy & atmosphere category (UBC's Technical Guidelines).
- Reduce greenhouse gas emissions levels to 33% below 2007 levels. (UBC's 2010 Climate Action Plan).
- Divert 50% of campus waste from construction of new institutional buildings from the landfill.
- Reduce water consumption in institutional buildings by 40% from 2000 levels.
- And, reuse/ recycle existing materials, or else include recyclable materials, or use "green/ sustainable materials", as verified by a third party. (All from UBC's February 2010 Climate Action Plan and UBC Sustainability's Technical Guidelines).

Additionally, the New Sub Committee has stated aims to exceed the mandates by:

- Building not a LEED Gold but rather a LEED Platinum building (80 points minimum compared to 60 points).
- Designing the structural elements for a 100 year life span and interior elements for a 50 year life, i.e. for durability and adaptability.
- Using no materials which might threaten human or ecological health or rights (International Labour Organization etc.).
- Produce a building which will have a "net positive ecological impact" on energy, water, and local ecosystems.
- Provide a healthy culturally enriching environment for students (including 100% of rooms receiving natural sunlight). (From UBC's technical guidelines.)

For example, in conversation with the architects we discovered that the interior spaces and facade have been designed to be predominantly free from structural importance (in fact the first floor façade's foundation is to be entirely separate from the rest of the building), enabling easy

future retrofits in the interests of changing functionality and changing perceptions of aesthetics. Furthermore they're using a Portland lime cement mix with reduces the cement content in concrete by a minimum of %35 and is claimed by its producer to reduce greenhouse gas emissions from associated production by 10%. This claim is further evaluated in the sensitivity analysis of our report.

2.0 Goal and Scope

In accordance with the ISO 14040 and 14044 standards, this report will provide sections to describe the Goal and Scope. The following Goal and Scope section outlines the details of the LCA study that was carried out on the New UBC Student Union Building.

The Goal & Scope is critical to documenting the context and guiding an LCA study's execution. The purpose of defining the Goal of the study is to unambiguously state the context of the study, whereas the Scope details how the actual modeling of the study was carried out. For this New SUB LCA study report, the format immediately below has been used to unambiguously outline the details of the parameters outlined in ISO 14040 and 14044.

Parameter Name

Parameter definition.

Details of how this item is defined for the New SUB Building LCA study.

This format has been followed throughout the Goal & Scope in order to provide the audience with an explanation each parameter and transparently state how it is defined for the New SUB LCA study.

2.1 Goal of Study

The following are descriptions for a set of parameters which unambiguously state the context of the New SUB LCA study.

Intended application

Describes the purpose of the LCA study.

This LCA study will be used to evaluate the environmental impacts of the new SUB building.

Reasons for carrying out the study

Describes the motivation for carrying out the study.

The report itself is an educational asset to help disseminate education on LCA and help further the development of this scientific method into sustainability in building construction practices at UBC and the green building industry as LCA is rapidly gaining acceptance at all scales of sustainable construction standards and corporate social responsibility policy.

Intended audience

Describes those who the LCA study is intended to be interpreted by.

The results of this study are to be primarily communicated to the public. In addition to the general public, the LCA report is intended to be communicated to industry and governments groups observing and involved in green building, as LCA is an emerging topic of significance in this area. The results should also be helpful for projects stake holders such as the UBC Alma Mater Society and the New SUB Committee (project clients) representing UBC Students generally, UBC Properties Trust (project managers), and Dialog & B+H (the principal architects) and Bird Construction (acting as construction managers).

Intended for comparative assertions

State whether the results of this LCA study are to be compared with the results of other LCA studies.

The results of this LCA study are not intended for comparative assertions. However; it will act as a benchmark to be used to drive development toward performance based green design, and potentially further LCA(s) likely to be conducted of this building.

2.2 Scope of Study

Product system to be studied

Describes the collection of unit processes that will be included in the study.

A unit process is a measurable activity that consumes inputs and emits outputs as a result of providing a product or service. The main processes that make up the product system to be studied in this LCA study are: the manufacturing of construction products (Figure 1)), the construction of a building (Figure 2), maintenance (a combination of demolition, manufacturing and construction itself), operating energy (Figure 3) and expected demolition (Figure 4). These three processes are the building blocks of the LCA models that have been developed to describe the impacts associated with the New SUB. The unit processes and inputs and outputs considered within these three main processes are outlined below.

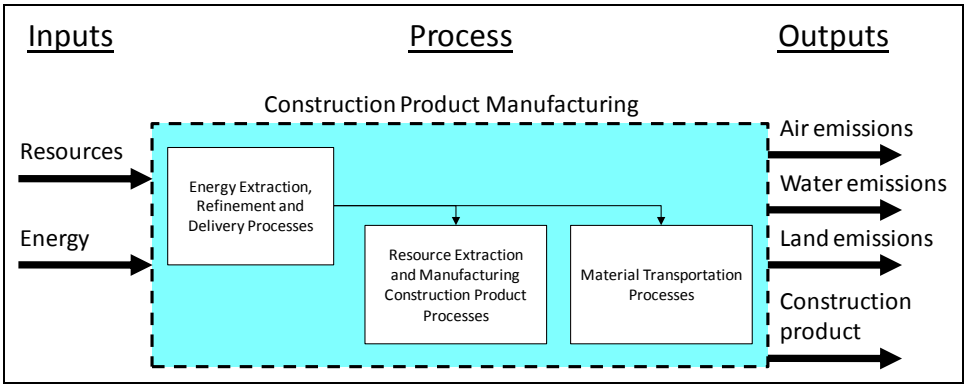

Figure 1: Generic unit processes considered within Construction Product manufacturing process by Impact Estimator software

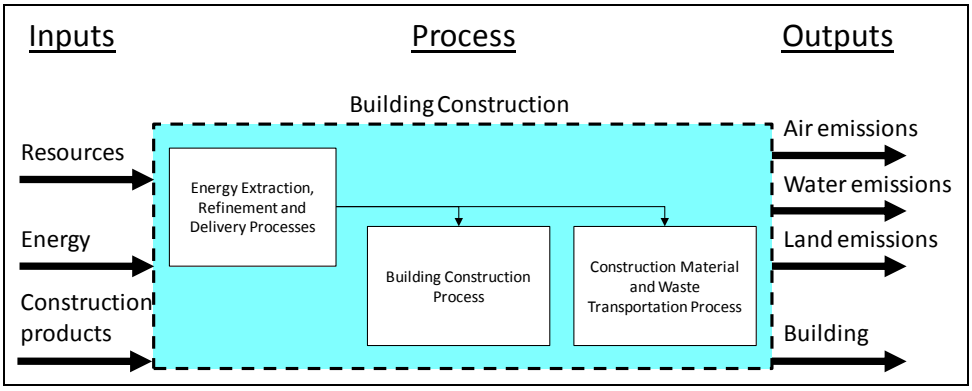

Figure 2: Generic unit processes considered within Building Construction process by Impact Estimator software

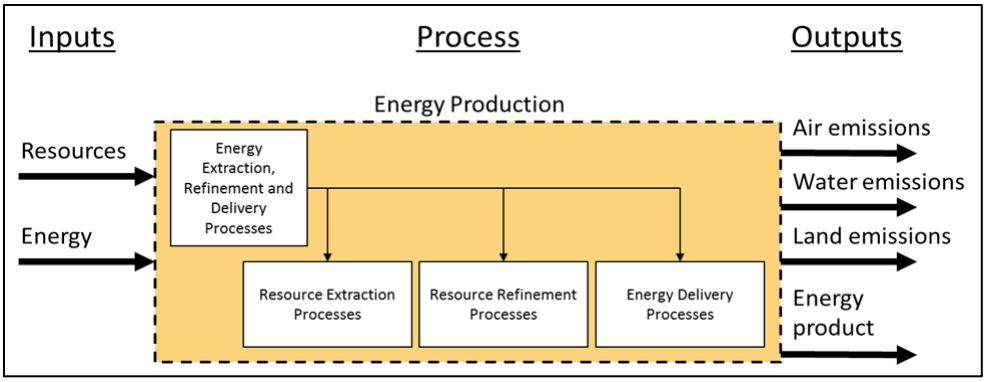

Figure 3: Generic unit processes considered within Energy Production process by Impact Estimator software

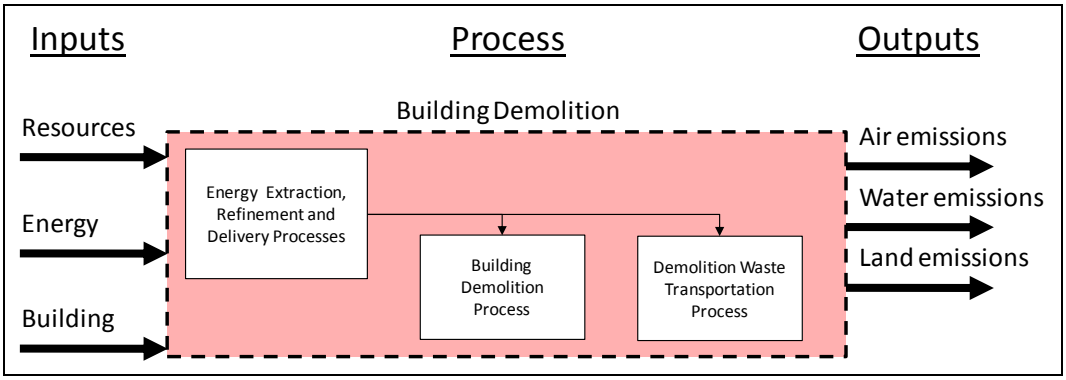

Figure 4: Generic unit processes considered within Building Demolition process by Impact Estimator software

As seen in the above figures, the inputs and outputs occurring at the various stages in a buildings life cycle are captured. The construction product manufacturing, building construction processes, energy production processes, building maintenance process, and the building demolition unit process capture the capture the cradle to grave process. The organization of these processes into the product systems to describe the environmental impacts of the new building requires the definition of a system boundary. Thus, the product system studied in this new SUB building LCA study is further defined in the system boundary section below.

System boundary

Details the extent of the product system to be studied in terms of product components, life cycle stages, and unit processes.

This study includes the construction products used to create their structures and envelopes. This indicates that product components must be defined and the materials within the products studied.

The material product components (i.e. building assemblies) that were included from the products (i.e. buildings) are the footings, slabs on grade, walls, columns and beams, roofs, as well as all associated doors and windows, gypsum board, vapour barriers, insulation, cladding, roofing, and curtain walls. These material product components are in turn assemblies of construction product

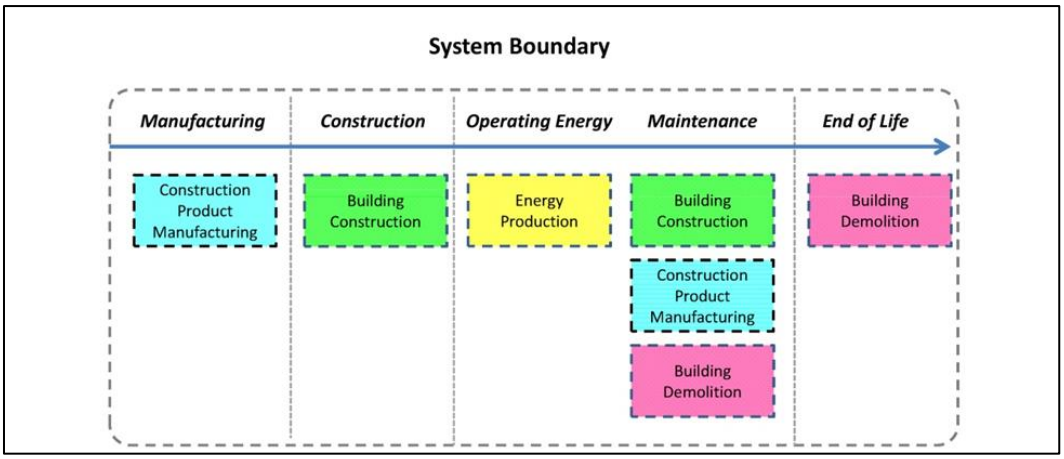

Figure 5: System boundary for Renovation and Building New scenarios

The life cycle stages we consider with regards to the New Student Union Building include those spanning from cradle-to-grave. The process begins from site preparation, starting with resource extraction and manufacturing of construction products, the building construction process then it goes to the maintenance and operating energy phase and it ends with building demolition process.

Functions of the product system

Describes the functions served by the product focused on in the LCA study.

A description of the New SUB's major functions has been outlined in the introduction of this report.

Functional unit

A performance characteristic of the product system being studied that will be used as a reference unit to normalize the results of the study.

The functional units used in this study to normalize the LCA results for the New SUB include:

- *per gross square foot area constructed*
- *per cubic foot constructed*
- *per specific functional use area*

Further discussion of these functional units and their application are contained in the Impact Assessment sub-section under Functions and Impacts.

Allocation procedures

Describes how the input and output flows of the studied product system (and unit processes within it) are distributed between it and other related product systems.

The problem of allocation arises in three situations – i) when a process produces more than one product, ii) a waste treatment process collectively treats multiple waste products and iii) when materials are recycled or reused in subsequent life cycles. An allocation problem arises in these situations because the input and output flows from the processes must be shared amongst the products and subsequent life cycles.

In this study, the cut-off allocation method was used, which entails that only the impacts directly caused by a product within a given life cycle stage are allocated to that product. The LCA starts from extracting the raw material and doesn't include the process that the raw material is created and ends with the demolition phase and doesn't include the treatment of the demolished materials.

Impact assessment methodology and categories selected

State the methodology used to characterize the LCI results and the impact categories that will address the environmental and other issues of concern.

The primary impact assessment method used in the New SUB LCA study was the Athena Impact Estimator developed by the Athena Institute with input and database information/ characterization factors from the Tool for the Reduction and Assessment of Chemical and other

environmental Impacts (TRACI), developed by the US Environmental Protection Agency (US EPA).

The impact categories selected and the units used to express them (i.e. category indicators) are listed below.

- Acidification potential – H^+ mol equivalents
- Eutrophication potential – kg N equivalents
- Fossil fuel consumption – MJ
- Global warming potential – kg CO_2 equivalents
- Human health respiratory effects potential – kg PM_{10} equivalents
- Ozone depletion potential – kg CFC^{-11} equivalents
- Smog potential – kg O_3 equivalents

Short descriptions of each of these impact categories are provided in the Impact Assessment sub-section in Results and Interpretation.

Interpretation to be used

Statement of significant issues, model evaluation results and concluding remarks.

Analysis and discussions of uncertainty, sensitivity, and functional units of this LCA study are contained in the Results and Interpretation section of this report, whereas concluding remarks are contained in the Conclusion.

Assumptions

Explicit statement of all assumptions used by the modeller to measure, calculate or estimate information in order to complete the study of the product system.

As with data sources, there were two main areas where assumptions were integrated, which include – performing materials takeoffs of building assemblies and those contained within the Impact Estimator.

The details of the methods used in completing the material take offs on the building drawings are summarized in the Model Development section of this report.

All of the inputs and assumptions associated with interfacing these takeoffs with the Impact Estimator are documented in the Input Document (Appendix A) and the Assumptions Document

(Appendix B) Assumptions were typically required in the development of building assembly information due to missing information as well as limitations in construction product Life Cycle Inventory (LCI) data and assembly characteristics in the Impact Estimator.

Assumptions regarding the completion of take offs to estimate material use, referenced LCI data and transportation networks have all been developed by the Athena Institute and are built into the Impact Estimator version 4.2 This information is proprietary; however, parts can be accessed through the inner workings report found on the Athena Institute webpage.[1]

Value choices and optional elements

Details the application and use of normalization, grouping, weighting and further data quality analysis used to better understand the LCA study results.

Value choices and optional elements were not included in this study due to limited time and resources; however, this report does provide sufficient documentation for its audience to carry out these types of analyses.

Limitations

Describe the extents to which the results of the modeling carried out on the product system accurately estimate the impacts created by the product system defined by the system boundary of the study.

The following limitations should be considered when interpreting the results of this LCA study: System Boundary – Any of the impacts created or avoided through the reuse, recycling or waste treatment of the construction or demolition wastes emitted were outside the scope of this study.

Data Sources and Assumptions – This LCA study used original architectural and structural drawings obtained to develop information on the building assemblies in the partial construction of the New SUB. The resulting LCA models are specific to this building as their bill of materials

reflect its unique design. Furthermore, the life cycle inventory flows and their characterization predominantly reflect averages of industry processes and their impacts for North America.

[1] –V4.1 Software and Database Overview
http://www.athenasmi.org/wp-content/uploads/2011/10/ImpactEstimatorSoftwareAndDatabaseOverview.pdf

Data quality requirements

Qualitative and quantitative description of the sourced data used in the study including its age, geographical and technological coverage, precision, completeness, reproducibility and uncertainty.

The sources of data used in the development of this LCA study include those used to estimate results for the bill of materials, life cycle inventory (LCI) flows and the characterization of LCI flows.

Bill of materials - Architectural and structural drawings were obtained to develop information on the building assemblies. The precision of the quantity take offs does rely somewhat on the quantity takeoffs built into the Impact Estimator, as the quantity take offs from the drawings are input and completed by the Impact Estimator. However, the use of the Impact Estimator does enable these results to be reproduced due to all results being documented in the Inputs and Assumptions Documents contained in Appendix A and B in this report.

LCI flows – The Athena LCI Database was the source of LCI data. The quality of the data and modeling assumptions used to develop the Athena LCI Database (which is built into the Impact Estimator) was outside the time and resource constraints of this study. However, some of this information can be accessed through the Athena Institute webpage's Software database overview and the LCI Databases [2]. Generally speaking, this database is specific to the current North American context, and thus does create some geographic and temporal limitations on this study. For instance, i) The construction product manufacturing as well as fuel refining and production LCI data is based on North American averages ii) The transportation matrix that estimates distances and modes for construction product transportation as well as construction and demolition wastes is specific to Vancouver, British Columbia iii) The LCI data and modeling parameters in the Impact Estimator were developed by the Athena Institute to reflect current circumstances and technologies.

Characterization factors – Documentation of the US EPA TRACI impact assessment method can be found on the US EPA website[3]. Generally speaking, this method characterized LCI flows to reflect their potential to cause damage on average in North America. Qualitative discussion of

[2] http://www.athenasmi.org/our-software-data/lca-databases/

[3] US EPA TRACI documentation - http://www.epa.gov/nrmrl/std/traci/traci.html

the uncertainties present in the impact assessment results are contained in this report in the Impact Assessment sub-section of Results and Interpretation.

Type of critical review

A review of the methods, data, interpretations, transparency, and consistency of the LCA study.

A critical review has not been carried out in the study; however, every effort has been made to be transparent about how the LCA study was developed.

Type and format of the report required for the study

Statement of the type and format followed by the report.

This report followed the final report outline provided by Rob Sianchuk - the instructor of the LCA course this project was carried out under in the UBC Civil Engineering department.

3.0 Model Development

The impact assessment model is developed from both the structure and envelope of the building, as well as the operational energy use of the building. The Athena Impact Estimator (IE) was the program used to generate the model of the New SUB Project.

3.1 Structure and envelope

The structure and envelope portion of the model considers the physical materials incorporated into the structure.

3.1.1 Material Take-off Development

The initial phase of the Life Cycle Assessment was the material take-off, the quantifying of all materials included within the scope of the study. To complete this, OnCenter's Onscreen Take-off (OST) software was utilized.

The OST software is a tool in which digital drawings are uploaded and serve as a backdrop for digitizing. Area, line and/or count conditions are created and elements of interest are traced, while the software utilizes the selected scale to output the measurements of the traced areas (Figure 6).

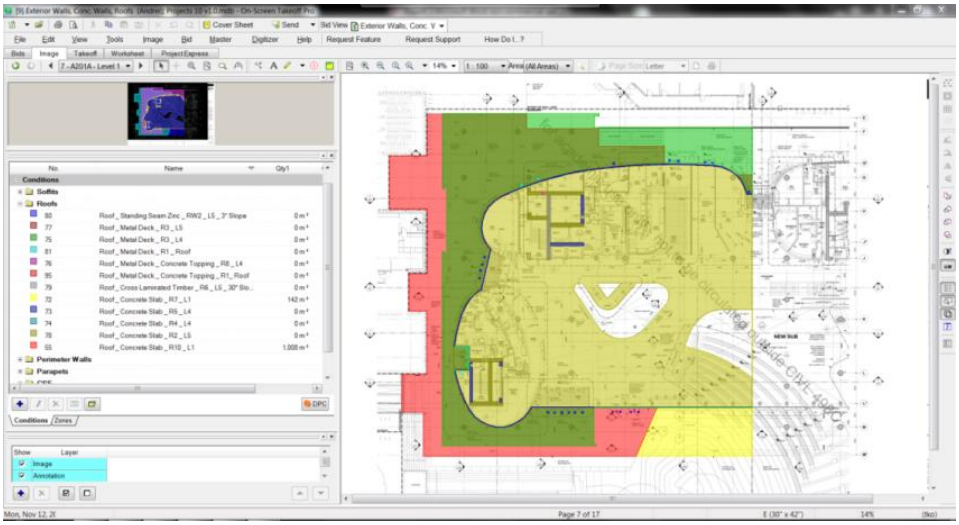

Figure 6: On Screen Takeoff User Interface

Each condition has subsequent input fields where height, thickness and slope can be set to enable OST to generate the final quantities of interest as seen in Figure 7. Unlimited conditions can be created and organized through the use of layers and folders and the cumulative results can be displayed in the take-off tab of the software. Results can then be read directly from OST or exported in a spread sheet format for further organization/ manipulation in a program such as Excel.

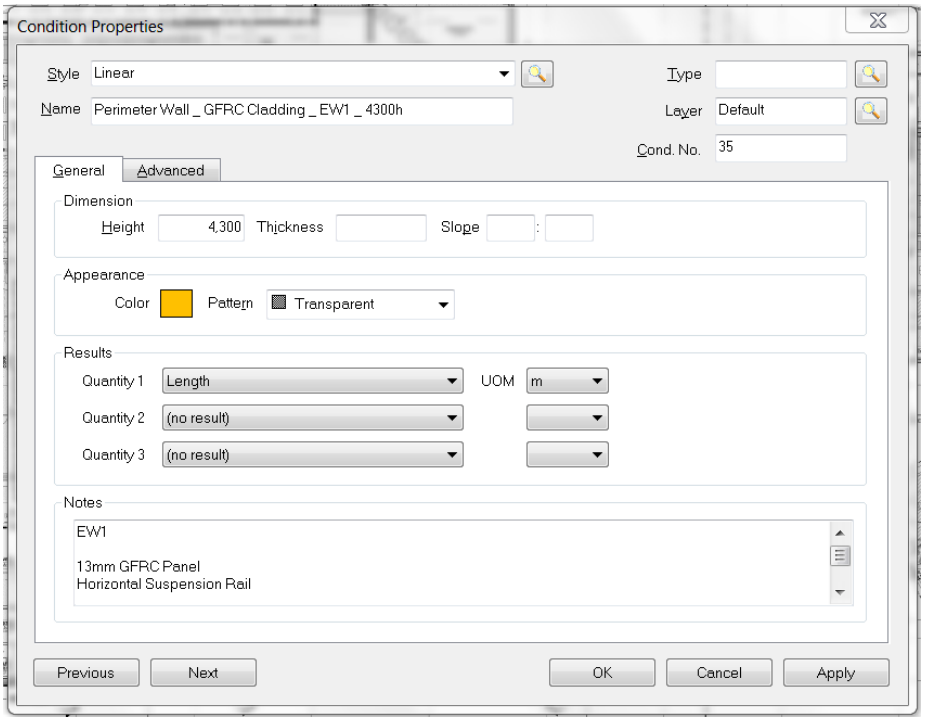

Figure 7: On Screen Takeoff - Condition Properties Window

When creating conditions in OST the general nomenclature was used:

Assembly Group _ Assembly Type _ Assembly Name _ Additional Descriptors

For example, the condition entitled “Exterior Wall _ GFRC Cladding _ EW1 _ 4300h” corresponds to an exterior wall with GFRC cladding. The assembly is defined as “EW1” in the architectural drawings and has a height of 4300mm.

Since several OST conditions were combined to produce single inputs in the IE the nomenclature was modified slightly to better represent the input logic used for the modeling:

Assembly Group _ Modeled Assembly Sub-Structure _ Assembly Name _ Additional Descriptors

The modified nomenclature for the above example appears as following “Exterior Wall _ Steel Stud _ EW1 _ GFRC Cladding”.

The modified nomenclature is used in both the IE software and the inputs and assumptions document. Correlation can be made from the OST nomenclature and the modified nomenclature by use of the Assembly Group, and the Assembly Name.

Area, line and count conditions are the basis of all the material take-off conducted but were utilized in different ways to generate the results of interest, the details of which are described in section 3.1.2 Material Take-off Assumptions of this report.

The material-takeoff component was complete with no significant challenges. Since The NEW SUB is currently in construction the drawings were developed, detailed, clear and complete. Being provided the architectural drawings (Issued for Construction, May 7, 2012), specifications (Issued for Construction, May 7, 2012), schedules (Issued for Construction, May 7, 2012) and structural drawings (Issued for Construction, May 7 20120) we were able to extract all of the required information.

3.1.2 Material Take-off Assumptions

This section further defines the take-off methods used for the different assembly groups as defined by the Athena Impact Estimator as well as the underlining assumptions which were made during modelling. The specific modeling inputs and assumptions for each input in the IE can be found in Appendix A and Appendix B respectively.

3.1.2.1 Foundations

The Foundation assembly group includes the slab on grade (SOG), strip footings, pad footings and core footings as classified in the IE.

Area, linear and count conditions were used in the most basic form to complete the footing take-off. Area to measure the SOG and irregular shaped core footings, linear to measure the length of strip footings and count to count the different types of standardized pad footings. Conditions were created for the different footing depths so volumes could be determined.

The footing inputs in the IE are restricted to specified depths which did not always correspond to the actual depth. Because of this the unrestricted inputs were adjusted to maintain the overall volume of the structural element as described below.

Slab on grade input is limited to 100mm and 200mm thickness, for this building, it was primarily 125mm and 225mm thick slabs. In order to correlate the correct volumes, the area was factored up as the thickness of 100mm was chosen. There is no allowance to select reinforcement for this area.

Strip footings were input as long linear sections. No input restrictions were encountered during modeling and so the appropriate length, width and height were entered into the IE.

Concrete footings are limited to a range of 190 to 500mm thick in the Impact Estimator. The majority of footings were thicker than this, therefore the width of the footings were increased to make the equivalent volume of concrete match. Multiple identical footings were input by multiplying the length of the

footing by the number of footings counted. Rebar size was primarily 25M and 30M in the footings however the inputs were limited to 20M.

3.1.2.2 Beams and Columns

The Beams and Columns assembly group includes all concrete columns (beams are included in the floor assembly group as slab bands were utilized in the design), all glulam columns and beams, and structural steel columns and beams (not included in the composite metal floor and roof assemblies)

Count conditions were used in OST to track the quantity of each column type, and area conditions were used to determine the supported area of the columns.

The IE uses the following primary input variables: number of beams, number of columns, floor to floor height, bay size, span and live load. Due to the irregular layout of columns and supported areas the average bay and span spacing was used by taking the square root of the total supported floor area divided by the number of columns supporting the area. Furthermore, the IE assumes an average flyash content for concrete columns and was unable to be changed to %35 as per drawing specifications.

3.1.2.3 Floors

The Floor assembly group is defined as any horizontal structural component confined by the exterior walls of the building. This includes both suspended concrete slabs and composite metal deck structures.

The area conditions in OST were used to quantify the floor slabs and to determine total material volume a layered approach was taken. The entire area of a given floor was measured and assigned the minimum thickness found in the slab. Any areas with a thickness above the minimum were subsequently measured and the difference in thickness was used to calculate the extra/over volume. While the take-off was conducted in this manor, the IE only utilizes the plan area for suspended slab inputs.

Due to the irregular layout of suspended slabs, the measured total area was divided by the average span to determine the floor width to be input in the IE.

The specified concrete strength for suspended slabs is 35MPa which was modeled as 30MPa as it was the closest available input in the IE.

3.1.2.4 Interior walls

Interior walls consist of all walls within the building envelope including steel stud, wood stud, shaft walls, masonry walls, concrete walls and interior curtain walls. The components from sub structure up to and including paint were considered. Additional wall finishes such as decorative wood or acoustic panels were beyond the scope of this study.

The interior wall take-off consisted of three parts. Linear conditions were used on the plan drawings to measure the length of a wall type (including all doors and window openings) and the subsequent "height" field was filled with the appropriate height so the total wall area could be generated. Area conditions were used on the elevation drawings to measure the window area within the walls and count conditions were used on the plan drawings to count the doors within the walls.

Conditions were created for each wall type, each window type within a given wall type and each door type within a given wall type. Figure 8 illustrates the condition combinations used to quantify a given wall assembly.

Name	Height	Quantity 1	UOM1	Quantity 2	UOM2
InteriorWall_SteelStud_W6-22_4300	4,300 mm	37	m	0	
InteriorWall_SteelStud_W6-22_6100	6,100 mm	12	m	0	
InteriorWall_SteelStud_W6-22_Door_HollowMetal	0 mm	2	EA	0	
InteriorWall_SteelStud_W6-22_Door_Wood	0 mm	2	EA	0	
InteriorWall_SteelStud_W6-22_Window_GL1	0 mm	19	m²	3	EA

Figure 8: On Screen Take-Off - Interior Wall Conditions for a Given Wall Type

There were several underline assumptions made to all interior wall material take-offs.

- Wall heights were assumed to span floor to floor and no reduction was made for slab thickenings or slab bands.
- Doors were modeled as standard 812mm x 2133mm size. Double doors were counted as two standard doors.

- The specified abuse resistant gypsum board in corridors to a height of 1200mm above finished floor was ignored due to the inability of the IE to model different materials for a given layer.
- Bulk heads and dropped ceilings were not included in the scope of this study.

Due to the limited size of the IE data base surrogate materials were required to model particular interior wall components. Surrogates were materials selected with the most similar material products. In the worst case some components could not be modeled at all. Table 2 lists the most common surrogates used for the interior walls

Table 2: IE Surrogates for Interior Wall Components

Material Specification	IE Surrogate Material
Black Mat Acoustical Blanket	Rockwool Bat Insulation (50mm)
Coated Glass Mat Backer Board (16mm)	Moisture Resistant Gypsum Board (16mm)
Fireboard (16mm)	Type X Fire Resistant Gypsum Board (16mm)
Steel C-H Studs (100mm, 152mm)	Steel Stud (92mm, 152mm)
Steel Furring Channel (22mm, 41mm)	Steel Stud (92mm, 92mm)
Shaft Liner (19mm)	Type X Fire Resistant Gypsum Board (16mm)
Acoustic Sealant	Omitted from Study
Fabric Wrapped Acoustic Panels	Omitted from Study
Veneer Plywood Panels	Omitted from study

3.1.2.5 Exterior Walls

The exterior wall assembly group consists of all exterior facing walls and roof parapets (the projection of exterior wall above the roof line). The components from sub structure up to and including the exterior finishes were considered.

The exterior wall take-off consisted of three parts. Linear conditions were used on the plan drawings to measure the length of a wall type (including all doors and window openings) and the subsequent “height” field was filled with the appropriate height so the total wall area could be generated. Area conditions were used on the elevation drawings to measure the window area (for punch

windows only, curtain walls were measured linearly) within the walls and count conditions were used on the plan drawings to count the doors within the walls. Careful consideration of wall height had to be made when conducting the exterior wall take-off. For a systematic approach, the assemblies were broken down on a floor by floor basis. The elevation and sections drawings were used to identify the given height of a wall type which was then measured on the plan view, one condition for each height. The area was generated from the length and height for each condition and the final quantity for each assembly was generated by the sum of these areas. Once the total area was determined for a given wall type, it was divided by the total length of that wall type to approximate the average height for input into the IE.

There were no general assumptions applied to all exterior wall types, however, due to the limited size of the IE data base surrogate materials were required to model particular exterior wall components. Surrogates were materials selected with the most similar material products. Table 3 lists the most common surrogates used for the exterior walls.

Table 3: IE Surrogates for Exterior Wall Components

Material Specification	IE Surrogate Material
Aluminum Louver Cladding	Steel Cladding – Commercial (26Ga)
Corrugated Plastic Drainage Sheet	Polyethylene Vapor Barrier (6mil)
Curtain Wall – Double Glazed, Low-E, Argon	Curtain Wall – Double Glazed Standard
Curtain Wall - Triple Glazed Argon	Curtain Wall – Double Glazed Standard
Fiberglass Faced Exterior Sheathing (16mm)	Moisture Resistant Gypsum Board (16mm)
GFRC Cladding	Fibre Cement Siding
High Density Polyethylene Drainage Mat	Polyethylene Vapor Barrier (6mill)
HSS Support Framing	Heavy Gauge, Load Bearing Steel Stud
Mineral Fibre Board Insulation	Rockwool Batt Insulation
Prefinished Aluminum Cladding	Steel Cladding – Commercial (26Ga)
Protection Board (25mm)	Extruded Polystyrene Insulation (25mm)
Self-Adhesive Air/Vapour Barrier	Polyethylene Vapor Barrier (6mil)
Spray Applied Rubber Transition Membrane	EPDM Membrane
Standing Seam Zinc Roof Wall	Steel Cladding – Commercial (26Ga)
Torch-on Sheet Waterproofing	2-ply SBS membrane

3.1.2.6 Roofs

The roof assemblies include all horizontal surfaces exposed to exterior space including roofs, terraces, and patios and soffits. The components from sub structure (excluding beams except for composite deck, and wood truss assemblies) up to and including the exterior finishes were considered.

The roof take-off utilized the area condition to measure the roof area from the plan drawings. If the roof contained a slope, it was determined from the sections/elevations and input into the “slope” field of the area condition. With this information, the OST software automatically adjusts the measured plan area to account for the roof slope.

All of the roofing assemblies utilized a modified bitumen membrane which was modeled with a pre-defined envelope assembly in the "Modified Bitumen Membrane Roofing System" category of the IE. To determine the materials included in this assembly an isolated system was created and bill of materials generated. As a result it was noted that the pre-defined system includes a modified bitumen membrane, protection board, insulation, and roof sheathing. Furthermore, it was noted that the insulation quantity is the only one which varied with the input thickness and so the specified roof insulation thickness was used as the governing value for the input roof assembly. If a roofing assembly did not contain one of the above material components it was unable to be removed from the IE. If the assembly contained more material components, they were added as subsequent envelope materials.

Due to the limited size of the IE data base surrogate materials were required to model particular roof and soffit components. Surrogates were materials selected with the most similar material products. In the worst case some components could not be modeled at all. Table 4 lists the most common surrogates used for the roofs and soffits.

Table 4: IE Surrogates for Roof Components

Material Specification	IE Surrogate Material
Acoustic Metal Deck	Pre-Engineered Metal Deck System + Acoustic Insulation (92mm)
CLT Wood Deck	Plywood Deck
Entangled Nylon Fibre Drainage Mat	Spunbond Polyethylene Air barrier
GFRC Cladding	Fiber Cement Siding
Gravel Fill (75mm)	Roof Ballast
HDPE Drainage Board	Polyethylene Vapor Barrier (6mil)
Metal Deck	Pre-Engineered Metal Deck System
Mineral Fibre Board Insulation	Rockwool Bat
Standing Seam Zinc Roof wall	Steel Cladding – Commercial 26 (Ga) + Pre-Engineered Metal Roof System
Spray Fireproofing	Type X Fire Resistant Gypsum Board (16mm)
Play Surface	Omitted from Study
Landscape Buildup	Omitted from Study
Leak Detection System	Omitted from Study

3.2 Energy Use Phase

The energy use phase of the model considers the operational energy consumed by the building by source.

3.2.1 Energy Use Development

In our model, the energy consumption during the use phase of the New SUB Project was based on an energy simulation report generated by the energy consultants, Halsall, dated June 14, 2012.

The energy simulation is based on the following modelling inputs:

Building Envelope

- R-25 wall
- R-30 roof
- Triple glazed windows
- High efficiency curtain wall
- Skylights along central atrium

- 49% window to wall ratio

Lighting

- 6.8W/m^2 lighting power density
- Occupancy sensors located throughout the building
- Daylight harvesting along perimeter and in atrium

Heating

- 81.2% seasonal efficiency
- Heat recovery from electrical rooms (150kW of heat reclaim)

Cooling

- High efficiency heat pumps
- Water cooled chillers
- Solar driven absorption chiller

Fans & pumps

- Premium efficiency motors
- Variable speed drives

Service Hot Water

- Low flow fixtures
- 75 Viessmann solar thermal panels (generating approx.. 135,000 ekWh/yr)

Detail assumptions, uncertainties and sources of error within the energy model are beyond the scope of this report.

3.2.2 Energy use Assumptions

The results of the energy report were presented in ekWh/yr. The electrical consumption was input directly into the IE however the natural gas consumption had to be converted from eKwh/year to m^3/year using the following conversion:

$$\frac{ekWh}{yr} x \frac{therm}{29.307 ekWh} x \frac{2.7902 m^3}{therm}$$

4.0 Results and Interpretation

The following section presents the quantified results of material quantities and energy consumption of the model generated in section 3.0 Model Development.

4.1 Inventory Analysis

Inventory analysis is the phase of LCA in which inputs and outputs are compiled and quantified.

4.1.1 Bill of Materials

Once the building model was developed as described in section 3.0 Model Development the Athena IE was used to generate a Bill of Materials (BOM), a list of materials and quantities which fall within the scope of the study. The complete Bill of Materials for the New SUB Project by assembly type and for the total building can be found in Appendix C.

Since the materials are presented with different functional units it is difficult to make a finite comparison to determine which materials are present in the greatest quantity, however, there are several values which stand out in importance and in magnitude. The five main materials of interest are Concrete 30 MPa (flyash 35%), 1/2" Fire-Rated Type X Gypsum Board, Ballast (aggregate stone), Modified Bitumen Membrane and Rebar, Rod, Light Sections. The validity of these quantities is discussed below, and a sensitivity analysis of these materials is conducted in section 4.2 Sensitivity Analysis.

4.1.1.1 Concrete 30MPa (flyash %35)

Cast in place concrete is the primary construction material of the New SUB project and as such, deserves critical evaluation. A quick check can be made on concrete volumes by use of the volume to gross square foot ratio. Industry standard for large scale commercial buildings lies in a range between 0.041 m^3/GSF and 0.044m^3/GSF. Since composite deck, metal deck and cross laminated panels are used in addition to cast in place concrete, one would expect the ratio of the New SUB Project to be at the lower end of the range. With the generated bill of materials the concrete volume to gross square foot ratio was determined to be 0.061 m^3/GSF.

With a concrete ratio well above industry average, it is important to identify where an over estimate may have occurred. As described in section 3.0 Model Development above, the actual concrete volume was maintained for the input of footing assemblies and for the most part, the wall assemblies as well. The main source of uncertainty lies within the floors, roofs and columns and beams assemblies.

The method used to determine column and beam sizing is completely dependent upon the metrics built into the Impact Estimator. That is, the IE calculates the sizing of beams and columns based on the following inputs; number of beams, number of columns, floor to floor height, bay size, supported span and live load. The IE uses this information to internally develop a basic symmetrical column layout and conduct calculations to determine the column size. Additionally these calculations don't consider the shear walls throughout the building (which provide most of the support to the floors) and would likely result in larger column size estimates than required.

Similar to the columns the IE calculates suspended slab sizes based on several inputs: floor width, span, concrete strength, concrete flyash content and live load. With this information the IE develops a slab layout and determines the required slab thickness. Since the built in calculations are unknown, it provides substantial uncertainty in the results.

4.1.1.2 Rebar

Like concrete volume, a quick check can be made on the rebar quantity based on a ratio. The ratio of interest is rebar weight to concrete volume with the average value for a concrete structure being 190 lb/cy – 210 lb/cy. Based on our bill of materials, the weight per volume ratio of our structure is 99 lb/cy. Since the concrete is suspected to be high, naturally the rebar weight to concrete volume ratio would be skewed on the low end. However, a difference of %100 is far too great to be associated entirely with an over estimate of concrete.

Similarly to concrete volume, the rebar quantity is calculated based on the built in metrics of the IE. The rebar input for foundation, columns and beams, floors,

walls and roofs is a single choice of rebar size, either 15M or 20M. Based on the modelling assumptions made, it is known that the rebar in the footing assembly is under estimated since 20M bar was used in place of 25M and 30M bar, however without being familiar with the inner workings of the IE it is difficult to trace any potential source of error for the remaining assemblies which used the correct rebar size input.

4.1.1.3 Modified Bitumen Membrane

The modified bitumen membrane is mostly prevalent in the roof structure with additional contributions from the exterior walls. The quantity presented in the bill of materials is greater than many of the other materials and so a closer look is warranted.

The location of modified bitumen specified by the drawings was very clear and no assumptions had to be made during the roofing take-off. A Modified bitumen membrane was, however, used as a surrogate material for the torch on sheet waterproofing below grade. However, since this product also contains modified bitumen, the choice of surrogate would have little impact on the results.

The key uncertainty in the presented value is based on the built in metrics of the IE which converts an input roof area into a weight of modified bitumen. The assumptions made in the conversion are untraceable and so the validity of the output is hard to verify.

4.1.1.4 Roof Ballast

The roof ballast is another material in the bill of materials with a quantity magnitude greater than others. Similar to the bitumen membrane the location of roof ballast is well defined and leaves no uncertainty at the material take-off stage.

The key uncertainty in the final value is based on the built in metrics of the IE which converts an input roof area into a weight of modified bitumen. The assumptions made in the conversion are untraceable and so the validity of the output is hard to verify.

4.1.1.5 Type X Gypsum

Type X Gypsum board is present in the greatest quantity over the other gypsum products and the primary contributor are the interior wall assemblies. Due to the assumptions and substitutions made at the modelling stage, it is known that the quantity in our materials is an over estimate.

Since the wall height was assumed to be top of slab to top of slab the actual wall height was not accurately represented. In reality the interior walls span from top of slab to bottom of slab and thus the height was over estimated by the floor thickness (200mm on average). Additionally, since the abuse resistant drywall to 1200mm in all corridors was omitted there was no reduction to the outer gypsum board layer (where abuse resistant drywall would be located instead) which was most commonly Type X gypsum board.

Type X gypsum board was also used a surrogate for several fire resistant materials (fireboard, shaft liner and spray fireproofing) which would also contribute to an over estimate of material.

4.1.2 Energy Use

The results extracted from the Halsall energy simulation report are displayed in Figure 9. Discussions with the consultant clarified that the energy used by heating and hot water is supplied by natural gas and the remainder of the energy is supplied by electricity. Table 5 summarizes the energy consumption by source per year and by total over the 50 year design life of the building.

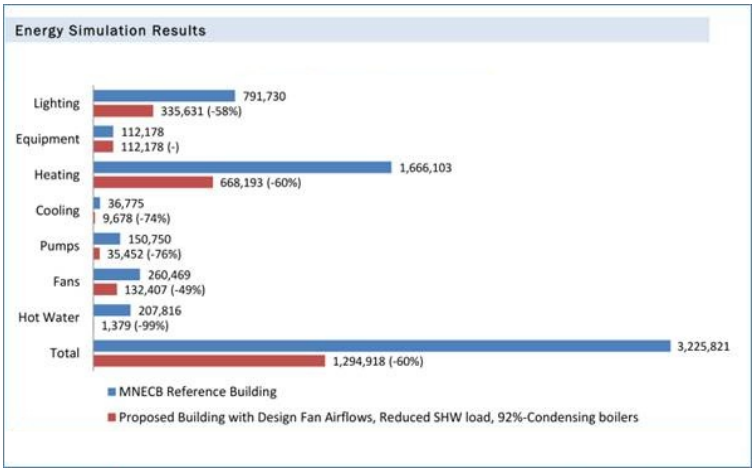

Figure 9: Halsall Energy Simulation Results

Table 5: Energy Consumption by Source

End Use	Electricity ekWh/yr	Natural Gas ekWh/yr
Lighting	335,631.00	-
Equipment	112,178.00	-
Heating	-	668,193.00
Cooling	9,678.00	-
Pumps	35,452.00	-
Fans	132,407.00	-
Hot Water	-	1,379.00
Annual Total	**625,346.00**	**669,572.00**

Design Life Total	**31,267,300.00**	**33,478,600.00**

4.2 Impact Assessment

Impact assessment is the phase on LCA aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system through the life cycle of a product. For the New SUB Project the impact assessment included a review of the impact categories, a sensitivity analysis, uncertainties, and the functions and impacts.

4.2.1 Impact Categories

The model created in the Impact Estimator was used to produce outputs indicating the impacts across seven categories through each lifecycle stage. The categories are referred to as impact categories and consist of: acidification potential, eutrophication potential, fossil fuel consumption, global warming potential, human health criteria, ozone depletion potential, and smog potential.

4.2.1.1 Acidification Potential

Acidification potential describes the ability of certain gases to react with water to produce compounds dangerous to human, animal, and plant health. Such reactions include: CO2 (aq) + H2O = CO32− + 2 H+, the 2 H+ decreasing the ph and increasing the acidity of sea water leading to disrupted biological processes, and extinction. Other implicated gasses include sulfur dioxide (SO2), nitrogen oxides (NOx), ammonia (NH3). The category indicator is H+ equivalence (moles of H+ eq).

Figure 10 presents the acidification potential of the New SUB Project, as calculated from our building model, broken down by assembly group. These results are expanded upon in Appendix D by including a breakout by life cycle stage.

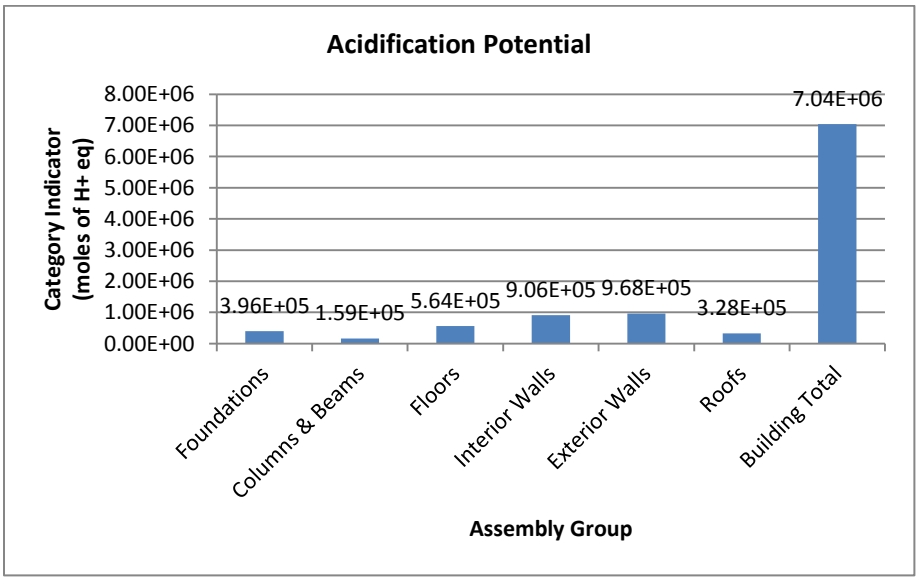

Figure 10: Category Indicator - Acidification Potential

4.2.1.2 Eutrophication Potential

Eutrophication potential is defined by weight of nitrogen equivalence (kg N eq). Nitrogen and associated compounds runoff into aquatic ecosystems and encourages the growth of algae and aquatic weeds which can crowd out existing species and lead to oxygen depletion and effective poisoning. A common contributor is nitrogen heavy fertilizer for use in agriculture. Effects include toxicity to human, aquatic mammals and potential death in fish and shellfish.

Figure 11 presents the eutrophication potential of the New SUB Project, as calculated from our building model, broken down by assembly group. These results are expanded upon in Appendix D by including a breakout by life cycle stage.

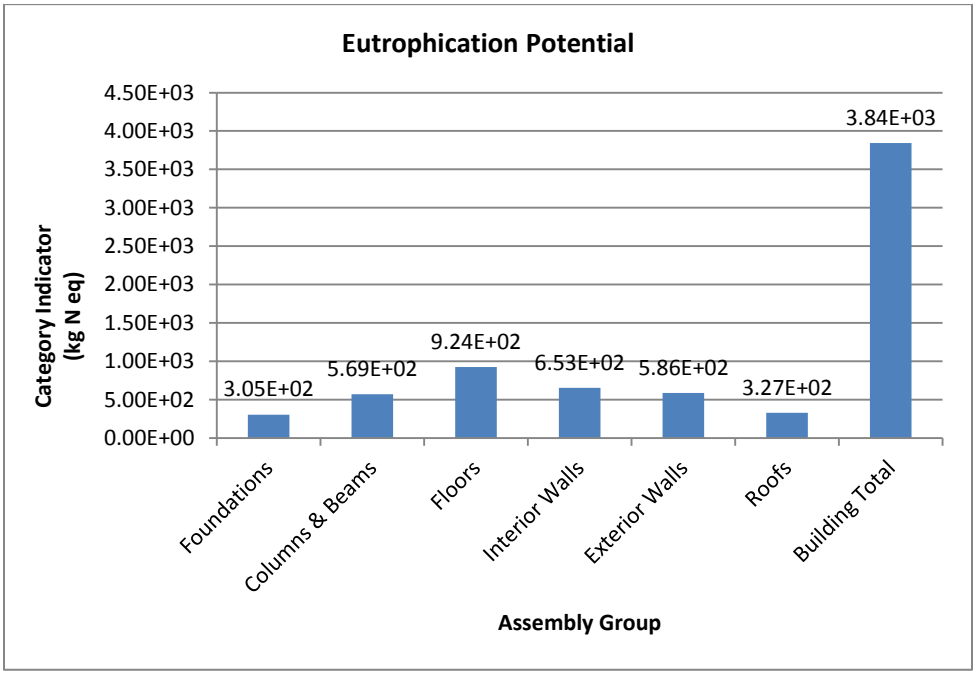

Figure 11: Category Indicator - Eutrophication Potential

4.2.1.3 Fossil Fuel Consumption

Fossil fuels (coal, petroleum, and natural gas) are decomposed organic compounds which, when burnt, produce high energy per mass yields and high emissions (carbon, methane, sulphur etc.). They account for approximately 80% of global energy use and have several impacts: emission of ecologically damaging compounds (including those above and those implicated as detrimental to human health, and ecosystem health, oceans, forests, etc.), depletion of non-renewable resources, and important international relations/ diplomatic issues (war, etc.). The category indicator is megajoules (MJ) which describes energy expended through these sources.

Figure 12 presents the fossil fuel consumption equivalent of the New SUB Project, as calculated from our building model, broken down by assembly group. These results are expanded upon in Appendix D by including a breakout by life cycle stage.

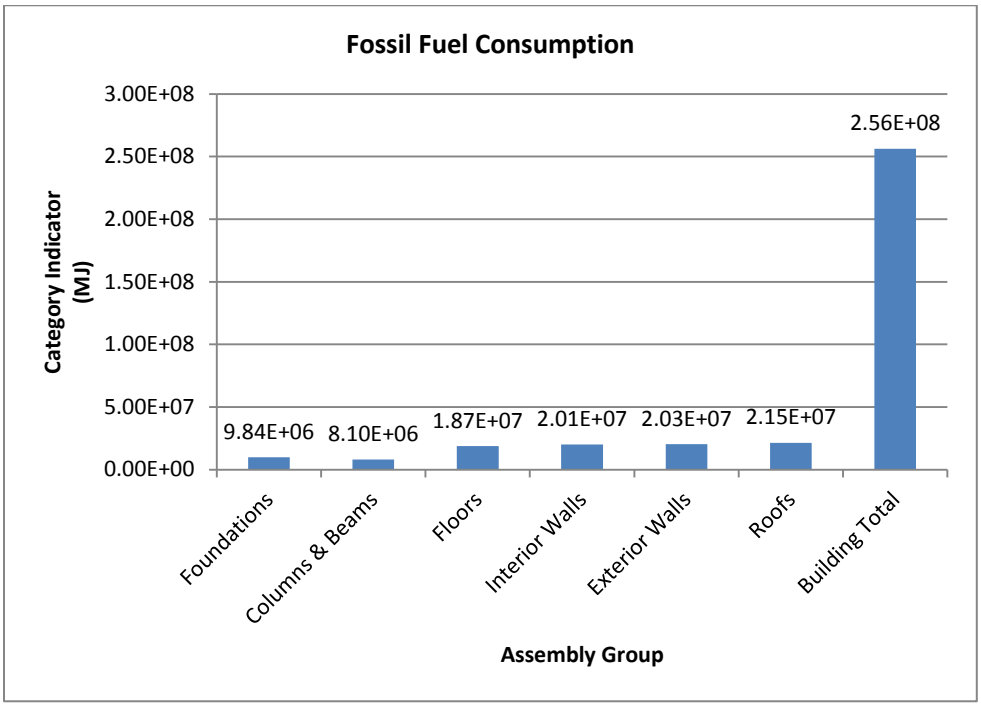

Figure 12: Category Indicator - Fossil Fuel Consumpti

4.2.1.4 Global Warming Potential

Global warming describes high and rising temperatures worldwide due to a complex weave of dynamic earth processes, some attributed to human activities: the greenhouse effect. Here we use a category indicator of weight of CO2 equivalence (kg CO2 eq) to describe carbon dioxide's role in increasing the atmospheres capacity to absorb infrared radiation (i.e. warming). Endpoints include agricultural effects (draught), species effects (diseases such as malaria), and increasing tropical storms.

Figure 13 presents the global warming potential of the New SUB Project, as calculated from our building model, broken down by assembly group. These results are expanded upon in Appendix D by including a breakout by life cycle stage.

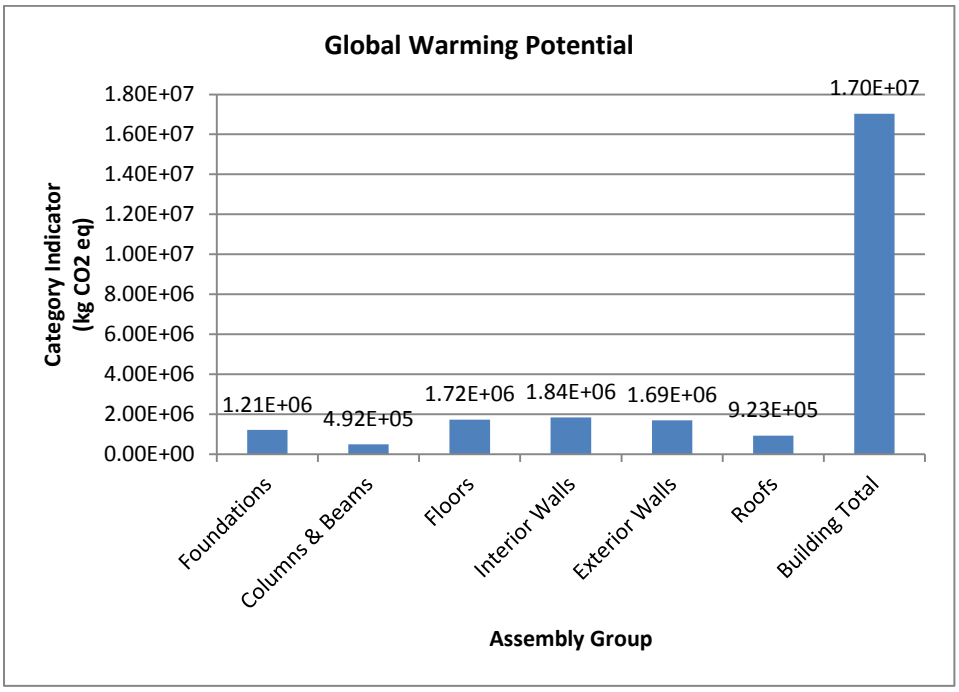

Figure 13: Category Indicator - Global Warming Potential

4.2.1.5 Human Health Respiratory Effects Potential

Human health criteria describe the weight of air borne particulate matter less than 10 µm (kg PM10 eq). Particulate emissions can contribute to respiratory problems, asthma and chronic bronchitis, as well as birth defects: premature and low weight births. The endpoint recipient is human health, and the midpoint would be particulate matter such as fly ash, tobacco smoke, smog contributor (S02) etc.

Figure 14 presents the human health respiratory effects potential of the New SUB Project, as calculated from our building model, broken down by assembly group. These results are expanded upon in Appendix D by including a breakout by life cycle stage.

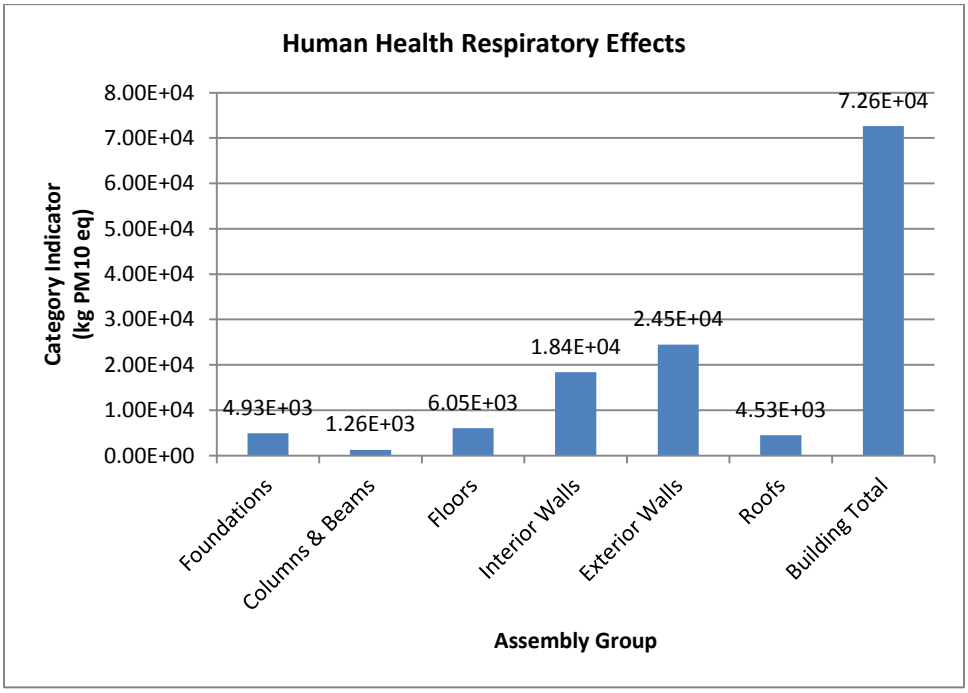

Figure 14: Category Indicator - Human Health Respiratory Effects

4.2.1.6 Ozone Depletion Potential

Ozone depletion potential describes the emission of certain substances' potential to change stratospheric ozone levels from steady state, increasing the atmospheres absorption of infrared radiation. We use kg of CFC-11 equivalence, chlorofluorocarbons being the major contributor implicated in ozone depletion. Endpoints include agricultural and human health effects and material damage

Figure 15 presents the ozone depletion potential of the New SUB Project, as calculated from our building model, broken down by assembly group. These results are expanded upon in Appendix D by including a breakout by life cycle stage.

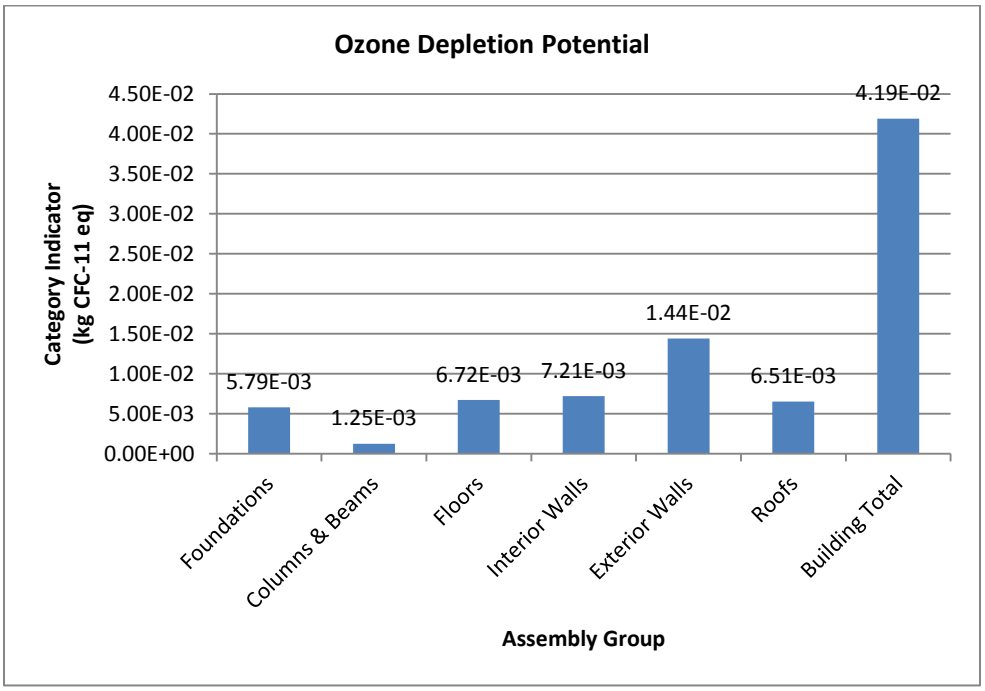

Figure 15: Category Indicator - Ozone Depletion Potential

4.2.1.7 Smog Potential

Smog potential describes a given emissions' influence on photo-chemical ozone formation which contributes to human health effects: emphysema, bronchitis and asthma and possible plant and animal effects. It's represented in terms of kg O3 eq. Implicated compounds include nitrogen oxides and volatile organic matter associated with industrial activity and fossil fuel consumption.

Figure 16 presents the smog potential of the New SUB Project, as calculated from our building model, broken down by assembly group. These results are expanded upon in Appendix D by including a breakout by life cycle stage.

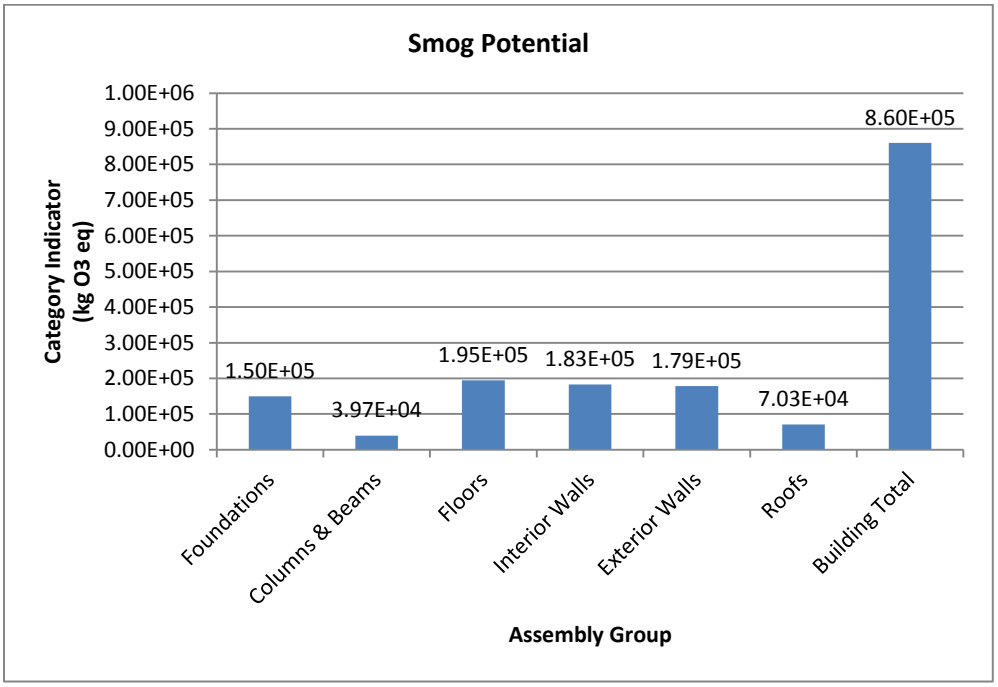

Figure 16: Category Indicator - Smog Potential

4.2.2 Uncertainty

Uncertainty exists in all phases of life cycle assessment from the definition of the Goal and Scope, to the Inventory Analysis and to the Impact Assessment itself. Uncertainly in these phases occurs primarily due to data uncertainty, model uncertainty, uncertainty due to choices, temporal variability, spatial variability, variability between objects/ sources and human mistakes.

The focus of uncertainty for this report is that attributed to data uncertainty, model uncertainty, uncertainty due to choices and uncertainty due to mistakes.

Data uncertainty occurs in our project at the material take-off level as a result of unknown information. Since the drawings and specifications for the New SUB Project were complete and well detailed there was no significant unknown information in regards to the material composition of the building.

Modeling uncertainty is most prevalent in this study given the layout of the Athena Impact Estimator software. The IE was developed with preliminary design in mind and because of this; it requires minimal inputs for specific assembly groups and conducts various back ground calculations to fill in the missing information. When a complete set of information is known, it becomes difficult to properly model in the IE without careful analysis at each step of the process to very that the calculated quantity is within acceptable limits of the actual quantity. At times, assumptions are made that cannot be avoided, for example, it was noted that drywall tape and compound was applied to every input containing gypsum board, when in reality, exterior gypsum sheathing, and primary layers of a double layered gypsum wall do not have these materials. While the impacts of the added material are likely small it demonstrates that the program does not have the capability to generate very specific models.

Uncertainty due to choices arises in all stages in the generation of this model. In the goal and scope it was decided that the system boundary will include footings, columns and beams, floors, interior walls, exterior walls and roofs. The impacts of earthworks, landscaping, mechanical, electrical, and interior finishes are not included and the significance of the impacts associated with these categories is not known. At the material take-off phase, the choices in how to conduct the estimate and to what degree

of accuracy will influence the final result. For example, we decided to estimate interior wall heights from top of slab to top of slab to increase the efficiency of the take-off phase; however this results in higher estimates and the extend of the impact is not known without further investigation. In the modeling phase, assumptions were made when deciding on surrogate materials. While every effort was made to choose materials similar in properties it is unknown if the associated summary measures across all life cycle stages were similar as well.

Uncertainty due to mistakes also arises in all stages in the generation of this model. During the take-off phase it is possible to miss identify material specifications and material dimensions. It is also possible that materials were overlooked entirely. In addition, since the quantities are digitized from digital drawings the accuracy of the "tracing" will contribute a component of error to the results. When working with the Athena Impact Estimator, it becomes difficult to track the large quantity of assemblies and their associated values and the sheer volume of data entry required lends itself to human error. While measures were taken to minimize human error, such as the creation of a nomenclature system to track assemblies from OST to the IE, and careful review of the model and bill of material results the potential for errors still exists.

4.2.3 Sensitivity Analysis

A sensitivity analysis was carried out on the five building materials identified in section 4.0 Results and Interpretation (Concrete 30 MPa (flyash 35%), 5/8" Fire-Rated Type X Gypsum Board, Ballast (aggregate stone), Modified Bitumen Membrane and Rebar, Rod, Light Sections, to provide clearer understanding of the impacts due to errors in measurement and more importantly the impacts associated with specific building materials in the context of a whole building.

Additionally, a sixth case was completed in order to look at the impacts of choosing a high flyash (35%) concrete for this building compared to the impact that would have occurred if an average flyash content (9%) was used.

The analysis was conducted with the use of the "extra basic material" input of the Impact Estimator. An additional ten percent of the material in question was added to the baseline model and the change in impact was analysed. Since the analysis was

primarily conducted to compare the impacts of various materials, it was decided to exclude the impacts associated with operational energy from both the baseline and 10% added material models as they would dilute the results significantly.

The relative sensitivity comparison was completed for each of the following impact categories presented in section 4.2.1

4.2.3.1 Sensitivity Analysis – Acidification Potential

While concrete dominates this sensitivity category as seen in (Figure 17), it is noted that the rebar and bitumen membrane have a significant impact relative to their quantities in the building compared to concrete. It is possible that PVC in a modified bitumen membrane could attribute to the creation of hydrogen ions and thus create a higher sensitivity

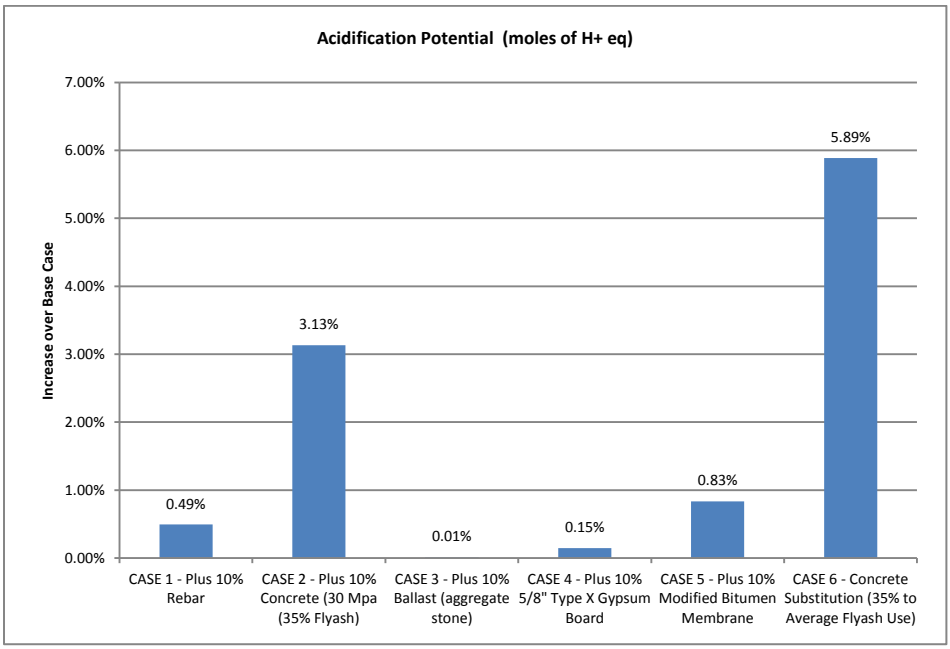

Figure 17: Sensitivity Analysis - Acidification Potential

4.2.3.2 Sensitivity Analysis – Fossil Fuel Consumption

Sensitivity to impacts on the Fossil Fuel Consumption showed in Figure 18 highlights a significant impact of cementations products and modified bitumen roofing membrane and moderate impact of rebar.

The low impact of a variable quantity of gypsum and ballast show that any significant change of this product or error in their measurement will result in very little impact to the fossil fuel consumption.

With the building utilizing a high fly ash substitution for cement in the concrete mix, the sensitivity shows a 2.68% savings in additional energy consumption by substituting regular concrete with one that has a 35% cement reduction.

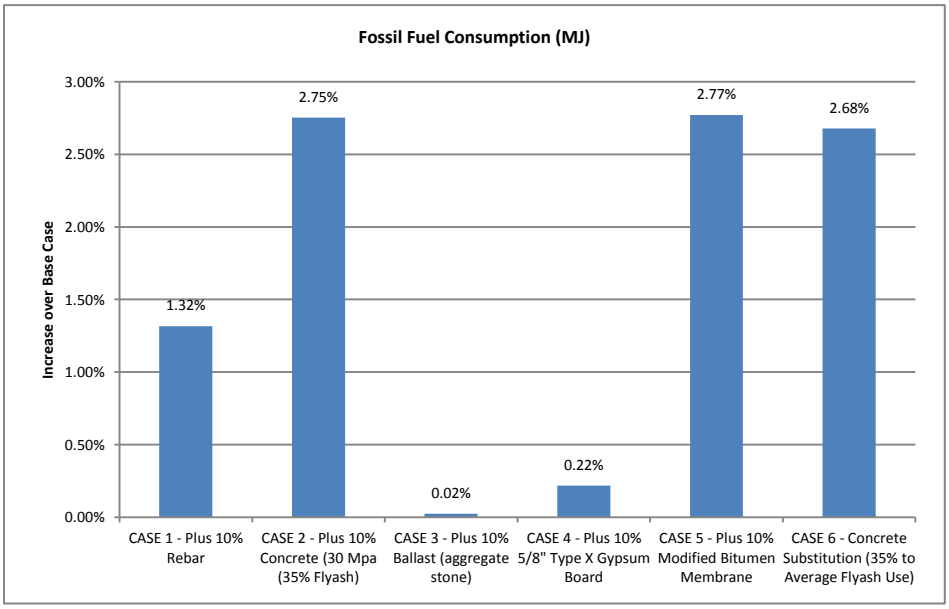

Figure 18: Sensitivity Analysis - Fossil Fuel Consumption

4.2.3.3 Sensitivity Analysis – Eutrophication Potential

As seen in Figure 19 concrete and rebar have the most significant impact to the eutrophication potential and thus a substitution of these materials, or an error in their take-off quantity will the most significant impact on this category.

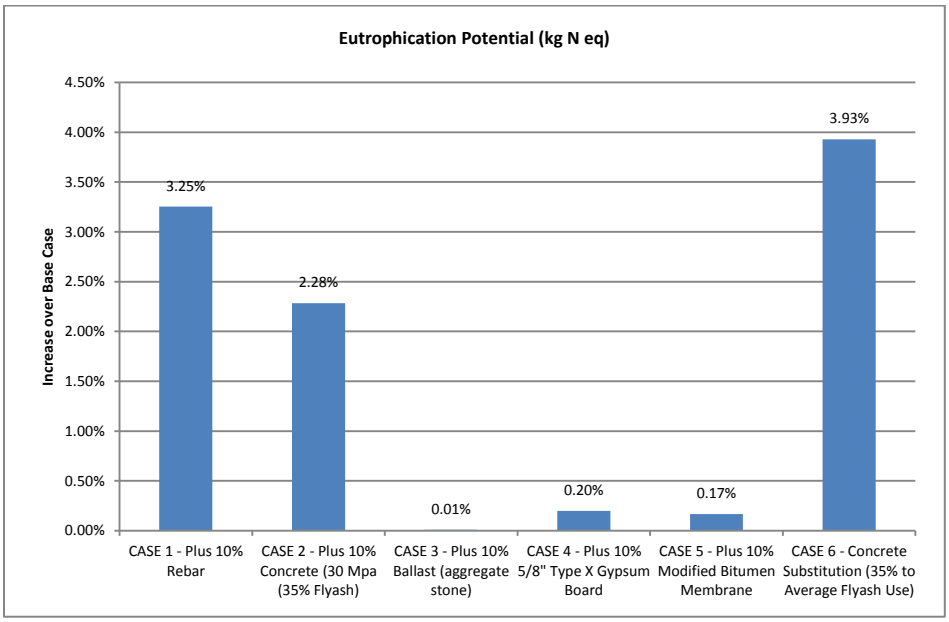

Figure 19: Sensitivity Analysis - Eutrophication Potential

4.2.3.4 Sensitivity Analysis – Global Warming Potential

Figure 20 highlights the implications of the use of concrete and the resultant CO_2 emissions. The production of cement includes a significant release of carbon dioxide through the calcining process of conveyor limestone into lime ($CaCO_3$ $\rightarrow CaO + CO_2$), through this process, approximately 44% of the limestone weight is lost as carbon dioxide, thus having a significant impact to the global warming potential.

In comparing Case 2 to Case 6, it can be concluded that in order to achieve the same global warming savings potential as using a high cement reduction concrete mix, the designers need to use nearly 20% less regular concrete. The primary drawback to this choice could be in areas where high strength is required from the concrete at an early age since fly ash concrete comes up to strength at a slower rate than regular concrete.

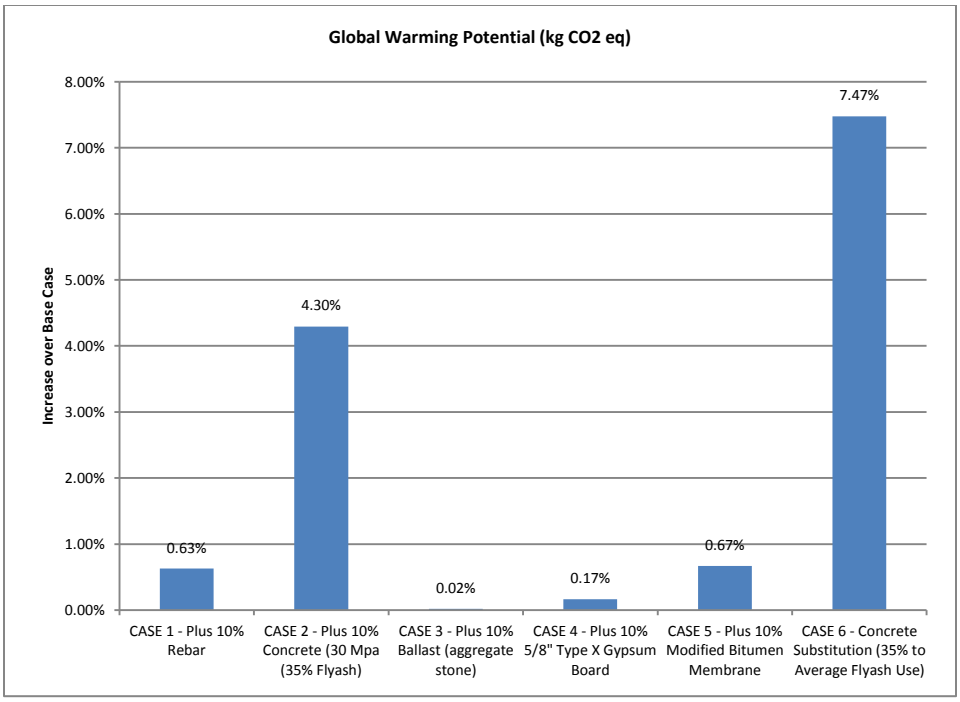

Figure 20: Sensitivity Analysis - Global Warming Potential

4.2.3.5 Sensitivity Analysis – HH Respiratory Effects

Figure 21 highlights the relationship of ballast or other aggregates to human health respiratory effects. Other sensitivities of this product on the other impact categories showed an overall impact of less than 0.02%, however in this impact category, the impact is 0.63% or over thirty times the relative impact of this product on the other impact categories. The production of dust, especially silica, in the crushing and handling of aggregate can result in significant impacts to the HH respiratory effects as this figure has shown.

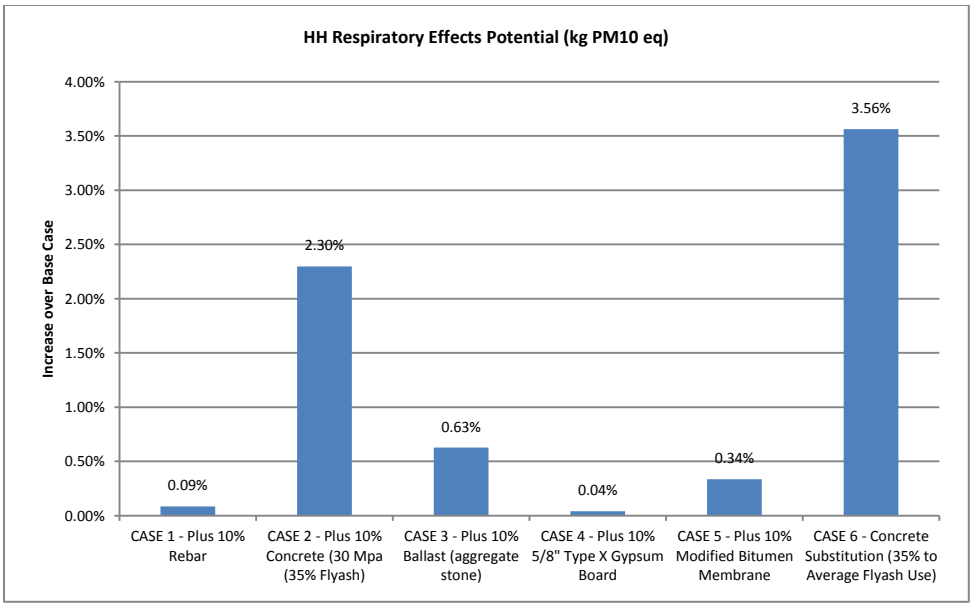

Figure 21: Sensitivity Analysis - HH Respiratory Effects potential

4.2.3.6 Sensitivity Analysis – Ozone Depletion Potential

As seen in Figure 22, of the products included in the sensitivity analysis, cement usage in connection with the measured concrete consumption has significant impacts to the overall results of ozone depletion.

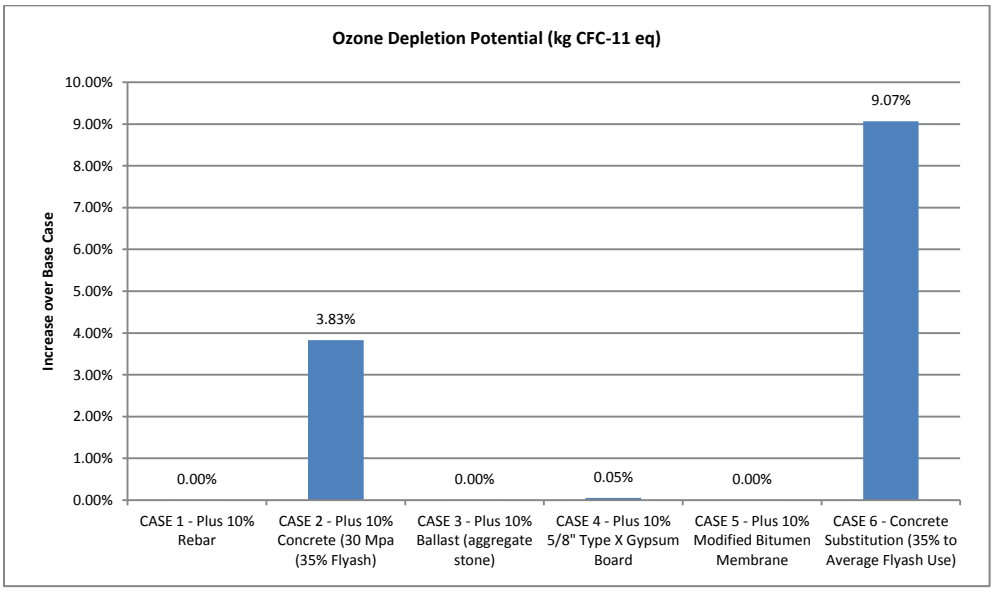

Figure 22: Sensitivity Analysis - Ozone Depletion Potential

4.2.3.7 Sensitivity Analysis – Smog Potential

As seen in figure 23, cement usage in connection with the measured concrete consumption has significant impacts to the overall results of smog potential.

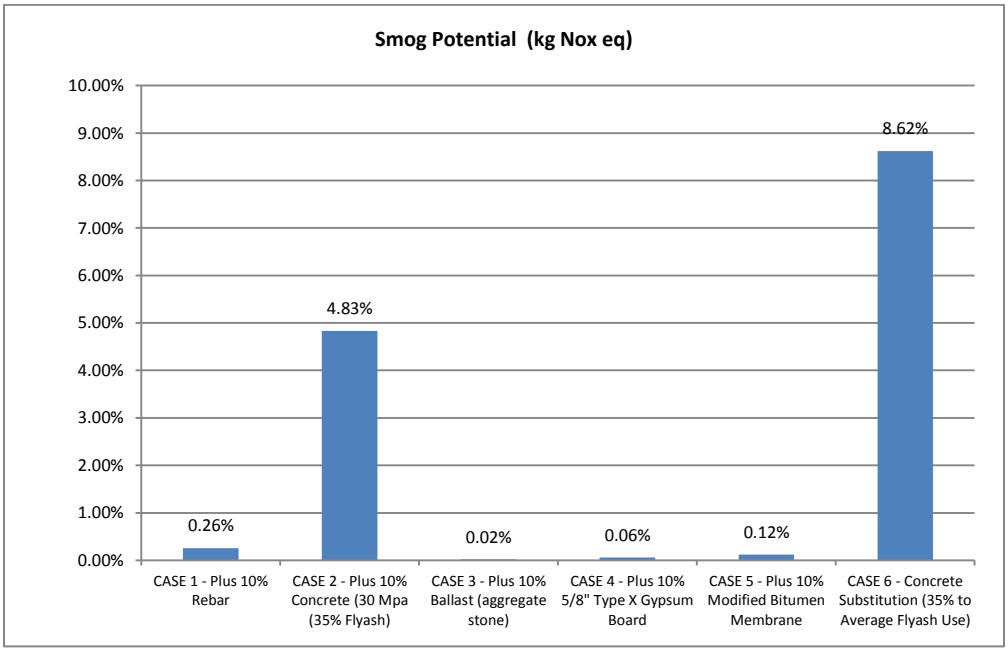

Figure 23: Sensitivity Analysis - Smog Potential

4.2.4 Functions and Impacts

In order to put the calculates data in context, and make comparisons to similar structures, an assessment of the buildings function needs to be completed and functional units need to be defined.

4.2.4.1 Building Functions

The purpose of New SUB Project was intended to provide a building that combines four main functions:

- Provide central social and recreational areas
- Provide central space with bookable rooms for student use
- Provide an area for the AMS offices and clubs
- Provide central food and retail services

As seen from our functional area take-off (Table 6) the primary spaces provided are atriums/ hallways / lounges, office/ club rooms, study/ bookable rooms and food services space which directly reflect the goals defined set out by the AMS. In addition the New Sub provides auditoriums, a ball room, commercial retail units, storage rooms, washrooms and storage space. It should be noted that the measured functional area is less than the measured gross square foot (GSF) area because unlike the standard GSF measurement, functional area does not include inaccessible space such as mechanical shafts, elevator shafts, wall footprints, etc.

Table 6: Functional Areas

Functional Use	Floor Area		
	m^2	ft^2	%
Atriums/ Hallways/ Lounges	6,175	66,474	34%
Auditoriums/ Lecture halls	358	3,854	2%
Ballroom	815	8,773	5%
Commercial Retail Units	875	9,419	5%
Food Prep/ Food Services/ Kitchens/ Restaurants	1,989	21,412	11%
Mechanical Rooms	1,753	18,871	10%
Office/ Club Rooms	3,386	36,450	19%
Stairwells	715	7,697	4%
Storage Rooms	370	3,983	2%
Studio Space	252	2,713	1%
Study/Bookable Rooms	951	10,237	5%
Washrooms/Locker Rooms	402	4,328	2%
Total	**18,041**	**194,211**	**100%**

The atriums, hallways, and lounges all contain seating, desks, and study space, which along with the open nature of the walkways and the location of surrounding areas provide a functional corridor between areas, utilising the available space efficiently. This open floor plan also allows for the reassignment of space as the needs of the stakeholders change over the projected 50 year lifespan of the building. The amount of food services and retail space also allows for revenue within the building, allowing for the majority of students, faculty, and campus guests, to find what they require in one central building.

4.2.4.2 Functional Unit

In Life Cycle Assessments, a “functional unit” is used to quantify the performance of a product system for use as a reference base unit. Using appropriate functional units, comparisons can be made across a wide selection of product systems. In the context of our report, the functional units can be compared to those of similar buildings for comparative analysis.

The functional units for this study are, category indicator:

1. per general building square foot constructed
2. per specific building square foot constructed
3. per generic cubic foot constructed

The first method evaluates the environmental impact over the gross square foot (GSF) area of the entire facility. The second is used to gain insight into the concentrated impact for specific functional areas within the building. The third method looks at the total volume of the structure, this measurement can help to put in the context of the environmental impact when used in conjunction to method 1 since it helps to understand buildings that may have large open spaces such as atriums or stadiums.

Table 7 and Table 8 summarize the resulting functional units, as described above, for the New Sub Project.

Table 7: Functional Units - Per Building Size

		Per GSF Constructed (/ GSF)	Per Volume Constructed (/ ft^3)
	Building Total	222,296	4,285,285
Acidification Potential (moles of H+ eq)	7.04E+06	3.17E+01	1.64E+00
Eutrophication Potential (kg N eq)	3.84E+03	1.73E-02	8.97E-04
Fossil Fuel Consumption (MJ)	2.56E+08	1.15E+03	5.98E+01
Global Warming Potential (kg CO2 eq)	1.70E+07	7.66E+01	3.98E+00
Human Health Respiratory Effects (kg PM10 eq)	7.26E+04	3.27E-01	1.69E-02
Ozone Layer Depletion (kg CFC-11 eq)	4.19E-02	1.88E-07	9.78E-09
Smog Potential (kg 03 eq)	8.60E+05	3.87E+00	2.01E-01

Table 8: Functional Units - Per Specific Floor Area

		Acidification Potential (moles of H+ eq)	Eutrophication Potential (kg N eq)	Fossil Fuel Consumption (MJ)	Global Warming Potential (kg CO2 eq)	Human Health Respiratory Effects (kg PM10 eq)	Ozone Layer Depletion (kg CFC-11 eq)	Smog Potential (kg 03 eq)
	Building Total	**7.04E+06**	**3.84E+03**	**2.56E+08**	**1.70E+07**	**7.26E+04**	**4.19E-02**	**8.60E+05**
Atriums/ Hallways/ Lounges (ft^2)	**66,474**	1.06E+02	5.78E-02	3.85E+03	2.56E+02	1.09E+00	6.30E-07	1.29E+01
Auditoriums/ Lecture halls (ft^2)	**3,854**	1.83E+03	9.97E-01	6.65E+04	4.42E+03	1.88E+01	1.09E-05	2.23E+02
Ballroom (ft^2)	**8,773**	8.03E+02	4.38E-01	2.92E+04	1.94E+03	8.28E+00	4.78E-06	9.81E+01
Commertial Retail Units (ft^2)	**9,419**	7.48E+02	4.08E-01	2.72E+04	1.81E+03	7.71E+00	4.45E-06	9.13E+01
Food Prep/ Food Services/ Kitchens/ Restaurants (ft^2)	**21,412**	3.29E+02	1.80E-01	1.20E+04	7.96E+02	3.39E+00	1.96E-06	4.02E+01
Mechanical Rooms (ft^2)	**18,871**	3.73E+02	2.04E-01	1.36E+04	9.03E+02	3.85E+00	2.22E-06	4.56E+01
Office/ Club Rooms (ft^2)	**36,450**	1.93E+02	1.05E-01	7.03E+03	4.67E+02	1.99E+00	1.15E-06	2.36E+01
Stairwells (ft^2)	**7,697**	9.15E+02	4.99E-01	3.33E+04	2.21E+03	9.44E+00	5.44E-06	1.12E+02
Storage Rooms (ft^2)	**3,983**	1.77E+03	9.65E-01	6.43E+04	4.28E+03	1.82E+01	1.05E-05	2.16E+02
Studio Space (ft^2)	**2,713**	2.60E+03	1.42E+00	9.44E+04	6.28E+03	2.68E+01	1.54E-05	3.17E+02
Study/ Bookable Rooms (ft^2)	**10,237**	6.88E+02	3.75E-01	2.50E+04	1.66E+03	7.09E+00	4.09E-06	8.40E+01
Washrooms/ Locker Rooms (ft^2)	**4,328**	1.63E+03	8.88E-01	5.92E+04	3.94E+03	1.68E+01	9.68E-06	1.99E+02

5.0 Conclusions

Through the Life Cycle Assessment process the environmental impacts of The NEW Sub Project were critically analyzed and quantified. The system boundary consisted of foundations, columns and beams, floors, interior walls, exterior walls and roofs in addition to the operating energy consumption of the building. The environmental impacts were presented as category indicators across the following impact categories: acidification potential, eutrophication potential, fossil fuel consumption, global warming potential, human health and respiratory effects, ozone layer depletion potential and smog potential. The resulting category indicators for each impact category were transposed into functional units which serve as a basis of comparison across similar product systems. Since the New SUB Project is unique in its function compared to existing buildings in the UBC LCA project database impact comparisons were not developed and the presented results serve as a baseline of comparison for studies.

A sensitivity analysis was conducted on the five materials present in the greatest quantity for two reasons. First, to determine the magnitude of error associated with any uncertainties in the material-takeoffs and building model and second, to determine which materials present the greatest environmental impact in the context of a whole building. The latter being a significant use of LCA in the design phase to aid in the selection of the most environmentally sustainable materials.

The materials evaluated in the sensitivity analysis were Concrete 30MPa (flyash 35%), 1/2" Fire-Rated Type X Gypsum Board, Ballast (aggregate stone), Modified Bitumen Membrane and Rebar and Concrete 30MPa (flyash 35%) was discovered to have the most significant impact across all assembly measures by several orders of magnitude.

The sensitivity analysis continued with a comparison of the impacts associated with the use of normal concrete, containing 9% cement reduction by use of flyash, to the concrete specified for the New SUB Project, containing a 35% cement reduction. The category indicators associated with the use of normal concrete was substantially greater across all impact categories. For Global Warming Potential, the primary impact category of interest, the average concrete resulted in a 7.4% increase in kg CO2 eq over the baseline case of 35% cement reduced concrete. Considering 9% cement reduced concrete was the minimum we could evaluate, the reduction value comes close to the anticipated 10% difference between a 0% cement reduction and 35% cement reduction provided by the structural consultants.

Energy use data was provided in an energy simulation report from Halsall constants and input directly into the Impact Estimator. It was noted that the category indicators due to energy use are significant

over the design life of a structure, and for many impact categories, are greater than those associated with material manufacturing, construction, maintenance and decommissioning combined. This observation highlights the importance of innovative and sustainable design of mechanical and electrical systems.

Uncertainly in this assessment is primarily attributed to the nature of the Impact Estimator. Some assemblies require minimal input leaving the built in metrics to calculate the resulting material quantity. The assemblies which utilize the most built in calculations are those associated with the structure and as shown by the sensitivity analysis any inaccuracies in concrete volume will have the greatest effect on the overall results.

We feel that the modelling uncertainties warrant a critical review of the bill of materials to further refine the accuracy of the model. It is recommended that a conventional structural take-off be complete and material volumes compared to those generated by the Impact Estimator to verify the accuracy of the results. Refinement can be made as necessary using the conventional structural assembly inputs or the total volume could be placed directly into the extra basic materials input. The sensitivity analysis should be expanded to include all materials present in the structure to identify other significant materials which may require a quantity comparison.

Furthermore, we feel that the system boundary is quite restrictive and a model containing all associated earthwork, landscape, mechanical, electrical and interior finishes would be an asset to evaluate the relative significance of these assembly groups and comment on the validity of our chosen system boundary in regards to total environmental impacts of The New SUB Project.

Appendix A – IE Inputs

IE Inputs Document - New SUB Project

Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
1.0 Foundation					
	1.1 Concrete Footing				
		1.1.1 Concrete Footing _ F1			
			Quantity (ea)	15.00	1.00
			Length (m)	2.50	37.50
			Width (m)	2.50	2.50
			Thickness (mm)	400.00	400.00
			Total Volume (m^3)	37.50	37.50
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	15.00	15.00
		1.1.2 Concrete Footing _ F2			
			Quantity (ea)	29.00	1.00
			Length (m)	4.00	255.20
			Width (m)	4.00	4.00
			Thickness (mm)	1,100.00	500.00
			Total Volume (m^3)	510.40	510.40
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	0.35	35.00
			Rebar (M)	25.00	20.00
		1.1.3 Concrete Footing _ F3			
			Quantity (ea)	8.00	1.00
			Length (m)	4.20	100.80
			Width (m)	4.20	4.20
			Thickness (mm)	1,200.00	400.00
			Total Volume (m^3)	169.34	169.34
			Concrete (MPa)	30.00	4,000.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	30.00	20.00
		1.1.4 Concrete Footing _ F4			
			Quantity (ea)	7.00	1.00
			Length (m)	4.90	89.18
			Width (m)	4.90	4.90
			Thickness (mm)	1,300.00	500.00
			Total Volume (m^3)	218.49	218.49
			Concrete (MPa)	30.00	4,000.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	30.00	20.00
		1.1.5 Concrete Footing _ Misc. _ 700d			
			Length (m)	8.00	8.00
			Width (m)	3.00	6.00
			Thickness (mm)	700.00	350.00
			Total Volume (m^3)	16.80	16.80
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	25.00	20.00
		1.1.6 Concrete Footing _ Misc. _ 875d			
			Length (m)	3.00	4.25
			Width (m)	5.67	7.00
			Thickness (mm)	875.00	500.00
			Total Volume (m^3)	14.87	14.88
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	25.00	20.00
		1.1.7 Concrete Footing _ Misc. 1200d			
			Length (m)	8.33	20.00
			Width (m)	3.00	3.00
			Thickness (mm)	1,200.00	500.00
			Total Volume (m^3)	30.00	30.00
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	25.00	20.00
		1.1.8 Concrete Footing _ Misc. 2500d			
			Length (m)	10.00	50.00
			Width (m)	3.90	3.90
			Thickness (mm)	2,500.00	500.00
			Total Volume (m^3)	97.50	97.50
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	25.00	20.00
		1.1.9 Concrete Footing _ SF1			
			Length (m)	343.00	343.00
			Width (m)	0.60	0.60
			Thickness (mm)	350.00	350.00
			Total Volume (m^3)	72.03	72.03
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	15.00	15.00
		1.1.10 Concrete Footing _ Stair Core 1			
			Length (m)	10.00	40.00
			Width (m)	16.00	16.00
			Thickness (mm)	2,000.00	500.00
			Total Volume (m^3)	320.00	320.00
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	30.00	20.00
		1.1.11 Concrete Footing _ Stair Core 2			
			Length (m)	19.10	95.50
			Width (m)	20.10	20.10
			Thickness (mm)	2,500.00	500.00
			Total Volume (m^3)	959.78	959.78
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	30.00	20.00
		1.1.12 Concrete Footing _ Stair Core 3			
			Length (m)	13.95	13.95
			Width (m)	20.00	80.00
			Thickness (mm)	2,000.00	500.00
			Total Volume (m^3)	558.00	558.00
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	30.00	20.00
		1.1.13 Concrete Footing _ Stair Core 4			
			Length (m)	10.85	10.85
			Width (m)	20.00	100.00
			Thickness (mm)	2,500.00	500.00
			Total Volume (m^3)	542.50	542.50
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Rebar (M)	30.00	20.00

IE Inputs Document - New SUB Project

Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
	1.2 Concrete Slab on Grade				
		1.2.1 Concrete Slab on Grade _ Lower Level _ 125mm			
			Length (m)	Varies	56.40
			Width (m)	Varies	100.00
			Area (m^2)	4,516.00	5,640.00
			Thickness (mm)	125.00	100.00
			Total Volume (m^3)	564.50	564.00
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
		Envelope	Category	Board Insulation	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	100.00	25.38
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
		1.2.2 Concrete Slab on Grade _ Lower Level _ 225mm			
			Length (m)	Varies	8.30
			Width (m)	Varies	10.00
			Area (m^2)	83.00	83.00
			Thickness (mm)	100.00	100.00
			Total Volume (m^3)	8.30	8.30
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
		1.2.3 Concrete Slab on Grade _ Level 1 _ 125mm			
			Length (m)	Varies	7.80
			Width (m)	Varies	12.50
			Area (m^2)	78.00	97.50
			Thickness (mm)	125.00	100.00
			Total Volume (m^3)	9.75	9.75
			Concrete (MPa)	30.00	30.00
			Concrete Flyash (%)	35.00	35.00
2.0 Columns and Beams					
	2.1 Concrete				
		2.1.1 Columns and Beams _ Concrete _ Lower Level			
			Number of Beams	None	None
			Number of Columns	53.00	53.00
			Column Height (m)	4.26	4.26
			Supported Area (m^2)	4,647.00	4,647.00
			Bay Sizes (m)	9.36	9.36
			Supported Span (m)	9.36	9.36
			Live Load (kPa)	4.80	4.80
			Column Type	Concrete	Concrete
			Beam Type	n/a	n/a
		2.1.2 Columns and Beams _ Concrete _ Level 1			
			Number of Beams	None	None
			Number of Columns	43.00	43.00
			Column Height (m)	6.60	6.60
			Supported Area (m^2)	3,579.00	3,579.00
			Bay Sizes (m)	9.12	9.12
			Supported Span (m)	9.12	9.12
			Live Load (kPa)	4.80	4.80
			Column Type	Concrete	Concrete
			Beam Type	n/a	n/a
		2.1.3 Columns and Beams _ Concrete _ Level 2			
			Number of Beams	None	None
			Number of Columns	42.00	42.00
			Column Height (m)	4.30	4.30
			Supported Area (m^2)	3,522.00	3,522.00
			Bay Sizes (m)	9.16	9.16
			Supported Span (m)	9.16	9.16
			Live Load (kPa)	4.80	4.80
			Column Type	Concrete	Concrete
			Beam Type	n/a	n/a
		2.1.4 Columns and Beams _ Concrete _ Level 3			
			Number of Beams	None	None
			Number of Columns	42.00	42.00
			Column Height (m)	4.30	4.30
			Supported Area (m^2)	3,579.00	3,579.00
			Bay Sizes (m)	9.23	9.23
			Supported Span (m)	9.23	9.23
			Live Load (kPa)	4.80	4.80
			Column Type	Concrete	Concrete
			Beam Type	n/a	n/a
		2.1.5 Columns and Beams _ Concrete _ Level 4			
			Number of Beams	None	None
			Number of Columns	33.00	33.00
			Column Height (m)	4.30	4.30
			Supported Area (m^2)	1,591.00	1,591.00
			Bay Sizes (m)	6.94	6.94
			Supported Span (m)	6.94	6.94
			Live Load (kPa)	4.80	4.80
			Column Type	Concrete	Concrete
			Beam Type	n/a	n/a
	2.2 Glulam				
		2.2.1 Columns_Beams_Glulam_Lower Level			
			Number of Beams	None	None
			Number of Columns	3.00	3.00
			Column Height (m)	Varies	4.26
			Supported Area (m^2)	644.50	644.50
			Bay Sizes (m)	4.50	4.50
			Supported Span (m)	12.50	12.50
			Live Load (kPa)	4.80	4.80
			Column Type	Glulam	Glulam
			Beam Type	n/a	n/a
		2.2.2 Columns and Beams _ Glulam _ Level 1			
			Number of Beams	None	None
			Number of Columns	12.00	12.00
			Column Height (m)	Varies	6.60
			Supported Area (m^2)	486.00	486.00
			Bay Sizes (m)	4.50	4.50
			Supported Span (m)	9.00	9.00
			Live Load (kPa)	1.82	2.40
			Column Type	Glulam	Glulam
			Beam Type	n/a	n/a
		2.2.3 Columns and Beams _ Glulam _ Level 2			
			Number of Beams	None	None
			Number of Columns	27.00	27.00
			Column Height (m)	4.30	4.30
			Supported Area (m^2)	1,093.50	1,093.50
			Bay Sizes (m)	Varies	4.50
			Supported Span (m)	Varies	9.00
			Live Load (kPa)	1.82	2.40
			Column Type	Glulam	Glulam
			Beam Type	n/a	n/a

IE Inputs Document - New SUB Project

Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		2.2.4 Columns and Beams_ Glulam _Level 2 - 4 _ Great Hall Foyer			
			Number of Beams	9.00	9.00
			Number of Columns	9.00	9.00
			Column Height (m)	8.60	8.60
			Supported Area (m^2)	137.00	137.00
			Bay Sizes (m)	3.25	3.25
			Supported Span (m)	Varies	5.60
			Live Load (kPa)	4.80	4.80
			Column Type	Glulam	Glulam
			Beam Type	Glulam	Glulam
		2.2.5 Columns and Beams _ Glulam _ Level 3			
			Number of Beams	None	None
			Number of Columns	25.00	25.00
			Column Height (m)	4.30	4.30
			Supported Area (m^2)	1,012.50	1,012.50
			Bay Sizes (m)	Varies	4.50
			Supported Span (m)	Varies	9.00
			Live Load (kPa)	1.82	2.40
			Column Type	Glulam	Glulam
			Beam Type	n/a	n/a
		2.2.6 Columns and Beams _ Glulam _ Level 4			
			Number of Beams	None	None
			Number of Columns	30.00	30.00
			Column Height (m)	4.30	4.30
			Supported Area (m^2)	1,215.00	1,215.00
			Bay Sizes (m)	Varies	4.50
			Supported Span (m)	Varies	9.00
			Live Load (kPa)	1.82	2.40
			Column Type	Glulam	Glulam
			Beam Type	n/a	n/a
		2.2.7 Columns and Beams _ Glulam _ Level 5 _ Roof Wall			
			Number of Beams	30.00	30.00
			Number of Columns	38.00	38.00
			Column Height (m)	2.80	2.80
			Supported Area (m^2)	518.00	518.00
			Bay Sizes (m)	3.25	3.25
			Supported Span (m)	Varies	10.00
			Live Load (kPa)	1.82	1.82
			Column Type	Glulam	Glulam
			Beam Type	Glulam	Glulam
		2.2.8 Columns and Beams _ Glulam _ L5 _ Sawtooth Roof			
			Number of Beams	None	None
			Number of Columns	12.00	12.00
			Column Height (m)	1.00	1.00
			Supported Area (m^2)	644.50	644.50
			Bay Sizes (m)	4.50	4.50
			Supported Span (m)	12.50	12.50
			Live Load (kPa)	1.82	2.40
			Column Type	Glulam	Glulam
			Beam Type	n/a	n/a
	2.3 Steel				
		2.3.1 Columns and Beams_ Steel _Level 2 - 4 _ Great Hall			
			Number of Beams	13.00	13.00
			Number of Columns	26.00	26.00
			Column Height (m)	8.60	8.60
			Supported Area (m^2)	683.00	683.00
			Bay Sizes (m)	2.47	4.93
			Supported Span (m)	21.30	10.65
			Live Load (kPa)	4.80	4.80
			Column Type	Structural Steel	WF
			Beam Type	Structural Steel	WF
		2.3.2 Columns and Beams _ Steel _ Level 5 _ Mechanical Room			
			Number of Beams	7.00	7.00
			Number of Columns	21.00	21.00
			Column Height (m)	6.00	6.00
			Supported Area (m^2)	978.00	978.00
			Bay Sizes (m)	9.00	9.00
			Supported Span (m)	16.25	16.25
			Live Load (kPa)	1.82	2.40
			Column Type	Structural Steel	WF
			Beam Type	Structural Steel	WF
3.0 Floor					
	3.1 Composite Metal				
		3.1.1 Floor _ Composite Metal _ Level 2 _ Great Hall			
			Floor Area (m^2)	1,056.00	1,056.00
			Number of Bays per Row	1.00	3.00
			Number of Rows	13.00	13.00
			Bay Size (m)	Varies	9.03
			Span (m)	3.00	3.00
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80
		3.1.2 Floor _ Composite Metal _ Level 2 _ Nest and Bridge Lounge			
			Floor Area (m^2)	321.00	321.00
			Number of Bays per Row	Varies	5.00
			Number of Rows	Varies	12.00
			Bay Size (m)	Varies	3.57
			Span (m)	Varies	1.50
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80
		3.1.3 Floor _ Composite Metal _ Level 3 _ Nest, Bridge Lounge and Pocket Lounge			
			Floor Area (m^2)	380.00	380.00
			Number of Bays per Row	1.00	1.00
			Number of Rows	17.00	17.00
			Bay Size (m)	Varies	11.18
			Span (m)	2.00	2.00
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80
		3.1.4 Floor _ Composite Metal _ Level 4 _ Child Minding			
			Floor Area (m^2)	74.00	74.00
			Number of Bays per Row	1.00	1.00
			Number of Rows	5.00	5.00
			Bay Size (m)	Varies	7.40
			Span (m)	2.00	2.00
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
	3.2 Concrete Suspended Slab				
		3.2.1 Floor _ Concrete Suspended Slab _ Level 1			
			Floor Width (m)	Varies	380.00
			Span (m)	9.00	9.00
			Floor Area (m^2)	3,420.00	3,420.00
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80
		3.2.2 Floor _ Concrete Suspended Slab _ Level 2			
			Floor Width (m)	Varies	397.67
			Span (m)	9.00	9.00
			Floor Area (m^2)	3,579.00	3,579.00
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80
		3.2.3 Floor Concrete Suspended Slab Level 3			
			Floor Width (m)	Varies	391.33
			Span (m)	9.00	9.00
			Floor Area (m^2)	3,522.00	3,522.00
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80
		3.2.4 Floor _ Concrete Suspended Slab _ Level 4			
			Floor Width (m)	Varies	279.89
			Span (m)	9.00	9.00
			Floor Area (m^2)	2,519.00	2,519.00
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80
		3.2.5 Floor _ Concrete Suspended Slab _ Level 5			
			Floor Width (m)	Varies	119.44
			Span (m)	9.00	9.00
			Floor Area (m^2)	1,075.00	1,075.00
			Concrete (MPa)	35.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	4.80	4.80
4.0 Interior Wall					
	4.1 Cast In Place				
		4.1.1 Interior Wall Cast In Place C1 250w 30MPa Metal Door			
			Length (m)	50.00	32.21
			Height (m)	Varies	4.41
			Area (m^2)	170.45	142.05
		Concrete	Strength (MPa)	30.00	30.00
			Thickness (mm)	250.00	300.00
			Reinforcement (M)	15M Vert./ 10M Horiz.	15.00
			Concrete Flyash (%)	35.00	35.00
		Openings	Number of Windows	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	2.00	2.00
			Door Type	Hollow Metal	Steel Interior Door
		4.1.2 Interior Wall _ Cast In Place _ C1 _ 300w _ 30MPa			
			Length (m)	15.00	15.00
			Height (m)	3.90	3.90
			Area (m^2)	58.50	58.50
		Concrete	Strength (MPa)	30.00	30.00
			Thickness (mm)	300.00	300.00
			Reinforcement (M)	15M Vert./ 10M Horiz.	15.00
			Concrete Flyash (%)	35.00	35.00
		Openings	Number of Windows	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		4.1.3 Interior Wall _ Cast In Place _ C1 _ 450w _ 45MPa _ Metal Door			
			Length (m)	198.00	297.00
			Height (m)	Varies	4.69
			Area (m^2)	928.62	1,392.93
		Concrete	Strength (MPa)	45.00	30.00
			Thickness (mm)	450.00	300.00
			Reinforcement (M)	15M Vert./ 20M Horiz.	15.00
			Concrete Flyash (%)	35.00	35.00
		Openings	Number of Windows	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	6.00	6.00
			Door Type	Hollow Metal	Steel Interior Door
		4.1.4 Interior Wall Cast In Place C1 600w 45MPa Metal Door			
			Length (m)	498.00	498.00
			Height (m)	Varies	4.71
			Area (m^2)	2,345.26	2,345.26
		Concrete	Strength (MPa)	45.00	30.00
			Thickness (mm)	600.00	300.00
			Reinforcement (M)	15M Vert./ 20M Horiz.	20.00
			Concrete Flyash (%)	35.00	35.00
			Strength (MPa)	n/a	60.00
			Thickness (mm)	n/a	300.00
			Reinforcement (M)	n/a	20.00
			Concrete Flyash (%)	n/a	35.00
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	5.00	5.00
			Door Type	Hollow Metal	Steel Interior Door
	4.2 Concrete Block				
		4.2.1 Interior Wall _ Concrete Block _ M1 _ Concrete Block Wall _ 190mm Block _ Metal Door			
			Length (m)	168.00	168.00
			Height (m)	Varies	4.24
			Area (m^2)	711.90	711.90
		Concrete Block	Thickness (mm)	190.00	n/a
			Rebar (M)	10.00	10.00
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	4.00	4.00
			Door Type	Hollow Metal	Steel Interior Door

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.2.2 Interior Wall _ Concrete Block _ M1-A _ Acoustic Concrete Block Wall _ 190mm Block _ Metal Door			
			Length (m)	46.00	46.00
			Height (m)	4.30	4.30
			Area (m^2)	197.80	197.80
		Concrete Block	Thickness (mm)	190.00	n/a
			Rebar (M)	10.00	10.00
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	2.00	2.00
			Door Type	Hollow Metal	Steel Interior Door
		Envelope	Category	Block Filler	Paint
			Material	Latex	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Block Filler	Paint
			Material	Latex	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.2.3 Interior Wall _ Concrete Block _ M1-A _ Acoustic Concrete Block Wall _ 190mm Block _ Wood Door			
			Length (m)	46.00	46.00
			Height (m)	4.30	4.30
			Area (m^2)	197.80	197.80
		Concrete Block	Thickness (mm)	190.00	n/a
			Rebar (M)	10.00	10.00
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	3.00	3.00
			Door Type	Solid Core Wood	Solid Wood Door
		Envelope	Category	Block Filler	Paint
			Material	Latex	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Block Filler	Paint
			Material	Latex	Latex Water Based
			Thickness (mm)	n/a	n/a
	4.3 Curtain Wall				
		4.3.1 Interior Wall _ Curtain Wall _ GL1B _ 6mm Tempered			
			Length (m)	147.00	147.00
			Height (m)	Varies	5.02
			Area (m^2)	738.10	738.10
		Curtain Wall	Percent Viewable Glazing (%)	100.00	100.00
			Percent Spandrel Panel (%)	None	None
			Thickness of Insulation (mm)	n/a	n/a
			Spandrel Type	n/a	n/a
		Door Opening	Number of Doors (ea)	22.00	60.00
			Door Type	Aluminum, Fully Glazed	Aluminum Exterior Door, 80% glazing
	4.4 Steel Stud				
		4.4.1 Interior Wall _ Steel Stud _ RS1 _ Rated Shaft Wall 1 HR FRR _ 100mm C-H Stud			
			Length (m)	28.00	28.00
			Height (m)	4.30	4.30
			Area (m^2)	120.40	120.40
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	100.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Shaft Wall	Gypsum Board
			Material	Shaftliner	Gypsum Fire Rated Type X
			Thickness (mm)	19.00	16.00
			Category	Shaft Wall	Gypsum Board
			Material	Fireboard	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Fire Resistant Insulation	Insulation
			Material	Mineral Fiber batt	Rockwool Batt
			Thickness (mm)	92.00	92.00
		4.4.2 Interior Wall _ Steel Stud _ RS2 _ Rated Shaft Wall 1 HR FRR w/ Additional GWB	100mm C-H Stud		
			Length (m)	103.00	103.00
			Height (m)	Varies	4.39
			Area (m^2)	451.90	451.90
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	100.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	none	none
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Shaft Wall	Gypsum Board
			Material	Shaftliner	Gypsum Fire Rated Type X
			Thickness (mm)	19.00	16.00
			Category	Shaft Wall	Gypsum Board
			Material	Fireboard	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Fire Resistant Insulation	Insulation
			Material	Mineral Fiber batt	Rockwool Batt
			Thickness (mm)	92.00	92.00

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.3 Interior Wall _ Steel Stud _ RS3 _ Rated Shaft Wall 1 HR FRR w/ Additional GWB _ 152mm C-H Stud			
			Length (m)	25.00	25.00
			Height (m)	Varies	6.47
			Area (m^2)	161.70	161.70
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Shaft Wall	Gypsum Board
			Material	Shaftliner	Gypsum Fire Rated Type X
			Thickness (mm)	19.00	16.00
			Category	Shaft Wall	Gypsum Board
			Material	Fireboard	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Fire Resistant Insulation	Insulation
			Material	Mineral Fiber batt	Rockwool Batt
			Thickness (mm)	150.00	150.00
		4.4.4 Interior Wall _ Steel Stud _ W1 _ Wall Furring _ 22mm Channel			
			Length (m)	36.00	36.00
			Height (m)	Varies	4.01
			Area (m^2)	144.30	144.30
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	22.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.5 Interior Wall _ Steel Stud _ W1-T _ Tile Clad Wall Furring _ 22mm Channel			
			Length (m)	19.00	19.00
			Height (m)	4.30	4.30
			Area (m^2)	81.70	81.70
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	22.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
		4.4.6 Interior Wall _ Steel Stud _ W2 _ Wall Furring _ 41mm Stud _ Metal Door			
			Length (m)	137.00	137.00
			Height (m)	Varies	4.26
			Area (m^2)	583.10	583.10
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	41.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	3.00	3.00
			Door Type	Hollow Metal	Steel Interior Door
		Envelope	Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.7 Interior Wall _ Steel Stud _ W3 _ Wall Furring _ 92mm Stud _ Metal Door			
			Length (m)	35.00	35.00
			Height (m)	4.30	4.30
			Area (m^2)	150.50	150.50
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	3.00	3.00
			Door Type	Hollow Metal	Steel Interior Door
		Envelope	Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.8 Interior Wall _ Steel Stud _ W3 _ Wall Furring _ 92mm Stud _ Wood Door			
			Length (m)	35.00	35.00
			Height (m)	4.30	4.30
			Area (m^2)	150.50	150.50
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	1.00	1.00
			Door Type	Solid Core Wood	Solid Wood Door
		Envelope	Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.9 Interior Wall _ Steel Stud _ W3-T _ Tile Clad Wall Furring _ 92mm Stud			
			Length (m)	49.00	49.00
			Height (m)	Varies	4.56
			Area (m^2)	223.30	223.30
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
		4.4.10 Interior Wall _ Steel Stud _ W4 _ Wall Furring _ 152mm Stud			
			Length (m)	82.00	82.00
			Height (m)	Varies	4.61
			Area (m^2)	377.80	377.80
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.11 Interior Wall _ Steel Stud _ W4-T _ Wall Furring _ 152mm Stud			
			Length (m)	5.00	5.00
			Height (m)	4.30	4.30
			Area (m^2)	21.50	21.50
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
		4.4.12 Interior Wall _ Steel Stud _ W5 _ Basic Partition _ 92mm Stud _ Metal Door _ GL1			
			Length (m)	186.00	186.00
			Height (m)	Varies	4.31
			Area (m^2)	802.50	802.50
		Steed Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	3.00	3.00
			Total Window Area (m^2)	23.50	23.50
			Frame Type	Aluminum	Aluminum Frame
			Glazing Type	6mm Laminated	Standard Glazing
			Number of Doors (ea)	10.00	10.00
			Door Type	Solid Core Wood	Solid Wood Door
		Envelope:	Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.13 Interior Wall _ Steel Stud _ W5 _ Basic Partition _ 92mm Stud _ Wood Door _ GL1			
			Length (m)	186.00	186.00
			Height (m)	Varies	4.31
			Area (m^2)	802.50	802.50
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	3.00	3.00
			Total Window Area (m^2)	23.50	23.50
			Frame Type	Aluminum	Aluminum Frame
			Glazing Type	6mm Laminated	Standard Glazing
			Number of Doors (ea)	50.00	50.00
			Door Type	Hollow Metal	Solid Wood Door
			Envelope: Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None
		4.4.14 Interior Wall _ Steel Stud _ W5-2 _ Acoustic Partition w/ 2 Layers One Side _ 92mm Stud _ Metal Door _ GL1			
			Length (m)	195.50	195.50
			Height (m)	4.30	4.30
			Area (m^2)	840.65	840.65
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	35.00	35.00
			Total Window Area (m^2)	78.50	78.50
			Frame Type	Aluminum	Aluminum Frame
			Glazing Type	6mm Laminated	Standard Glazing
			Number of Doors (ea)	9.00	9.00
			Door Type	Hollow Metal	Steel Interior Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.15 Interior Wall _ Steel Stud _ W5-2 _ Acoustic Partition w/ 2 Layers One Side _ 92mm Stud _ Wood Door _ GL1			
			Length (m)	195.50	195.50
			Height (m)	4.30	4.30
			Area (m^2)	840.65	840.65
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	35.00	35.00
			Total Window Area (m^2)	78.50	78.50
			Frame Type	Aluminum	Aluminum Frame
			Glazing Type	6mm Laminated	Standard Glazing
			Number of Doors (ea)	25.00	25.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.16 Interior Wall _ Steel Stud _ W5-22 _ Acoustic Partition w/ 2 Layers Both Sides _ 92mm Stud _ Metal Door _ GL1			
			Length (m)	678.50	678.50
			Height (m)	Varies	4.26
			Area (m^2)	2,892.20	2,892.20
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	247.00	247.00
			Total Window Area (m^2)	750.00	750.00
			Frame Type	Aluminum	Aluminum
			Glazing Type	6mm Laminated	Standard Glazing
			Number of Doors	9.00	9.00
			Door Type	Hollow Metal	Steel Interior Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.17 Interior Wall _ Steel Stud _ W5-22 _ Acoustic Partition w/ 2 Layers Both Sides _ 92mm Stud _ Wood Door _ GL1A			
			Length (m)	678.50	678.50
			Height (m)	Varies	4.26
			Area (m^2)	2,892.20	2,892.20
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	18.00	18.00
			Total Window Area (m^2)	59.00	59.00
			Frame Type	Insulated Aluminum	Aluminum
			Glazing Type	13mm Laminated	Standard Glazing
			Number of Doors	137.00	137.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.18 Interior Wall _ Steel Stud _ W5-R _ Rated Partition _ 92mm Stud _ Metal Door			
			Length (m)	11.00	11.00
			Height (m)	4.30	4.30
			Area (m^2)	47.30	47.30
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	3.00	3.00
			Door Type	Hollow Metal	Steel Interior Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.19 Interior Wall _ Steel Stud _ W5-RA _ Rated Acoustic Partition _ 92mm Stud			
			Length (m)	14.00	14.00
			Height (m)	4.30	4.30
			Area (m^2)	60.20	60.20
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Mineral Fiber batt	Rockwool Batt
			Thickness (mm)	92.00	92mm
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.20 Interior Wall _ Steel Stud _ W5-T _ Tile Clad Partition Both Sides _ 92mm Stud _ Wood Door			
			Length (m)	25.00	25.00
			Height (m)	Varies	4.44
			Area (m^2)	111.10	111.10
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	2.00	2.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
			Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
		4.4.21 Interior Wall _ Steel Stud _ W6 _ Basic Partition _ 152mm Stud _ Metal Door			
			Length (m)	253.00	253.00
			Height (m)	Varies	4.82
			Area (m^2)	1,219.00	1,219.00
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	none
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	29.00	29.00
			Door Type	Hollow Metal	Steel Interior Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None
		4.4.22 Interior Wall _ Steel Stud _ W6 _ Basic Partition _ 152mm Stud _ Wood Door			
			Length (m)	253.00	253.00
			Height (m)	Varies	4.82
			Area (m^2)	1,219.00	1,219.00
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	none
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	31.00	31.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.23 Interior Wall _ Steel Stud _ W6-2 _ Acoustic Partition w/ 2 Layers One Sides _ 152mm Stud			
			Length (m)	10.00	10.00
			Height (m)	Varies	3.40
			Area (m^2)	34.00	34.00
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	152.00	152.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.24 Interior Wall Steel Stud W6-22 Acoustic Partition w/ 2 Layers Both Sides 152mm Stud Metal Door GL1			
			Length (m)	43.50	43.50
			Height (m)	Varies	3.89
			Area (m^2)	169.35	169.35
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	2.00	2.00
			Total Window Area (m^2)	9.50	9.50
			Frame Type	Aluminum	Aluminum Frame
			Glazing Type	6mm Laminated Glass	Standard Glazing
			Number of Doors (ea)	2.00	2.00
			Door Type	Hollow Metal	Steel Interior Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16mm
			Category	R-12 Acoustic Insulation	16.00
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	152.00	152.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.25 Interior Wall Steel Stud W6-22 Acoustic Partition w/ 2 Layers Both Sides 152mm Stud Wood Door GL1			
			Length (m)	43.50	43.50
			Height (m)	Varies	3.89
			Area (m^2)	169.35	169.35
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	2.00	2.00
			Total Window Area (m^2)	9.50	9.50
			Frame Type	Aluminum	Aluminum Frame
			Glazing Type	6mm Laminated Glass	Standard Glazing
			Number of Doors (ea)	2.00	2.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	16.00
			Category	R-12 Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	152.00	152.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.26 Interior Wall _ Steel Stud _ W6-R _ Rated Partition _ 152mm Stud _ Metal Door			
			Length (m)	211.00	211.00
			Height (m)	Varies	5.43
			Area (m^2)	1,144.80	1,144.80
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	none
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	15.00	15.00
			Door Type	Hollow Metal	Steel Interior Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.27 Interior Wall _ Steel Stud _ W6-RA _ Rated Acoustic Partition _ 152mm Stud			
			Length (m)	19.00	19.00
			Height (m)	7.10	7.10
			Area (m^2)	134.90	134.90
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	166.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Mineral Fiber batt	Rockwool Batt
			Thickness (mm)	152.00	152.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.28 Interior Wall Steel Stud W6-T Tile Clad Partition Both Sides 152mm Stud		Wood Door	
			Length (m)	60.00	60.00
			Height (m)	Varies	4.66
			Area (m^2)	279.60	279.60
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	4.00	4.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
			Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
		4.4.29 Interior Wall _ Steel Stud _ W6-T1 _ Tile Clad Partition One Side _ 152mm Stud		Wood Door	
			Length (m)	101.00	101.00
			Height (m)	Varies	5.17
			Area (m^2)	522.50	522.50
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	4.00	4.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.30 Interior Wall _ Steel Stud _ W7 _ Double Stud Acoustic/ Mechanical Partition _ 92mm Stud _ Metal Door _ GL1			
			Length (m)	209.00	209.00
			Height (m)	4.30	5.30
			Area (m^2)	898.70	1,107.70
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	36.00	36.00
			Total Window Area (m^2)	113.00	150.00
			Frame Type	Aluminum	Aluminum Frame
			Glazing Type	6mm Laminated Glass	Standard Glazing
			Number of Doors (ea)	2.00	2.00
			Door Type	Steel Door	Steel Interior Door
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
		Envelope	Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16mm	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		4.4.31 Interior Wall _ Steel Stud _ W7 _ Double Stud Acoustic/ Mechanical Partition _ 92mm Stud _ Wood Door _ GL1A			
			Length (m)	209.00	209.00
			Height (m)	4.30	5.30
			Area (m^2)	898.70	1,107.70
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	22.00	22.00
			Total Window Area (m^2)	55.00	78.00
			Frame Type	Insulated Aluminum	Aluminum Frame
			Glazing Type	13mm Laminated Glass	Standard Glazing
			Number of Doors (ea)	26.00	26.00
			Door Type	Solid Core Wood	Solid Wood Door
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
		Envelope	Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.32 Interior Wall _ Steel Stud _ W7-22 _ Double Stud Acoustic/ Mechanical Partition w/ 2 Layers Both Sides _ 92mm Stud _ Wood Door _ 10mm Glass			
			Length (m)	60.00	60.00
			Height (m)	4.30	4.30
			Area (m^2)	258.00	258.00
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	8.00	8.00
			Total Window Area (m^2)	14.00	14.00
			Frame Type	Wood Frame	Wood Frame
			Glazing Type	10mm Glass	Standard Glazing
			Number of Doors (ea)	4.00	4.00
			Door Type	Wood Door	Wood Door
		Envelope	Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness	n/a	n/a
		4.4.33 Interior Wall _ Steel Stud _ W7-T _ Double Stud Acoustic/ Mechanical Partition Tile Clad Both Sides _ 92mm Stud			
			Length (m)	40.00	40.00
			Height (m)	Varies	4.57
			Area (m^2)	182.80	182.80
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
		4.4.34 Interior Wall _ Steel Stud _ W7-T1 _ Double Stud Acoustic/ Mechanical Partition Tile Clad One Side _ 92mm Stud			
			Length (m)	7.00	7.00
			Height (m)	4.30	4.30
			Area (m^2)	30.10	30.10
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Category	Backer Board	Gypsum Board
			Material	Coated Glass Mat Gypsum	Moisture Resistant Gypsum Board
			Thickness (mm)	16.00	16.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
		Envelope	Category	R-12 Acoustical Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		4.4.35 Interior Wall _ Steel Stud _ W9 _ Double Stud Partition _ 152mm Stud			
			Length (m)	17.00	17.00
			Height (m)	Varies	6.34
			Area (m^2)	107.70	107.70
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	none
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Mineral Fiber batt	Rockwool Batt
			Thickness (mm)	92.00	92.00
			Category	R-12 Acoustical Insulation	Insulation
			Material	Mineral Fiber batt	Rockwool Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	None
	4.5 Wood Stud				
		4.5.1 Interior Wall _ Wood Stud _ W8 _ Double Stud Acoustic Partition _ 140/184mm Stud _ Wood Door _ 10mm Glass			
			Length (m)	69.00	69.00
			Height (m)	4.30	4.30
			Area (m^2)	296.70	296.70
			Wood Stud Sheathing Type	10mm Plywood	Plywood
			Stud Spacing (mm)	400.00	400.00
			Stud Type	Kiln-dried	Kiln-dried
			Stud Thickness (mm)	140.00	140.00
			Load Bearing	No	No
			Sheathing Type	10mm Plywood	Plywood
			Stud Spacing (mm)	400.00	400.00
			Stud Type	Kiln-dried	Kiln-dried
			Stud Thickness (mm)	184.00	184.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	2.00	2.00
			Total Window Area (m^2)	19.00	19.00
			Frame Type	Wood Frame	Wood Frame
			Glazing Type	10mm Laminated	Standard Glazing
			Number of Doors (ea)	4.00	4.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	13.00	13.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	13.00	13.00
			Category	Acoustic Insulation	Insulation
			Material	Black Mat Acoustical Blanket	Rockwool Batt
			Thickness (mm)	-	50.00
			Category	R-12 Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	92.00	92.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	13.00	13.00
			Category	Gypsum Board	Gypsum Board
			Material	Type X	Gypsum Fire Rated Type X
			Thickness (mm)	13.00	13.00
	4.6 Concrete Block/Steel Stud				
		4.6.1 Interior Wall _ Concrete Block/Steel Stud _ M2 _ Concrete Block Wall w/ Furring Both Sides _ 190mm Block/ 25mm Channel _ Wood Door			
			Length (m)	26.00	26.00
			Height (m)	Varies	4.07
			Area (m^2)	105.80	105.80
			Concrete Block Thickness (mm)	190.00	N/A
			Rebar (M)	10.00	10.00
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	50.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	3.00	3.00
			Door Type	Solid Core Wood	Solid Wood Door
			Envelope Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16.00	16.00
			Category	Interior Finish	Paint
			Material	Laytex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
5.0 Exterior Walls & Parapets					
	5.1 Cast In Place				
		5.1.1 Exterior Wall _ Cast In Place _ EW2 sim (No Insulation, No Finish) _ Below Grade Wall _ 250w _ 30MPa			
			Length (m)	11.00	11.00
			Height (m)	4.00	4.00
			Area (m^2)	44.00	44.00
			Concrete Strength (MPa)	30.00	30.00
			Concrete Thickness (mm)	250.00	300.00
			Concrete Reinforcement (M)	15M Vert./ 10M Horiz.	15.00
			Concrete Flyash (%)	35.00	35.00
			Openings Number of Windows	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Protection Board	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	25.00	25.38
			Category	Drainage Mat	Vapour & Air Barrier
			Material	HDPE Panel	Vapour Barrier
			Thickness (mil)	-	6.00
			Category	Waterproofing	Roof Envelopes
			Material	Torch-On Sheet	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
		5.1.2 Exterior Wall _ Cast In Place _ EW3 _ Below Grade Wall _ 250w _ 30MPa			
			Length (m)	83.00	83.00
			Height (m)	Varies	3.86
			Area (m^2)	320.55	320.55
			Concrete Strength (MPa)	30.00	30.00
			Concrete Thickness (mm)	250.00	300.00
			Concrete Reinforcement (M)	20M Vert./ 10M Horiz.	20.00
			Concrete Flyash (%)	35.00	35.00
			Openings Number of Windows	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Protection Board	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	25.00	25.38
			Category	Drainage Mat	Vapour & Air Barrier
			Material	HDPE Panel	Vapour Barrier
			Thickness (mil)	-	6.00
			Category	R-15 Board Insulation	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	75.00	75.00
			Category	Waterproofing	Roof Envelopes
			Material	Torch-On Sheet	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
		5.1.3 Exterior Wall _ Cast In Place _ EW3 _ Below Grade Wall _ 300w _ 30MPa			
			Length (m)	66.00	66.00
			Height (m)	Varies	4.17
			Area (m^2)	274.95	274.95
			Concrete Strength (MPa)	30.00	30.00
			Concrete Thickness (mm)	300.00	300.00
			Concrete Reinforcement (M)	20M Vert./ 10M Horiz.	20.00
			Concrete Flyash (%)	35.00	35.00
			Openings Number of Windows	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Protection Board	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	25.00	25.38
			Category	Drainage Mat	Vapour & Air Barrier
			Material	HDPE Panel	Vapour Barrier
			Thickness (mil)	-	6.00
			Category	R-15 Board Insulation	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	75.00	75.00
			Category	Waterproofing	Roof Envelopes
			Material	Torch-On Sheet	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
		5.1.4 Exterior Wall _ Cast In Place _ EW3 _ Below Grade Wall _ 600w _ 45MPa			
			Length (m)	8.00	8.00
			Height (m)	3.90	3.90
			Area (m^2)	31.20	31.20
			Concrete Strength (MPa)	45.00	30.00
			Concrete Thickness (mm)	600.00	300.00
			Concrete Reinforcement (M)	15M Vert./ 20M Horiz.	20M
			Concrete Flyash (%)	35.00	35.00
			Strength (MPa)	n/a	60MPa
			Thickness (mm)	n/a	300mm
			Reinforcement (M)	n/a	20M
			Concrete Flyash (%)	n/a	Average
			Openings Number of Windows	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Protection Board	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	25.00	25.38
			Category	Drainage Mat	Vapour & Air Barrier
			Material	HDPE Panel	Vapour Barrier
			Thickness (mil)	-	6.00
			Category	R-15 Board Insulation	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	75.00	75.00
			Category	Waterproofing	Roof Envelopes
			Material	Torch-On Sheet	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		5.1.5 Parapet _ Cast In Place _ EW1 _ GFRC Clad Wall _ 200w _ 30MPa _ Detail 4-A660			
			Length (m)	24.00	24.00
			Height (m)	0.58	0.58
			Area	13.92	13.92
		Concrete	Strength	30MPa	30MPa
			Thickness	200mm	200mm
			Reinforcement	-	15M
			Concrete Flyash %	35.00	35.00
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors	None	None
			Door Type	None	None
		Envelope	Category	Cladding	Cladding
			Material	Cladding w/ Suspension Rail and Steel Girt	Fiber Cement Siding
			Thickness (mm)	13.00	n/a
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
		5.1.6 Parapet _ Cast In Place _ EW1 _ GFRC Clad Wall _ 200w _ 30MPa _ Detail 5-A651			
			Length (m)	134.00	134.00
			Height (m)	1.10	1.10
			Area (m^2)	147.40	147.40
		Concrete	Strength (MPa)	30.00	30.00
			Thickness (mm)	200.00	200.00
			Reinforcement (M)	-	15.00
			Concrete Flyash (%)	35.00	35.00
		Openings	Number of Windows	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Cladding	Cladding
			Material	Cladding w/ Suspension Rail and Steel Girt	Fiber Cement Siding
			Thickness (mm)	13.00	n/a
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	-	6mil
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cladding	Cladding
			Material	Cladding w/ Suspension Rail and Steel Girt	Fiber Cement Siding
			Thickness (mm)	13.00	n/a
	5.2 Curtain Wall				
		5.2.1 Exterior Wall _ Curtain Wall _ GL1 _ Triple Glazed			
			Length (m)	249.00	249.00
			Height (m)	Varies	3.80
			Area (m^2)	946.45	946.45
		Curtain Wall	Percent Viewable Glazing (%)	86.00	86.00
			Percent Spandrel Panel (%)	14.00	14.00
			Thickness of Insulation (mm)	100.00	100.00
			Spandrel Type	Glazed	Opaque Glass
		Door Opening	Number of Doors (ea)	11.00	11.00
			Door Type	Aluminum, Fully Glazed	Aluminum Exterior Door, 80% glazing
		5.2.2 Exterior Wall _ Curtain Wall _ GL2 _ Double Glazed			
			Length (m)	556.00	556.00
			Height (m)	Varies	4.08
			Area (m^2)	2,266.84	2,266.84
		Curtain Wall	Percent Viewable Glazing (%)	96.00	96.00
			Percent Spandrel Panel (%)	4.00	4.00
			Thickness of Insulation (mm)	100.00	100.00
			Spandrel Type	Glazed	Opaque Glass
		Door Opening	Number of Doors (ea)	60.00	60.00
			Door Type	Aluminum, Fully Glazed	Aluminum Exterior Door, 80% glazing

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
	5.3 Steel Stud				
		5.3.1 Exterior Wall _ Steel Stud _ Curtainwall Head at Soffit _ Detail 2-A657			
			Length (m)	261.00	261.00
			Height (m)	Varies	1.39
			Area (m^2)	363.21	363.21
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	20.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	Yes	Yes
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Spray Foam Insulation	Insulation
			Material	Polyisocyanurate Foam	Polyisocyanurate Foam
			Thickness (mil)	100.00	100.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16mm	16mm
			Category	Interior Finish	Paint
			Material	Latex Paint	Latex Water Based
			Thickness	n/a	n/a
		5.3.2 Exterior Wall _ Steel Stud _ EW1 _ GFRC Clad Wall			
			Length (m)	539.00	539.00
			Height (m)	Varies	4.08
			Area (m^2)	2,198.50	2,198.50
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	177.00	177.00
			Total Window Area (m^2)	484.00	484.00
			Frame Type	Aluminum	Aluminum
			Glazing Type	Triple Glazed, Argon Filled	Standard
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Cladding	Cladding
			Material	Cladding w/ Suspension Rail and Steel Girt	Fiber Cement Siding
			Thickness (mm)	13.00	n/a
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Spray Foam Insulation	Insulation
			Material	Polyisocyanurate Foam	Polyisocyanurate Foam
			Thickness (mm)	100.00	100.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16mm	16mm
			Category	Interior Finish	Paint
			Material	Latex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		5.3.3 Exterior Wall _ Steel Stud _ EW7 _ Louvered Wall			
			Length (m)	223.00	223.00
			Height (m)	Varies	3.94
			Area (m^2)	879.20	879.20
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	92.00	92.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Cladding	Cladding
			Material	hed Aluminum Louver supported on Z-Girts	Steel Cladding - Commercial (26 ga)
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Cavity Wall Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	75.00	75.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	R-10 Spray Foam Insulation	Insulation
			Material	Polyisocyanurate Foam	Polyisocyanurate Foam
			Thickness (mm)	50.00	50.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16mm	16mm
			Category	Interior Finish	Paint
			Material	Latex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		5.3.4 Exterior Wall _ Steel Stud _ EW8 _ EIFS			
			Length (m)	196.00	196.00
			Height (m)	Varies	1.39
			Area (m^2)	271.70	271.70
			Steel Stud Sheathing Type	None	None
			Stud Spacing	400.00	400.00
			Stud Weight	25.00	20.00
			Stud Thickness (mm)	152mm	152mm
			Load Bearing	Yes	Yes
			Openings Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	3.00	3.00
			Door Type	Hollow Metal	Steel Exterior
			Envelope Category	Cladding	Cladding
			Material	tem Including Reinforcing and Starter Mesh	Stucco - Over metal mesh
			Thickness (mm)	-	n/a
			Category	R-25 Board Insulation	Insulation
			Material	Expanded Polystyrene	Polystyrene Expanded
			Thickness (mm)	150.00	150.00
			Category	Drainage Track	Vapour & Air Barrier
			Material	Corrugated Plastic Sheet	Polyethylene
			Thickness (mm, mil)	-	6.00
			Category	Transition Membrane	Roof Envelopes
			Material	Spray Applied Rubber Barrier	EPDM Membrane
			Thickness (mil)	40.00	60.00
			Category	Water Penetration Membrane	Vapour & Air Barrier
			Material	Spunbonded Polyolefin	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	100.00	100.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16mm	16mm
			Category	Interior Finish	Paint
			Material	Latex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		5.3.5 Exterior Wall _ Steel Stud _ EW9 _ Aluminum Cladding			
			Length (m)	100.00	100.00
			Height (m)	Varies	2.92
			Area (m^2)	291.94	291.94
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	6.00	6.00
			Door Type	Hollow Metal	Steel Exterior
			Envelope Category	Cladding	Cladding
			Material	tal Suspensions Rail and Vertical Steel Girt	Steel Cladding - Commercial (26 ga)
			Thickness (mm)	13.00	n/a
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Spray Foam Insulation	Insulation
			Material	Polyisocyanurate Foam	Polyisocyanurate Foam
			Thickness (mm)	100.00	100.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16mm	16mm
			Category	Interior Finish	Paint
			Material	Latex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		5.3.6 Exterior Wall _ Steel Stud _ RW _ Standing Seam Zinc Roof Wall			
			Length (m)	264.00	264.00
			Height (m)	Varies	4.30
			Area	1,134.48	1,134.48
			Steel Stud Sheathing Type	None	None
			Stud Spacing	None	600.00
			Stud Weight	None	25.00
			Stud Thickness (mm)	None	92.00
			Load Bearing	No	No
			Openings Number of Windows	75.00	75.00
			Total Window Area (m2)	156.00	156.00
			Frame Type	Aluminum Frame	Aluminum Frame
			Glazing Type	Triple Glazed, Argon Filled	Standard
			Number of Doors	None	None
			Door Type	None	None
			Envelope Category	Cladding	Cladding
			Material	Standing Seam Zinc	Steel Cladding - Commercial (26 ga)
			Thickness	-	n/a
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness	-	n/a
			Category	R-25 Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rocwool Bat
			Thickness	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	erglass Mat Facing Gypsum Board (Type X)	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness	-	92.00
			Category	Metal Deck	Steel Roof System
			Material	Acoustical Metal Deck	26 Ga. Galvanized Sheet (Commercial)
			Thickness	92.00	n/a
			Category	Interior Finish	Included in
			Material	Paint	26 Ga. Galvanized Sheet (Commercial)
			Thickness	n/a	n/a
		5.3.7 Parapet _ Steel Stud _ EW1 _ GFRC Clad Wall _ Detail 3-A657			
			Length (m)	35.00	35.00
			Height (m)	1.10	1.10
			Area (m^2)	38.50	38.50
			Steel Stud Sheathing Type	None	None
			Stud Spacing	400.00	400.00
			Stud Weight	20.00	20.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	Yes	Yes
			Openings Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Cladding	Cladding
			Material	Cladding w/ Suspension Rail and Steel Girt	Fiber Cement Siding
			Thickness (mm)	13.00	n/a
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Spray Foam Insulation	Insulation
			Material	Polyisocyanurate Foam	Polyisocyanurate Foam
			Thickness (mm)	50.00	50.00

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		5.3.8 Parapet _ Steel Stud _ EW1 _ GFRC Clad Wall _ Detail 4-A655			
			Length (m)	105.00	105.00
			Height (m)	1.10	1.10
			Area	115.50	115.50
		Steel Stud	Sheathing Type	None	None
			Stud Spacing	400.00	400.00
			Stud Weight	25.00	20.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	Yes	Yes
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors	None	None
			Door Type	None	None
		Envelope	Category	Cladding	Cladding
			Material	Cladding w/ Suspension Rail and Steel Girt	Fiber Cement Siding
			Thickness (mm)	13.00	n/a
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Insulation	Insulation
			Material	Mineral Wool	Rockwool Bat
			Thickness (mm)	150.00	150.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
		5.3.9 Parapet _ Steel Stud _ EW7 _ Louvered Wall _ Detail 6-A654/3-A653/5-A659			
			Length (m)	181.00	181.00
			Height (m)	0.85	0.85
			Area	153.85	153.85
		Steel Stud	Sheathing Type	None	None
			Stud Spacing	400.00	400.00
			Stud Weight	25.00	20.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	Yes	Yes
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors	None	None
			Door Type	None	None
		Envelope	Category	Cladding	Cladding
			Material	hed Aluminum Louver supported on Z-Girts	Steel Cladding - Commercial (26 ga)
			Thickness	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	75.00	75.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Insulation	Insulation
			Material	Mineral Wool	Rockwool Bat
			Thickness (mm)	150.00	150.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		5.3.10 Parapet _ Steel Stud _ EW9 _ Aluminum Cladding _ Detail 5-A659 sim			
			Length (m)	8.00	8.00
			Height (m)	0.85	0.85
			Area	6.80	6.80
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	20.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	Yes	Yes
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors	None	None
			Door Type	None	None
		Envelope	Category	Cladding	Cladding
			Material	tal Suspensions Rail and Vertical Steel Girt	Steel Cladding - Commercial (26 ga)
			Thickness (mm)	13.00	n/a
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	75.00	75.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Insulation	Insulation
			Material	Mineral Wool	Rockwool Bat
			Thickness (mm)	150.00	150.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
	5.4 Cast In Place/ Curtain Wall				
		5.4.1 Parapet Cast In Place/Curtain Wall 200w 30MPa G1 Detail 2-A656			
			Length (m)	28.00	28.00
			Height (m)	0.98	0.98
			Area	27.30	27.30
		Concrete	Strength	30.00	30.00
			Thickness	200.00	200.00
			Reinforcement	-	15.00
			Concrete Flyash %	35.00	35.00
		Curtain Wall	Percent Viewable Glazing	69.00	69.00
			Percent Spandrel Panel	31.00	31.00
			Thickness of Insulation (mm)	50mm	50mm
			Spandrel Type	Glazed	Opaque Glass
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors	None	None
			Door Type	None	None
		Envelope	Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
		5.4.2 Parapet _ Cast In Place/Curtain Wall _ G1 _ Triple Glazed _ 200w _ 30MPa _ Detail 4-A653			
			Length (m)	42.00	42.00
			Height (m)	0.47	0.47
			Area (m^2)	19.74	19.74
		Concrete	Strength (MPa)	30.00	30.00
			Thickness (mm)	200.00	200.00
			Reinforcement (M)	-	15.00
			Concrete Flyash (%)	35.00	35.00
		Curtain Wall	Percent Viewable Glazing (%)	36.00	36.00
			Percent Spandrel Panel (%)	64.00	64.00
			Thickness of Insulation (mm)	50.00	50.00
			Spandrel Type	Glazed	Opaque Glass
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		5.4.3 Parapet _ Cast In Place/Curtain Wall _ G2 _ Double Glazed _ 200w _ 30MPa _ Detail 2-A656 sim			
			Length (m)	8.00	8.00
			Height (m)	0.98	0.98
			Area (m^2)	7.80	7.80
		Concrete	Strength (MPa)	30.00	30.00
			Thickness (mm)	200.00	200.00
			Reinforcement (M)	-	15.00
			Concrete Flyash (%)	35.00	35.00
		Curtain Wall	Percent Viewable Glazing (%)	69.00	69.00
			Percent Spandrel Panel (%)	31.00	31.00
			Thickness of Insulation (mm)	50.00	50.00
			Spandrel Type	Glazed	Opaque Glass
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
		5.4.4 Parapet _ Cast In Place/Curtain Wall _ G2 _ Double Glazed _ 200w _ 30MPa _ Detail 6-A662			
			Length (m)	4.00	4.00
			Height (m)	0.58	0.58
			Area (m^2)	2.32	2.32
		Concrete	Strength (MPa)	30.00	30.00
			Thickness (mm)	200.00	200.00
			Reinforcement (M)	-	15.00
			Concrete Flyash (%)	35.00	35.00
		Curtain Wall	Percent Viewable Glazing (%)	48.00	48.00
			Percent Spandrel Panel (%)	52.00	52.00
			Thickness of Insulation (mm)	50.00	50.00
			Spandrel Type	Glazed	Opaque Glass
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
	5.5 Cast In Place/Steel Stud				
		5.5.1 Exterior Wall _ Cast In Place/Steel Stud _ EW2 _ Below Grade Wall _ 250w _ 30MPa			
			Length (m)	65.00	65.00
			Height (m)	Varies	3.62
			Area (m^2)	235.30	235.30
		Concrete	Strength (MPa)	30.00	30.00
			Thickness (mm)	250.00	300.00
			Reinforcement (M)	15M Vert./ 10M Horiz.	15.00
			Concrete Flyash (%)	35.00	35.00
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	41.00	92mm
			Load Bearing	No	No
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors	None	None
			Door Type	None	None
		Envelope	Category	Protection Board	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	25.00	25.38
			Category	Drainage Mat	Vapour & Air Barrier
			Material	HDPE Panel	Vapour Barrier
			Thickness (mil)	-	6.00
			Category	R-15 Board Insulation	Insulation
			Material	Extruded Polystyrene	Polystyrene Extruded
			Thickness (mm)	75.00	75.00
			Category	Waterproofing	Roof Envelopes
			Material	Torch-On Sheet	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16mm	16mm
			Category	Interior Finish	Paint
			Material	Latex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		5.5.2 Exterior Wall _ Cast In Place/Steel Stud _ EW10 _ Exterior Exposed Concrete _ 250w _ 30MPa			
			Length (m)	5.00	5.00
			Height (m)	3.55	3.55
			Area (m^2)	17.75	17.75
			Concrete Strength (MPa)	20.00	30.00
			Thickness (mm)	250.00	300.00
			Reinforcement (M)	15M Vert./ 10M Horiz.	15M
			Concrete Flyash (%)	35.00	35.00
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
			Openings Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	R-25 Spray Foam Insulation	Insulation
			Material	Polyisocyanurate Foam	Polyisocyanurate Foam
			Thickness (mm)	75.00	75.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16mm	16mm
			Category	Interior Finish	Paint
			Material	Latex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
		5.5.3 Exterior Wall _ Cast In Place/Steel Stud _ Concrete Upstand _ 200w _ 30MPa _ Detail 3-A657			
			Length (m)	73.00	73.00
			Height (m)	1.10	1.10
			Area (m^2)	80.30	80.30
			Concrete Strength (MPa)	30.00	30.00
			Thickness (mm)	200.00	200.00
			Reinforcement (M)	-	15.00
			Concrete Flyash (%)	35.00	35.00
			Steel Stud Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	41.00	92.00
			Load Bearing	No	No
			Openings Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
			Envelope Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	Cavity Wall Insulation	Insulation
			Material	Mineral Fibre Board	Rockwool Batt
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Gypsum Board	Gypsum Board
			Material	Regular	Gypsum Regular
			Thickness (mm)	16mm	16mm
			Category	Interior Finish	Paint
			Material	Latex Paint	Latex Water Based
			Thickness (mm)	n/a	n/a
	5.6 Curtain Wall/Steel Stud				
		5.6.1 Parapet _ Curtain Wall/Steel Stud _ G1 _ Triple Glazed _ Detail 5-A655/2-A662			
			Length (m)	36.00	36.00
			Height (m)	0.60	0.60
			Area (m^2)	21.60	21.60
			Curtain Wall Percent Viewable Glazing (%)	13.00	13.00
			Percent Spandrel Panel (%)	87.00	87.00
			Thickness of Insulation (mm)	50.00	50.00
			Spandrel Type	Gazed	Opaque Glass
			Steel Stud Sheathing Type	13mm Exterior Sheathing	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	20.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	Yes	Yes
			Openings Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors	None	None
			Door Type	None	None
			Envelope Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Insulation	Insulation
			Material	Mineral Wool	Rockwool Bat
			Thickness (mm)	150.00	150.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		5.6.2 Parapet _ Curtain Wall/Steel Stud _ G1 _ Triple Glazed _ Detail 6-A652			
			Length (m)	26.00	26.00
			Height (m)	0.60	0.60
			Area (m^2)	15.60	15.60
		Curtain Wall	Percent Viewable Glazing (%)	13.00	13.00
			Percent Spandrel Panel (%)	87.00	87.00
			Thickness of Insulation (mm)	50.00	50.00
			Spandrel Type	Glazed	Opaque Glass
		Steel Stud	Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	20.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	Yes	Yes
		Openings	Number of Windows	None	None
			Total Window Area (m2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors	None	None
			Door Type	None	None
		Envelope	Category	Waterproof Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Board Insulation	Insulation
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Wall Polyiso Foam Board Foil Facer
			Thickness (mm)	100.00	100.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Exterior Sheathing	Gypsum Board
			Material	tant, Fiberglass Mat Facing Gypsum Board	Gypsum Moisture Resistant
			Thickness (mm)	13.00	13.00
			Category	Insulation	Insulation
			Material	Mineral Wool	Rockwool Bat
			Thickness (mm)	150.00	150.00
6.0 Roofs and Soffits					
	6.1 Composite Metal				
		6.1.1 Roof _ Composite Metal _ R1 _ Exposed Membrane Roof _ Roof Level			
			Bay Size (m)	9.00	9.00
			Span (m)	1.72	1.72
			Area (m^2)	62.00	62.00
		Composite Metal Roof	Number of Bays per Row (ea)	1.00	1.00
			Number of Rows (ea)	4.00	4.00
			Concrete Strength (Mpa)	25.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	1.40	2.40
		Envelope	Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Protection Board	Included in
			Material	Asphalt Impregnated Fiberglass Felt	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Roof Sheathing	Included in
			Material	stant, Fiberglass Mat Facing Gypsum Board	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	13.00	n/a
		6.1.2 Roof _ Composite Metal _ R8 _ Play Area _ Level 4			
			Bay Size (m)	12.39	12.10
			Span (m)	3.00	3.07
			Area (m^2)	223.00	223.00
		Composite Metal Roof	Number of Bays per Row (ea)	2.00	2.00
			Number of Rows (ea)	3.00	3.00
			Concrete Strength (Mpa)	25.00	30.00
			Concrete Flyash (%)	35.00	35.00
			Live Load (kPa)	2.40	2.40
		Envelope	Category	Protection Board	Included in
			Material	Asphalt Impregnated Fiberglass Felt	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Roof Sheathing	Included in
			Material	stant, Fiberglass Mat Facing Gypsum Board	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
	6.2 Concrete Suspended Slab				
		6.2.1 Roof Concrete Suspended Slab R2 Exposed Membrane Level 5			
			Roof Width (m)	Varies	50.67
			Roof Span (m)	9.00	9.00
			Area (m^2)	456.00	456.00
		Concrete Suspended Slab	Strength (MPa)	35.00	30.00
			Live Load (kPa)	2.40	2.40
			Concrete Flyash %	35.00	35.00
		Envelope	Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Protection Board	Included in
			Material	Asphalt Impregnated Fiberglass Felt	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6mil

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Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
		6.2.2 Roof _ Concrete Suspended Slab _ R4 _ Crop Area _ Level 4			
			Roof Width (m)	Varies	39.22
			Roof Span (m)	9.00	9.00
			Area (m^2)	353.00	353.00
		Concrete Suspended Slab	Strength (MPa)	35.00	30.00
			Live Load (kPa)	2.40	2.40
			Concrete Flyash %	35.00	35.00
		Envelope	Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Roof Sheathing	Included in
			Material	tant, Fiberglass Mat Facing Gypsum Board	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6mil
		6.2.3 Roof _ Concrete Suspended Slab _ R5 _ Pavers on Concrete _ Level 4			
			Roof Width (m)	Varies	81.78
			Roof Span (m)	9.00	9.00
			Area (m^2)	736.00	736.00
		Concrete Suspended Slab	Strength (MPa)	35.00	30.00
			Live Load (kPa)	4.80	4.80
			Concrete Flyash %	35.00	35.00
		Envelope	Category	Pavers	Cladding
			Material	Concrete	Brick - Concrete
			Thickness (mm)	-	n/a
			Category	Fill	Roof Envelopes
			Material	Gravel	Ballast
			Thickness (mm)	75.00	n/a
			Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Protection Board	Included in
			Material	Asphalt Impregnated Fiberglass Felt	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6mil
		6.2.4 Roof _ Concrete Suspended Slab _ R7 _ Landscape on Concrete _ Level 1			
			Roof Width (m)	Varies	18.78
			Roof Span (m)	9.00	9.00
			Area (m^2)	169.00	169.00
		Concrete Suspended Slab	Strength (MPa)	35.00	30.00
			Live Load (kPa)	4.80	4.80
			Concrete Flyash %	35.00	35.00
		Envelope	Category	Filter Fabric	Included in
			Material	Polyethylene	Mod. Bit. (Inv.) - Extruded Polystyrene
			Thickness (mm)	-	n/a
			Category	Fill	Included in
			Material	Gravel	Mod. Bit. (Inv.) - Extruded Polystyrene
			Thickness (mm)	75.00	n/a
			Category	Drainage Board	Vapour & Air Barrier
			Material	HDPE Panel	Vapour Barrier
			Thickness (mm, mil)	25.00	6.00
			Category	Drainage Plane Membrane	Vapour & Air Barrier
			Material	Spun-Bonded Poly-Olefin Sheet	Air Barrier
			Thickness (mm)	-	n/a
			Category	R-30 Board Insulation	Included in
			Material	Extruded Polystyrene	Mod. Bit. (Inv.) - Extruded Polystyrene
			Thickness (mm)	150.00	n/a
			Category	SBS Membrane	Modified Bitumen Membrane Roofing System - Inverted
			Material	2-Ply SBS Membrane	Mod. Bit. (Inv.) - Extruded Polystyrene
			Thickness (mm)	-	150.00
		6.2.5 Roof _ Concrete Suspended Slab _ R10 _ Pavers on Concrete _ Level 1			
			Roof Width (m)	Varies	117.56
			Roof Span (m)	9.00	9.00
			Area (m^2)	1,058.00	1,058.00
		Concrete Suspended Slab	Strength (MPa)	35.00	30.00
			Live Load (kPa)	4.80	4.80
			Concrete Flyash %	35.00	35.00
		Envelope	Category	Pavers	Cladding
			Material	Concrete	Brick - Concrete
			Thickness (mm)	-	n/a
			Category	Fill	Included in
			Material	Gravel	Mod. Bit. (Inv.) - Extruded Polystyrene
			Thickness (mm)	75.00	n/a
			Category	Filter Fabric	Included in
			Material	Polyethylene	Mod. Bit. (Inv.) - Extruded Polystyrene
			Thickness (mm)	-	n/a
			Category	Drainage Board	Vapour & Air Barrier
			Material	HDPE Panel	Vapour Barrier
			Thickness (mm, mil)	25.00	6.00
			Category	R-30 Board Insulation	Included in
			Material	Extruded Polystyrene	Mod. Bit. (Inv.) - Extruded Polystyrene
			Thickness (mm)	150.00	n/a
			Category	SBS Membrane	Modified Bitumen Membrane Roofing System - Inverted
			Material	2-Ply SBS Membrane	Mod. Bit. (Inv.) - Extruded Polystyrene
			Thickness (mm)	-	150.00
	6.3 Light Frame Wood Truss				
		6.3.1 Roof _ Light Frame Wood Truss _ R6 _ Cross Laminated Timber Panel _ Level 5			
			Roof Width (m)	69.00	103.69
			Roof Span (m)	22.00	14.64
			Area (m^2)	1,518.00	1,518.00
		Light Frame Wood Truss	Truss Type	Glulam Timber Truss (Parallel)	Parallel
			Decking Type	Cross Laminated Timber Panel	Plywood
			Decking Thickness (mm)	102.00	19.00
			Live Load (kPa)	0.50	2.40
		Envelope	Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Protection Board	Included in
			Material	Asphalt Impregnated Fiberglass Felt	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00

IE Inputs Document - New SUB Project

Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
	6.4 Pre-Engineered Metal Roof System				
		6.4.1 Roof _ Pre-Engineered Metal Roof System _ R1 _ Exposed Membrane _ Roof Level			
			Roof Width (m)	Varies	30.58
			Roof Length (m)	Varies	30.58
			Area (m^2)	935.00	935.00
		Pre-Engineered Metal Roof System	Live Load (kPa)	1.82	2.40
		Envelope	Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Protection Board	Included in
			Material	Asphalt Impregnated Fiberglass Felt	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00
			Category	Roof Sheathing	Included in
			Material	tant, Fiberglass Mat Facing Gypsum Board	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	13.00	n/a
		6.4.2 Roof _ Pre-Engineered Metal Roof System _ R3 _ Exposed Membrane _ Acoustic Insulation _ Level 4			
			Roof Width (m)	Varies	27.37
			Roof Length (m)	Varies	27.37
			Area (m^2)	749.00	749.00
		Pre-Engineered Metal Roof System	Live Load (kPa)	1.00	2.40
		Envelope	Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Protection Board	Included in
			Material	Asphalt Impregnated Fiberglass Felt	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6mil
			Category	Roof Sheathing	Included in
			Material	tant, Fiberglass Mat Facing Gypsum Board	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	13.00	n/a
			Category	Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	-	92.00
		6.4.3 Roof _ Pre-Engineered Metal Roof System _ R3 _ Exposed Membrane _ Acoustic Insulation _ Level 5			
			Roof Width (m)	Varies	7.07
			Roof Length (m)	Varies	7.07
			Area (m^2)	50.00	50.00
		Pre-Engineered Metal Roof System	Live Load (kPa)	1.82	2.40
		Envelope	Category	SBS Membrane	Modified Bitumen Membrane Roofing System
			Material	2-Ply SBS Membrane	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	-	150.00
			Category	Protection Board	Included in
			Material	Asphalt Impregnated Fiberglass Felt	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	6.00	n/a
			Category	R-30 Board Insulation	Included in
			Material	Polyisocyanurate Foam w/ Glass Reinforce	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	150.00	n/a
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6mil
			Category	Roof Sheathing	Included in
			Material	tant, Fiberglass Mat Facing Gypsum Board	Mod. Bit. - Polyiso Foam Board Glass Facer + Gypsum
			Thickness (mm)	13.00	n/a
			Category	Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	-	92.00
		6.4.4 Roof _ Pre-Engineered Metal Roof System _ RW2 _ Standing Seam Zinc Roof Wall _ Acoustical Insulation _ Level 5			
			Roof Width (m)	Varies	22.47
			Roof Length (m)	Varies	22.47
			Area (m^2)	505.00	505.00
		Pre-Engineered Metal Roof System	Live Load (kPa)	1.82	2.40
		Envelope	Category	Cladding	Cladding
			Material	Standing Seam Zinc	Steel Cladding - Commercial (26 ga)
			Thickness (mm)	-	n/a
			Category	Drainage Mat	Vapour & Air Barrier
			Material	Entangled Nylon Fibre Mat	Air Barrier
			Thickness (mm)	19.00	n/a
			Category	R25 Board Insulation	Insulation
			Material	Mineral Wool Board	Rockwool Bat
			Thickness (mm)	175.00	175.00
			Category	SBS Membrane	Roof Envelopes
			Material	2-Ply SBS Membrane	Standard Modified Bitumen Membrane 2 ply
			Thickness (mm)	-	n/a
			Category	Roof Sheathing	Gypsum Board
			Material	erglass Mat Facing Gypsum Board (Type X)	Gypsum Fire Rated Type X
			Thickness (mm)	16.00	16.00
			Category	Acoustic Insulation	Insulation
			Material	Fiberglass Batt	Fiberglass Batt
			Thickness (mm)	-	92.00
			Category	Interior Finish	Paint
			Material	Paint	Alkyd Solvent Based
			Thickness (mm)	n/a	n/a

IE Inputs Document - New SUB Project

Assembly Group	Assembly Type	Assembly Name	Input Fields	Input Values	
				Known/Measured	IE Inputs
	6.5 Steel Stud				
		6.4.5 Soffit _ Steel Stud _ ES1/ES2 _ GFRC Clad Wall Level 1			
			Length (m)	Varies	46.07
			Height (m)	Varies	46.07
			Area	2,122.00	2,122.00
			Sheathing Type	None	None
			Stud Spacing (mm)	400.00	400.00
			Stud Weight (Ga)	25.00	25.00
			Stud Thickness (mm)	152.00	152.00
			Load Bearing	No	No
		Openings	Number of Windows (ea)	None	None
			Total Window Area (m^2)	None	None
			Frame Type	None	None
			Glazing Type	None	None
			Number of Doors (ea)	None	None
			Door Type	None	None
		Envelope	Category	Cladding	Cladding
			Material	GFRC	Fiber Cement Siding
			Thickness (mm)	13.00	n/a
			Category	Fireproofing	Gypsum Board
			Material	Spray Fireproofing	Gypsum Fire Rated Type X
			Thickness (mm)	25.00	16.00
			Category	Spray Foam Insulation	Insulation
			Material	Polyisocyanurate Foam	Polyisocyanurate Foam
			Thickness (mm)	100.00	100.00
			Category	Air/ Vapour Barrier	Vapour & Air Barrier
			Material	Polyethylene Sheet	Polyethylene
			Thickness (mil)	6.00	6.00

Appendix B – IE Assumptions

IE Input Assumptions Document - New SUB Project

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
1.0 Foundation	- The IE SOG inputs are limited to being either 100mm or 200mm. Since the actual SOG thicknesses for the New SUB Project are not exactly 100mm or 200mm thick, the measured areas required adjustments to equalize the total volume of the SOG. - The IE limits the thickness of footings to be between 190mm and 500mm thick. As there are a number of cases where footing thicknesses exceed 500mm, their widths were increased accordingly to maintain the same volume of footing while accommodating this limitation. - The specified concrete uses Limestone to reduce a minimum of 35% of the cement within the mix design. Because of this cement reduction, the concrete flyash was modelled to be 35% for all IE foundation inputs.		
	1.1 Concrete Footing		
		1.1.1 Concrete Footing _ F1	The length of this footing was adjusted to accommodate the the quantity of footings. The measured width was maintained, thicknesses was set at 400mm and the length was increased using the following calculations; = [(Cited Width) x (Cited Thickness)] Cited Length * 15 units = [(2.5m) x (400mm)] *2.5m * 15 units = 37.5m^3
		1.1.2 Concrete Footing _ F2	The length of this footing was adjusted to accommodate the the quantity of footings and the IE limitation of footing thicknesses to be under 500mm. The measured width was maintained, thicknesses was set at 500mm and the lengths were increased using the following calculations; = [(Cited Width) x (Cited Thickness)/500mm]* Cited Length * 29 units = [(4.0m) x (1100mm)/500mm] *4.0m * 29 units = 510.4m^3
		1.1.3 Concrete Footing _ F3	The length of this footing was adjusted to accommodate the the quantity of footings and the IE limitation of footing thicknesses to be under 500mm. The measured width was maintained, thicknesses was set at 400mm and the lengths were increased using the following calculations; = [(Cited Width) x (Cited Thickness)/400mm]* Cited Length * 8 units = [(4.2m) x (1200mm)/400mm] *4.2m * 8 units = 169.34m^3
		1.1.4 Concrete Footing _ F4	The length of this footing was adjusted to accommodate the the quantity of footings and the IE limitation of footing thicknesses to be under 500mm. The measured width was maintained, thicknesses was set at 500mm and the lengths were increased using the following calculations; = [(Cited Width) x (Cited Thickness)/500mm]* Cited Length * 7 units = [(4.9m) x (1300mm)/500mm] *4.9m * 7 units = 218.491m^3
		1.1.5 Concrete Footing _ Misc. _ 700d	The length of this footing was adjusted to accommodate the the quantity of footings and the IE limitation of footing thicknesses to be under 500mm. The measured width was maintained, thicknesses was set at 350mm and the lengths were increased using the following calculations; = [(Cited Width) x (Cited Thickness)/2]* Cited Length * 2 = [(8m) x (350mm] *3m * 2 = 16.8m^3
		1.1.6 Concrete Footing _ Misc. _ 875d	The length of this footing was adjusted to accommodate the the quantity of footings and the IE limitation of footing thicknesses to be under 500mm. The measured width was maintained, thicknesses was set at 500mm and the lengths were increased using the following calculations; = [(Factored Width) x (Factored Thickness)]* Cited Length * 2 = [(4.25m) x (500mm] *7m = 14.875m^3
		1.1.7 Concrete Footing _ Misc. _ 1200d	The length of this footing was adjusted to accommodate the IE limitation of footing thicknesses to be under 500mm. The measured width was maintained, thicknesses was set at 500mm and the lengths were increased using the following calculations; = [(Cited Width) x (Cited Thickness)/500mm]* Cited Length * adj. thickness = [(3m) x (1200mm)/500mm] *8.333m * 500mm = 30m^3
		1.1.8 Concrete Footing _ Misc. _ 2500d	The length of this footing was adjusted to accommodate the Impact Estimator limitation of footing thicknesses to be under 500mm. The measured width was maintained, thicknesses was set at 500mm and the lengths were increased using the following calculations; = [(Cited Width) x (Cited Thickness)/500mm]* Cited Length * adj. thickness = [(3.9m) x (2500mm)/500mm] *10m * 500mm = 97.5m^3
		1.1.9 Concrete Footing SF1	The length of this spread footing was totaled and inputted directly.
		1.1.10 Concrete Footing _ Stair Core 1	The area of this footing was measured and multiplied by the cited 1/4 of the actual thickness to get the volume, the length was then factored by four since the thickness of 2000mm can't be input directly. This was done using the following calculations; = [[(Measured Area) x (500mm)] *4 = [[(10m) x (16m) x 500mm] *4 = 320m^3
		1.1.11 Concrete Footing _ Stair Core 2	The area of this footing was measured and multiplied by the cited 1/5 of the actual thickness to get the volume, the length was then factored by four since the thickness of 2500mm can't be input directly. This was done using the following calculations; = [[(Measured Area) x (500mm)] *5 = [[(19.1m) x (20.1m) x 500mm] *5 = 959.775m^3

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
		1.1.12 Concrete Footing _ Stair Core 3	The area of this footing was measured and multiplied by the cited 1/4 of the actual thickness to get the volume, the length was then factored by four since the thickness of 2000mm can't be input directly. This was done using the following calculations; = [(Measured Area) x (500mm)] *4 = [(13.95m) x (20m) x 500mm] *4 = 558m^3
		1.1.13 Concrete Footing _ Stair Core 4	The area of this footing was measured and multiplied by the cited 1/5 of the actual thickness to get the volume, the length was then factored by four since the thickness of 2500mm can't be input directly. This was done using the following calculations; = [(Measured Area) x (500mm)] *5 = [(10.85m) x (20m) x 500mm] *5 = 542.5m^3
	1.2 Concrete Slab on Grade		
		1.2.1 Concrete Slab on Grade _ Lower Level _ 125mm	- The area of this slab had to be adjusted so that the thickness fit into the 100mm thickness specified in the IE. The area was factored up 25% to make up the difference between the 100mm inputted slab and the actual slab thickness of 125mm. - Because the SOG area was modified the insulation thickness should be reduced to 8mm to maintain the same material volume. The lowest IE input of 25.381mm was used.
		1.2.2 Concrete Slab on Grade _ Lower Level _ 225mm	- The base area of 125mm was already included in the previous input and so this input included just the additional 100mm thickness. The difference between the 225mm and 125mm slab. - The below grade insulation and vapour barrier was omitted for this portion of SOG due to the over estimate of the previous input.
		1.2.3 Concrete Slab on Grade _ Level 1 _ 125mm	- Similar to the SOG on the lower level, this SOG area was increased 25% to account for the additional thickness from 100mm to 125mm. - The below grade insulation and vapour barrier was omitted for this portion of SOG due to the over estimate at the lower level.
2.0 Columns and Beams	- The method used to measure column sizing was completely depended upon the metrics built into the IE. That is, the IE calculates the sizing of beams and columns based on the following inputs; number of beams, number of columns, floor to floor height, bay size, supported span and live load. This being the case, concrete columns were counted for on each floor, while each floor's area was measured, there were no traditional beams utilized in the structure. An average bay and span size were calculated in order to cover the measured area, as seen in the assumption details below for each input. - The IE does not allow the input of concrete flyash percent in the columns and beams assemblies and an average value of 9% is used by default.		
	2.1 Concrete		
		2.1.1 Columns and Beams _ Concrete _ Lower Level	- Because of the variability of actual bay and span sizes, they were approximated for the IE input using the following calculation; = sqrt[(Measured Supported Floor Area) / (Counted Number of Columns)] = sqrt[(4647 m^2) / (53)] = 9.36m - Since the floor to floor height of the lower level varies, and average height was used. Average(4.0, 4..9, 3.9) = 4.23m
		2.1.2 Columns and Beams _ Concrete _ Level 1	- Because of the variability of actual bay and span sizes, they were approximated for the IE input using the following calculation; = sqrt[(Measured Supported Floor Area) / (Counted Number of Columns)] = sqrt[(4647 m^2) / (53)] = 9.12m - Since the floor to floor height on level one varies, an average height was used. Average(6.1, 7.1) = 6.6m
		2.1.3 Columns and Beams _ Concrete _ Level 2	- Because of the variability of bay and span sizes, they were calculated using the following calculation; = sqrt[(Measured Supported Floor Area) / (Counted Number of Columns)] = sqrt[(3522 m^2) / (42)] = 9.16m
		2.1.4 Columns and Beams _ Concrete _ Level 3	- Because of the variability of actual bay and span sizes, they were approximated for the IE input using the following calculation; = sqrt[(Measured Supported Floor Area) / (Counted Number of Columns)] = sqrt[(3579 m^2) / (42)] = 9.23m
		2.1.5 Columns and Beams _ Concrete _ Level 4	- Because of the variability of actual bay and span sizes, they were approximated for the IE input using the following calculation; = sqrt[(Measured Supported Floor Area) / (Counted Number of Columns)] = sqrt[(1591 m^2) / (33)] = 6.94m
	2.2 Glulam		
		2.2.1 Columns and Beams _ Glulam _ Lower Level Level	- Since the floor to floor height of the lower level varies, and average height was used. Average(4.0, 4..9, 3.9) = 4.23m - The specified live load of 1.82kPa could not be modelled I the IE and so the lowest allowable input of 2.4kPa was selected.
		2.2.2 Columns and Beams _ Glulam _ Level 1	- Since the floor to floor height on level one varies, an average height was used. Average(6.1, 7.1) = 6.6m - The specified live load of 1.82kPa could not be modelled I the IE and so the lowest allowable input of 2.4kPa was selected.
		2.2.3 Columns and Beams _ Glulam _ Level 2	- Since the column spacing and span varies, the average values of 4.5m and 9.0m respectively were used for the IE. - The specified live load of 1.82kPa could not be modelled I the IE and so the lowest allowable input of 2.4kPa was selected.
		2.2.4 Columns and Beams_ Glulam _Level 2 - 4 _ Great Hall Foyer	- Since the span varied over the length of the roof an average value of 5.6m was selected for the IE input. - The column height of L2 and L3 were both included as the columns span over the two floors.

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
		2.2.5 Columns and Beams _ Glulam _ Level 3	- Since the column spacing and span varies, the average values of 4.5m and 9.0m respectively were used for the IE. - The specified live load of 1.82kPa could not be modelled I the IE and so the lowest allowable input of 2.4kPa was selected.
		2.2.6 Columns and Beams _ Glulam _ Level 4	- Since the column spacing and span varies, the average values of 4.5m and 9.0m respectively were used for the IE. - The specified live load of 1.82kPa could not be modelled I the IE and so the lowest allowable input of 2.4kPa was selected.
		2.2.7 Columns and Beams _ Glulam _ Level 5 _ Roof Wall	- Since the span varies, the average value of 10.0m was used for the IE. - The specified live load of 1.82kPa could not be modelled I the IE and so the lowest allowable input of 2.4kPa was selected. - There was a small portion of HSS in an area of this roof which was not considered significant enough to count separately.
		2.2.8 Columns and Beams _ Glulam _ L5 _ Sawtooth Roof	- The specified live load of 1.82kPa could not be modelled I the IE and so the lowest allowable input of 2.4kPa was selected.
	2.3 Steel		
		2.3.1 Columns and Beams_ Steel _Level 2 - 4 _ Great Hall	-The actual bay size of the beams is 2.47m however the IE limits the minimum bay size to 3.05, the number of the beams was kept the same but the bay size was doubled, to make the equivalent support area the beam span was reduced by half. - The column height of L2 and L3 were both included as the columns span over the two floors.
		2.3.2 Columns and Beams _ Steel _ Level 5 _ Mechanical Room	- The specified live load of 1.82kPa could not be modelled I the IE and so the lowest allowable input of 2.4kPa was selected.
3.0 Floor	- The IE calculated the thickness of the suspended slabs based on floor width, span, concrete strength, concrete flyash content and live load. - The specified concrete strength for suspended however the IE limits inputs to 20MPa 30MPa, or 60MPa strengths. 30MPa was used for the modelling. - The specified concrete uses Limestone to reduce a minimum of 35% of the cement within the mix design. Because of this cement reduction, the concrete flyash was modelled to be 35% for all IE floor inputs. - Composite metal roofs are included in section 6.1 Roofs and Soffits _ Composite Metal - Concrete suspended roof slabs are included in section 6.2 Roofs and Soffits _ Concrete Suspended Slab - Soffit finishes to concrete suspended slabs are included in section 6.5 Roofs and Soffits _ Steel Stud		
	3.1 Composite Metal		
		3.1.1 Floor _ Composite Metal _ Level 2 _ Great Hall	- Since the bay size varied, it was approximated using the following equation; Floor Area / (# of Rows * Bay Size) / # of Bays. This resulted in a bay size of 27.8m. The maximum allowable bay size in the IE is 12.1m and so the number of bays was increased to 3 reducing the span to 9.03m while maintaining the same floor area.
		3.1.2 Floor _ Composite Metal _ Level 2 _ Nest and Bridge Lounge	- Composite Deck area of the Nest (214 m^2) and Bridge Lounge (78+29m^2). An average span of 1.5m, approximate row count of 12 and approximate bay count of 5 were determined and the bay size was then approximated using; Floor Area / (# of Rows * Bay Size) / # of Bays
		3.1.3 Floor _ Composite Metal _ Level 3 _ Nest, Bridge Lounge and Pocket Lounge	- Composite Deck area of the Nest (203 m^2), Bridge Lounge (78+3m^2) and Pocket lounge (96m^2). Bay size was approximated using; Floor Area / (# of Rows * Bay Size) / # of Bays
		3.1.4 Floor _ Composite Metal _ Level 4 _ Child Minding	- Composite Deck area of the Indoor child minding area (74m^2). Bay size was approximated using; Floor Area / (# of Rows * Bay Size) / # of Bays
	3.2 Concrete Suspended Slab		
		3.2.1 Floor _ Concrete Suspended Slab _ Level 1	- Floor span was taken from the typical bayline spacing. The floor width was calculated by the floor area divided by the span as follows: 3420m^2 / 9.0m = 380m Floor Width
		3.2.2 Floor _ Concrete Suspended Slab _ Level 2	- Floor span was taken from the typical bayline spacing. The floor width was calculated by the floor area divided by the span as follows 3579m^2 / 9.0m = 397.7m Floor Width
		3.2.3 Floor _ Concrete Suspended Slab _ Level 3	- Floor span was taken from the typical bayline spacing. The floor width was calculated by the floor area divided by the span as follows 3522m^2 / 9.0m = 391.3m Floor Width
		3.2.4 Floor _ Concrete Suspended Slab _ Level 4	- Floor span was taken from the typical bayline spacing. The floor width was calculated by the floor area divided by the span as follows 2519m^2 / 9.0m = 379.8m Floor Width. Suspended roof slabs included in roofing systems
		3.2.5 Floor _ Concrete Suspended Slab _ Level 5	- Floor span was taken from the typical bayline spacing. The floor width was calculated by the floor area divided by the span as follows 1075m^2 / 9.0m = 119.4m Floor Width Suspended roof slabs included in roofing systems
4.0 Interior Walls	- All interior walls were assumed to be the full top of slab to top of slab height. No reduction in wall height was made to accommodate slab thickenings or slab bands. - The specified concrete uses Limestone to reduce a minimum of 35% of the cement within the mix design. Because of this cement reduction, the concrete flyash was modelled to be 35% for all concrete wall IE inputs. - The specifications call for abuse resistant gypsum board in corridors to a height of 1200mm above finished floor. The IE is unable to model a combination of finishes on a given layer of envelope and so the abuse resistent gypsum board was ignored. - Due to limitations of the IE all doors were assumed to be a standard (812mm x 2133). Double doors were counted as two standard sized doors.		
		4.1.1 Interior Wall _ Cast In Place _ C1 _ 250w _ 30MPa _ Metal Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE only accepts 200mm and 300mm wall thicknesses, the length of the wall was adjusted to maintain the same overall volume.
		4.1.2 Interior Wall _ Cast In Place _ C1 _ 300w _ 30MPa	
		4.1.3 Interior Wall _ Cast In Place _ C1 _ 450w _ 45MPa _ Metal Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE only accepts 200 and 300 wall thicknesses, the length of the wall was adjusted to maintain the same overall volume, as that is the functional unit of concrete. - Since the IE does not model 45MPa it was rounded to the nearest strength value of 30MPa.

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
		4.1.4 Interior Wall _ Cast In Place _ C1 _ 600w _ 45MPa _ Metal Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The specified 600mm concrete wall was modelled in the IE using two layers of 300mm concrete wall since 300mm is the maximum allowable thickness. - The specified 45MPa strength is not an available IE input and was modelled with one 300mm wall at 30MPa strength and the other at 60MPa strength. (A more than average flyash % was not available for 60MPa concrete).
	4.2 Concrete Block		
		4.2.1 Interior Wall _ Concrete Block _ M1 _ Concrete Block Wall _ 190mm Block _ Metal Door	-Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height.
		4.2.2 Interior Wall _ Concrete Block _ M1-A _ Acoustic Concrete Block Wall _ 190mm Block _ Metal Door	- Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors.
		4.2.3 Interior Wall _ Concrete Block _ M1-A _ Acoustic Concrete Block Wall _ 190mm Block _ Wood Door	- Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors.
	4.3 Curtain Wall		
		4.3.1 Interior Wall _ Curtain Wall _ GL1B _ 6mm Tempered	- Since there are various heights of this wall assembly The total area was calculated and divided by The total length to determine The weighted average of height. - The assembly specifications includes single pane 6mm laminated glass. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system.
	4.4 Steel Stud		
		4.4.1 Interior Wall _ Steel Stud _ RS1 _ Rated Shaft Wall 1 HR FRR _ 100mm C-H Stud	- The IE does not contain 100mm C-H studs in its material database and so 92mm regular studs were used as a surrogate due to similar material properties. - The IE does not contain 19mm Shaftliner or 16mm Fireboard in its material database. 16mm Type X Gypsum board was used as a surrogate due to similar material properties.
		4.4.2 Interior Wall _ Steel Stud _ RS2 _ Rated Shaft Wall 1 HR FRR w/ Additional GWB_ 100mm C-H Stud	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The IE does not contain 100mm C-H studs in its material database and so 92mm regular studs were used as a surrogate due to similar material properties. - The IE does not contain 19mm Shaftliner or 16mm Fireboard in its material database. 16mm Type X Gypsum board was used as a surrogate due to similar material properties.
		4.4.3 Interior Wall _ Steel Stud _ RS3 _ Rated Shaft Wall 1 HR FRR w/ Additional GWB _ 152mm C-H Stud	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The IE does not contain 152mm C-H studs in its material database and so 152mm regular studs were used as a surrogate due to similar material properties. - The IE does not contain 19mm Shaftliner or 16mm Fireboard in its material database. 16mm Type X Gypsum board was used as a surrogate due to similar material properties.
		4.4.4 Interior Wall _ Steel Stud _ W1 _ Wall Furring _ 22mm Channel	- The IE does not contain 22mm furring channel in its material database and so the smallest available steel stud thickness of 92mm was used as a surrogate due to
		4.4.5 Interior Wall _ Steel Stud _ W1-T _ Tile Clad Wall Furring _ 22mm Channel	- The IE does not contain 22mm furring channel in its material database and so the smallest available steel stud thickness of 92mm was used as a surrogate due to
		4.4.6 Interior Wall _ Steel Stud _ W2 _ Wall Furring _ 41mm Stud _ Metal Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The IE does not contain 22mm furring channel in its material database and so the smallest available steel stud thickness of 92mm was used as a surrogate due to similar material properties.
		4.4.7 Interior Wall _ Steel Stud _ W3 _ Wall Furring _ 92mm Stud _ Metal Door	- Since The IE can not model two types of doors in a single assembly, The total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors.
		4.4.8 Interior Wall _ Steel Stud _ W3 _ Wall Furring _ 92mm Stud _ Wood Door	- Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors.
		4.4.9 Interior Wall _ Steel Stud _ W3-T _ Tile Clad Wall Furring _ 92mm Stud	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The IE does not contain 16mm Coated Glass Map Backer Board so 16mm Moisture Resistant Gypsum board was used as a surrogate due to similar material properties. - This wall assembly contains a tile finish which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.10 Interior Wall _ Steel Stud _ W4 _ Wall Furring _ 152mm Stud	- Since there are various heights of this wall assembly The total area was calculated and divided by The total length to determine The weighted average of height.
		4.4.11 Interior Wall _ Steel Stud _ W4-T _ Wall Furring _ 152mm Stud	- The IE does not contain 16mm Coated Glass Map Backer Board so 16mm Moisture Resistant Gypsum board was used as a surrogate due to similar material properties. - This wall assembly contains a tile finish which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.12 Interior Wall _ Steel Stud _ W5 _ Basic Partition _ 92mm Stud _ Metal Door _ GL1	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors.
		4.4.13 Interior Wall _ Steel Stud _ W5 _ Basic Partition _ 92mm Stud _ Wood Door _ GL1	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors.
		4.4.14 Interior Wall _ Steel Stud _ W5-2 _ Acoustic Partition w/ 2 Layers One Side _ 92mm Stud _ Metal Door _ GL1	- Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors. - This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
		4.4.15 Interior Wall _ Steel Stud _ W5-2 _ Acoustic Partition w/ 2 Layers One Side _ 92mm Stud _ Wood Door _ GL1	- Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors. - This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.16 Interior Wall _ Steel Stud _ W5-22 _ Acoustic Partition w/ 2 Layers Both Sides _ 92mm Stud _ Metal Door _ GL1	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors. This assembly also contains two types of glazing and so it was separated similarly to the doors. - This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.17 Interior Wall _ Steel Stud _ W5-22 _ Acoustic Partition w/ 2 Layers Both Sides _ 92mm Stud _ Wood Door _ GL1A	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors. This assembly also contains two types of glazing and so it was separated similarly to the doors. - This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.18 Interior Wall _ Steel Stud _ W5-R _ Rated Partition _ 92mm Stud _ Metal Door	
		4.4.19 Interior Wall _ Steel Stud _ W5-RA _ Rated Acoustic Partition _ 92mm Stud	- This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.20 Interior Wall _ Steel Stud _ W5-T _ Tile Clad Partition Both Sides _ 92mm Stud _ Wood Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The IE does not contain 16mm Coated Glass Map Backer Board so 16mm Moisture Resistant Gypsum board was used as a surrogate due to similar material properties. - This wall assembly contains a tile finish which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.21 Interior Wall _ Steel Stud _ W6 _ Basic Partition _ 152mm Stud _ Metal Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors.
		4.4.22 Interior Wall _ Steel Stud _ W6 _ Basic Partition _ 152mm Stud _ Wood Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors.
		4.4.23 Interior Wall _ Steel Stud _ W6-2 _ Acoustic Partition w/ 2 Layers One Sides _ 152mm Stud	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.24 Interior Wall _ Steel Stud _ W6-22 _ Acoustic Partition w/ 2 Layers Both Sides _ 152mm Stud _ Metal Door _ GL1	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors. - This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.25 Interior Wall _ Steel Stud _ W6-22 _ Acoustic Partition w/ 2 Layers Both Sides _ 152mm Stud _ Wood Door _ GL1	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors. - This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.26 Interior Wall _ Steel Stud _ W6-R _ Rated Partition _ 152mm Stud _ Metal Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height.
		4.4.27 Interior Wall _ Steel Stud _ W6-RA _ Rated Acoustic Partition _ 152mm Stud	- This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.28 Interior Wall _ Steel Stud _ W6-T _ Tile Clad Partition Both Sides _ 152mm Stud _ Wood Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The IE does not contain 16mm Coated Glass Map Backer Board so 16mm Moisture Resistant Gypsum board was used as a surrogate due to similar material properties. - This wall assembly contains a tile finish which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.29 Interior Wall _ Steel Stud _ W6-T1 _ Tile Clad Partition One Side _ 152mm Stud _ Wood Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The IE does not contain 16mm Coated Glass Map Backer Board so 16mm Moisture Resistant Gypsum board was used as a surrogate due to similar material properties. - This wall assembly contains a tile finish which was excluded from the IE due to an absence of acceptable surrogate.
		4.4.30 Interior Wall _ Steel Stud _ W7 _ Double Stud Acoustic/ Mechanical Partition _ 92mm Stud _ Metal Door _ GL1	- Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors. This assembly also contains two types of glazing and so it was separated similarly to the doors.
		4.4.31 Interior Wall _ Steel Stud _ W7 _ Double Stud Acoustic/ Mechanical Partition _ 92mm Stud _ Wood Door _ GL1A	- Since the IE can not model two types of doors in a single assembly, the total quantity was divided in two and input as two assemblies, one with wood doors and one with metal doors. This assembly also contains two types of glazing and so it was separated similarly to the doors.

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
		4.4.32 Interior Wall _ Steel Stud _ W7-22 _ Double Stud Acoustic/ Mechanical Partition w/ 2 Layers Both Sides _ 92mm Stud _ Wood Door _ 10mm Glass	
		4.4.33 Interior Wall _ Steel Stud _ W7-T _ Double Stud Acoustic/ Mechanical Partition Tile Clad Both Sides _ 92mm Stud	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height.
		4.4.34 Interior Wall _ Steel Stud _ W7-T1 _ Double Stud Acoustic/ Mechanical Partition Tile Clad One Side _ 92mm Stud	
		4.4.35 Interior Wall _ Steel Stud _ W9 _ Double Stud Partition _ 152mm Stud	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height.
	4.5 Wood Stud		
		4.5.1 Interior Wall _ Wood Stud _ W8 _ Double Stud Acoustic Partition _ 140/184mm Stud _ Wood Door _ 10mm Glass	- This wall assembly contains a veneer plywood finish on one side and fabric wrapped acoustic panel finish on the other. Both materials were excluded from the IE due to an absence of acceptable surrogate. - The IE does not contain Black Mat Acoustical Blanket in its database so 50mm Rockwool was used as a surrogate due to similar material properties. - This wall assembly contains an acoustic sealant which was excluded from the IE due to an absence of acceptable surrogate.
	4.6 Concrete Block/Steel Stud		
		4.6.1 Interior Wall _ Concrete Block/Steel Stud _ M2 _ Concrete Block Wall w/ Furring Both Sides _ 190mm Block/ 25mm Channel _ Wood Door	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - This wall assembly contains a 25mm furring channel on both sides, a single layer of the smallest available steel stud thickness of 92mm was used as a surrogate due to similar material properties.
5.0 Exterior Walls & Parapets	- The specified concrete uses Limestone to reduce a minimum of 35% of the cement within the mix design. Because of this cement reduction, the concrete flyash was modelled to be 35% for all concrete wall assemblies.		
	5.1 Cast In Place		
		5.1.1 Exterior Wall _ Cast In Place _ EW2 sim (No Insulation, No Finish) _ Below Grade Wall _ 250w _ 30MPa	- The specified wall thickness is 250mm which was rounded up to the nearest allowable input of 300mm in the IE. Note that concrete volume equalization by modification of the wall length was not conducted as it would alter the square foot area and finishes associated with it. - Protection board was modeled for the full height of the wall instead of the specific 0.9m due to limitations of the IE. The minimum IE input of 25.381mm was used instead of the specified 25mm. - The specified drainage mat is a high density polyethylene (HDPE) panel which is not a material in the IE database. A 6mil polyethylene vapour barrier was used as a surrogate due to the similar material properties. - The specified waterproofing is a torch on sheet membrane composed of a polyester reinforced SBS. A standard 2-ply SBS membrane was used as a surrogate due to similar material properties.
		5.1.2 Exterior Wall _ Cast In Place _ EW3 _ Below Grade Wall _ 250w _ 30MPa	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The specified wall thickness is 250mm which was rounded up to the nearest allowable input of 300mm in the IE. Note that concrete volume equalization by modification of the wall length was not conducted as it would alter the square foot area and finishes associated with it. - Protection board was modeled for the full height of the wall instead of the specific 0.9m due to limitations of the IE. The minimum IE input of 25.381mm was used instead of the specified 25mm. - The specified drainage mat is a high density polyethylene (HDPE) panel which is not a material in the IE database. A 6mil polyethylene vapour barrier was used as a surrogate due to the similar material properties. - The specified waterproofing is a torch on sheet membrane composed of a polyester reinforced SBS. A standard 2-ply SBS membrane was used as a surrogate due to similar material properties.
		5.1.3 Exterior Wall _ Cast In Place _ EW3 _ Below Grade Wall _ 300w _ 30MPa	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - Protection board was modeled for the full height of the wall instead of the specified 0.9m due to limitations of the IE. The minimum IE input of 25.381mm was used instead of the specified 25mm. - The specified drainage mat is a high density polyethylene (HDPE) panel which is not a material in the IE database. A 6mil polyethylene vapour barrier was used as a surrogate due to the similar material properties. - The specified waterproofing is a torch on sheet membrane composed of a polyester reinforced SBS. A standard 2-ply SBS membrane was used as a surrogate due to similar material properties.
		5.1.4 Exterior Wall _ Cast In Place _ EW3 _ Below Grade Wall _ 600w _ 45MPa	- The specified 600mm 45MPaconcrete wall was modelled using two layers of 300mm concrete wall since 300mm is the maximum allowable thickness in the IE. One layer of wall was modelled at 30MPa and the other 60Mpa to approximate the specified strength. Note that a more than average flyash % was not available for 60MPa concrete. - Protection board was modeled for the full height of the wall instead of the specified 0.9m due to limitations of the IE. The minimum IE input of 25.381mm was used instead of the specified 25mm. - The specified drainage mat is a high density polyethylene (HDPE) panel which is not a material in the IE database. A 6mil polyethylene vapour barrier was used as a surrogate due to the similar material properties. - The specified waterproofing is a torch on sheet membrane composed of a polyester reinforced SBS. A standard 2-ply SBS membrane was used as a surrogate due to similar material properties.
		5.1.5 Parapet _ Cast In Place _ EW1 _ GFRC Clad Wall _ 200w _ 30MPa _ Detail 4-A660	- Reinforcement was assumed to be 15M, the lightest available choice, as concrete parapets are non structural elements. - The specified cladding is a fiber reinforced concrete panel which is not a material in the IE database. Fibre cement siding was selected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.1.6 Parapet _ Cast In Place _ EW1 _ GFRC Clad Wall _ 200w _ 30MPa _ Detail 5-A651	- Reinforcement was assumed to be 15M, the lightest available choice, as concrete parapets are non structural elements. - The specified cladding is a fiber reinforced concrete panel which is not a material in the IE database. Fibre cement siding was selected as a surrogate as it contains similar material properties.

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
	5.2 Curtain Wall		
		5.2.1 Exterior Wall _ Curtain Wall _ GL1 _ Triple Glazed	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - This assembly includes triple glazed argon filled glass as the glazing component. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system.
		5.2.2 Exterior Wall _ Curtain Wall _ GL2 _ Double Glazed	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - This assembly includes double glazed low-E argon filled glass as the glazing component. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system.
	5.3 Steel Stud		
		5.3.1 Exterior Wall _ Steel Stud _ Curtainwall Head at Soffit _ Detail 2-A657	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The specified assembly incorporates HSS support framing. To model this the steel studs were selected to be load bearing, heavy gauge steel studs. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.3.2 Exterior Wall _ Steel Stud _ EW1 _ GFRC Clad Wall	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The IE provides an option for low-E argon filled glazing however the specified product is only argon filled. Because of this standard glazing was selected for the model. - The specified cladding is a fiber reinforced concrete panel which is not a material in the IE database. Fibre cement siding was selected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.3.3 Exterior Wall _ Steel Stud _ EW7 _ Louvered Wall	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The specified cladding is prefinished aluminum louvers which is not a material in the IE database. A commercial grade steel cladding was selected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.3.4 Exterior Wall _ Steel Stud _ EW8 _ EIFS	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The specified assembly incorporates HSS support framing. To model this the steel studs were selected to be load bearing, heavy gauge steel studs. - The specified drainage track is a corrugated plastic sheet which is not a material in the IE database. A polyethylene vapor barrier was selected as a surrogate as it contains similar material properties. - The specified transition membrane is a spray applied rubber which is not a material in the IE database. An EPDM rubber sheet membrane was elected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.3.5 Exterior Wall _ Steel Stud _ EW9 _ Aluminum Cladding	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The specified cladding is prefinished aluminum panel which is not a material in the IE database. A commercial grade steel cladding was selected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.3.6 Exterior Wall _ Steel Stud _ RW _ Standing Seam Zinc Roof Wall	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height - The Pre-Engineered metal roof system is more appropriate assembly for the roof wall structure however it does not allow openings to be added. Since there are a large quantity of windows in the roof wall steel studs were chosen as the base of the assembly model. - The IE provides an option for low-E argon filled glazing however the specified product is only argon filled. Because of this standard glazing was selected for the model. - The specified cladding is standing seam Zinc which is not a material in the IE database. A commercial steel cladding was determined to be the most suitable option as a surrogate. - The specified exterior sheathing consists of a type X fiberglass faced water resistant gypsum board which is not a material in the IE database. Type X gypsum was selected as a surrogate as it contains similar material properties. - A steel roof system was chosen to model the corrugated metal deck component of this assembly. - An insulation thickness was not specified and so 92mm was assumed to match the specified deck depth.
		5.3.7 Parapet _ Steel Stud _ EW1 _ GFRC Clad Wall _ Detail 3-A657	- The specified cladding is a fiber reinforced concrete panel which is not a material in the IE database. Fibre cement siding was selected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.3.8 Parapet _ Steel Stud _ EW1 _ GFRC Clad Wall _ Detail 4-A655	- The specified assembly incorporates HSS support framing. To model this the steel studs were selected to be load bearing, heavy gauge steel studs. - The specified cladding is a fiber reinforced concrete panel which is not a material in the IE database. Fibre cement siding was selected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
		5.3.9 Parapet _ Steel Stud _ EW7 _ Louvered Wall _ Detail 6-A654/3-A653/5-A659	- The specified assembly incorporates HSS support framing. To model this the steel studs were selected to be load bearing, heavy gauge steel studs. - The specified cladding is prefinished aluminum louvers which is not a material in the IE database. A commercial grade steel cladding was selected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.3.10 Parapet _ Steel Stud _ EW9 _ Aluminum Cladding _ Detail 5-A659 sim	- The specified assembly incorporates HSS support framing. To model this the steel studs were selected to be load bearing, heavy gauge steel studs. - The specified cladding is prefinished aluminum panel which is not a material in the IE database. A commercial grade steel cladding was selected as a surrogate as it contains similar material properties. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
	5.4 Cast In Place/ Curtain Wall		
		5.4.1 Parapet _ Cast In Place/Curtain Wall _ 200w _ 30MPa _ G1 _ Detail 2-A656	- Reinforcement was assumed to be 15M, the lightest available choice, as concrete parapets are non structural elements. - This assembly includes triple glazed argon filled glass as the glazing component. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.4.2 Parapet _ Cast In Place/Curtain Wall _ G1 _ Triple Glazed _ 200w _ 30MPa _ Detail 4-A653	- Reinforcement was assumed to be 15M, the lightest available choice, as concrete parapets are non structural elements. - This assembly includes triple glazed argon filled glass as the glazing component. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.4.3 Parapet _ Cast In Place/Curtain Wall _ G2 _ Double Glazed _ 200w _ 30MPa _ Detail 2-A656 sim	- Reinforcement was assumed to be 15M, the lightest available choice, as concrete parapets are non structural elements. - This assembly includes double glazed low-E argon filled glass as the glazing component. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.4.4 Parapet _ Cast In Place/Curtain Wall _ G2 _ Double Glazed _ 200w _ 30MPa _ Detail 6-A662	- Reinforcement was assumed to be 15M, the lightest available choice, as concrete parapets are non structural elements. - This assembly includes double glazed low-E argon filled glass as the glazing component. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
	5.5 Cast In Place/Steel Stud		
		5.5.1 Exterior Wall _ Cast In Place/Steel Stud _ EW2 _ Below Grade Wall _ 250w _ 30MPa	- Since there are various heights of this wall assembly the total area was calculated and divided by the total length to determine the weighted average of height. - The specified wall thickness is 250mm which was rounded up to the nearest allowable input of 300mm in the IE. Note that concrete volume equalization by modification of the wall length was not conducted as it would alter the square foot area and finishes associated with it. - The specified steel stud thickness is 41mm which is not an available input in the IE so the value was rounded to 92mm, the nearest available input dimension. - Protection board was modeled for the full height of the wall instead of the specified 0.9m due to limitations of the IE. The minimum IE input of 25.381mm was used instead of the specified 25mm. - The specified drainage mat is a high density polyethylene (HDPE) panel which is not a material in the IE database. A 6mil polyethylene vapour barrier was used as a surrogate due to the similar material properties. - The specified waterproofing is a torch on sheet membrane composed of a polyester reinforced SBS. A standard 2-ply SBS membrane was used as a surrogate due to similar material properties.
		5.5.2 Exterior Wall _ Cast In Place/Steel Stud _ EW10 _ Exterior Exposed Concrete _ 250w _ 30MPa	- The specified wall thickness is 250mm which was rounded up to the nearest allowable input of 300mm in the IE. Note that concrete volume equalization by modification of the wall length was not conducted as it would alter the square foot area and finishes associated with it.
		5.5.3 Exterior Wall _ Cast In Place/Steel Stud _ Concrete Upstand _ 200w _ 30MPa _ Detail 3-A657	- Reinforcement was assumed to be 15M, the lightest available choice, as concrete parapets are non structural elements. - The specified steel stud thickness is 41mm which is not an available input in the IE so the value was rounded to 92mm, the nearest available input dimension.
	5.6 Curtain Wall/Steel Stud		
		5.6.1 Parapet _ Curtain Wall/Steel Stud _ G1 _ Triple Glazed _ Detail 5-A655/2-A662	- This assembly includes triple glazed argon filled glass as the glazing component. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system. - The specified assembly incorporates HSS support framing. To model this the steel studs were selected to be load bearing, heavy gauge steel studs. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.
		5.6.2 Parapet _ Curtain Wall/Steel Stud _ G1 _ Triple Glazed _ Detail 6-A652	- This assembly includes triple glazed argon filled glass as the glazing component. The IE is unable to model this configuration of glazing and utilizes a standard double glazed system. - The specified assembly incorporates HSS support framing. To model this the steel studs were selected to be load bearing, heavy gauge steel studs. - The specified exterior sheathing consists of a fiberglass faced water resistant gypsum board which is not a material in the IE database. Moisture resistant gypsum was selected as a surrogate as it contains similar material properties.

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
6.0 Roofs and Soffits	- The predefines assembly entitled "Modified Bitumen Membrane Roofing System" in the IE was used for the majority of the roofing systems. To determine the materials included in this assembly an isolated system was created and bill of materials generated. As a result it was determined the pre defined system includes SBS membrane, protection board, insulation, and sheathing. Furthermore, it was noted that the insulation quantity is the only one which varied with the input thickness and so the roof insulation thickness was used as the governing thickness for the roof assembly. - The specified concrete uses Limestone to reduce a minimum of %35 of the cement within the mix design. Because of this cement reduction, the concrete flyash was modelled to be %35 for all		
	6.1 Composite Metal		
		6.1.1 Roof _ Composite Metal _ R1 _ Exposed Membrane Roof _ Roof Level	- The specified concrete strength is 25MPa which was rounded up to 30MPa, the nearest allowable input in the IE. - The specified live load is 1.4kPa which was rounded up to 2.4kPa, the nearest allowable input in the IE.
		6.1.2 Roof _ Composite Metal _ R8 _ Play Area _ Level 4	- The measured bay size of 12.39m could not be input into the IE due to its size limitations. The maximum bay size of 12.10m was entered and the span was adjusted to maintain the same total roof area using the following equation; Span = (Roof Area / (Bay Size * Number of Bays)) / Number of Spans - The specified concrete strength is 25MPa which was rounded up to 30MPa, the nearest allowable input in the IE. - The specified roofing system includes a "Play Surface" which was omitted due to the absence of an appropriate surrogate.
	6.2 Concrete Suspended Slab		
		6.2.1 Roof _ Concrete Suspended Slab _ R2 _ Exposed Membrane _ Level 5	- Since the roof area was irregular with no defined width the measured area was divided by the average span to determine the input width. - The specified concrete strength is 25MPa which was rounded to 30MPa, the nearest allowable input in the IE. - This assembly does not contain exterior sheathing however it can not be removed from the pre-defined IE roofing assembly and was therefore included in the model.
		6.2.2 Roof _ Concrete Suspended Slab _ R4 _ Crop Area _ Level 4	- Since the roof area was irregular with no defined width the measured area was divided by the average span to determine the input width. - The specified concrete strength is 25MPa which was rounded to 30MPa, the nearest allowable input in the IE. - This assembly does not contain protection board it can not be removed from the pre-defined IE roofing assembly and was therefore included in the model. - The specified roofing system includes a "Planting Buildup" and "Leak Detection System" which were omitted due to the absence of an appropriate surrogate.
		6.2.3 Roof _ Concrete Suspended Slab _ R5 _ Pavers on Concrete _ Level 4	- Since the roof area was irregular with no defined width the measured area was divided by the average span to determine the input width. - The specified concrete strength is 25MPa which was rounded to 30MPa the nearest allowable input in the IE. - This assembly does not contain exterior sheathing however it can not be removed from the pre-defined IE roofing assembly and was therefore included in the model.
		6.2.4 Roof _ Concrete Suspended Slab _ R7 _ Landscape on Concrete _ Level 1	- Since the roof area was irregular with no defined width the measured area was divided by the average span to determine the input width. - The specified concrete strength is 25MPa which was rounded to 30MPa, the nearest allowable input in the IE. - The specified drainage board is a high density polyethylene (HDPE) panel which is not a material in the IE database. A polyethylene vapour barrier was used as a surrogate due to the similar material properties. - The specified roofing system includes a "Planting Buildup" and "Leak Detection System" which were omitted due to the absence of an appropriate surrogate.
		6.2.5 Roof _ Concrete Suspended Slab _ R10 _ Pavers on Concrete _ Level 1	- Since the roof area was irregular with no defined width the measured area was divided by the average span to determine the input width. - The specified concrete strength is 25MPa which was rounded to 30MPa the nearest allowable input in the IE. - The specified drainage board is a high density polyethylene (HDPE) panel which is not a material in the IE database. A polyethylene vapour barrier was used as a surrogate due to the similar material properties. - The specified roofing system includes a "Leak Detection System" which was omitted due to the absence of an appropriate surrogate.
	6.3 Light Frame Wood Truss		
		6.3.1 Roof _ Light Frame Wood Truss _ R6 _ Cross Laminated Timber Panel _ Level 5	- The measured span of 22m could not be input into the IE due to its size limitations. The maximum span size of 14.64m was entered and the roof width was adjusted to maintain the same total roof area using the following formula; Roof Width = Total Area / Span. - The specified structural base of this roofing assembly is cross laminated timber (CLT) which is not in the IE database. Plywood was determined to be the closest available surrogate. - The specified live load is 0.5kPa which was rounded up to 2.4kPa, the nearest allowable input in the IE. - This assembly does not contain exterior sheathing however it can not be removed from the pre-defined IE roofing assembly and was therefore included in the model.
	6.4 Pre-Engineered Metal Roof System		
		6.4.1 Roof _ Pre-Engineered Metal Roof System _ R1 _ Exposed Membrane _ Roof Level	- Since the assembly has no concrete it was not modeled as a composite deck but rather a pre-engineered metal deck. Because of which, the beam and column support structure has been included in the beams and columns section under the input "2.3.2 Columns and Beams _ Steel _ Level 5 _ Mechanical Room" - Since the roof area was irregular with no defined length or width, the square root of the total area was used to determine the length and width inputs. - The specified live load is 1.82kPa which was rounded up to 2.4kPa, the nearest allowable input in the IE.
		6.4.2 Roof _ Pre-Engineered Metal Roof System _ R3 _ Exposed Membrane _ Acoustic Insulation _ Level 4	- Since the assembly has no concrete it was not modeled as a composite deck but rather a pre-engineered metal deck. Because of which, the beam and column support structure has been included in the beams and columns section under the input "2.3.1 Columns and Beams_ Steel _Level 2 - 4 _ Great Hall" - Since the roof area was irregular with no defined length or width, the square root of the total area was used to determine the length and width inputs. - The specified live load is 1.0kPa which was rounded up to 2.4kPa, the nearest allowable input in the IE. - Insulation thickness was not provided so 92mm was assumed to match the depth of the deck corrugations.

Assembly Group	Assembly Type	Assembly Name	Specific Assumptions
		6.4.3 Roof _ Pre-Engineered Metal Roof System _ R3 _ Exposed Membrane _ Acoustic Insulation _ Level 5	- Since the assembly has no concrete it was not modeled as a composite deck but rather a pre-engineered metal deck. Because of which, the beam and column support structure has been included in the beams and columns section under the input "2.2.7 Columns and Beams _ Glulam _ Level 5 _ Roof Wall" - Since the roof area was irregular with no defined length or width, the square root of the total area was used to determine the length and width inputs. - The specified live load is 1.82kPa which was rounded up to 2.4kPa the nearest allowable input in the IE. - Insulation thickness was not provided so 92mm was assumed to match the depth of the deck corrugations.
		6.4.4 Roof _ Pre-Engineered Metal Roof System _ RW2 _ Standing Seam Zinc Roof Wall _ Acoustical Insulation _ Level 5	- Since the assembly has no concrete it was not modeled as a composite deck but rather a pre-engineered metal deck. Because of which, the beam and column support structure has been included in the beams and columns section under the input "2.2.7 Columns and Beams _ Glulam _ Level 5 _ Roof Wall" - Since the roof area was irregular with no defined length or width, the square root of the total area was used to determine the length and width inputs. - The specified live load is 1.82kPa which was rounded up to 2.4kPa, the nearest allowable input in the IE. - The specified cladding is standing seam Zinc which is not a material in the IE database. A commercial steel cladding was determined to be the most suitable surrogate. - The specified drainage plane is an entangles nylon fibre mat which is not a material in the IE database. A conventional drainage plane (air barrier) was determined to be the most suitable surrogate. - Insulation thickness was not provided so 92mm was assumed to match the depth of the deck corrugations.
	6.5 Steel Stud		
		6.4.5 Soffit _ Steel Stud _ ES1/ES2 _ GFRC Clad Wall Level 1	- The soffits were included with the roofing assemblies as they are horizontal envelope components. Since the soffit super structure (concrete suspended slab and composite metal deck) is included in the flooring assemblies the soffits were modeled as a steel stud wall serving as a surrogate for the galvanized steel suspension system and z-girts. - Since the soffit area was irregular with no defined length or width, the square root of the total area was used to determine the length and width inputs. - The specified cladding is a fiber reinforced concrete panel which is not a material in the IE database. Fibre cement siding was selected as a surrogate due to similar material properties. - Spray fireproofing is not a material available in the IE database. Fire rated gypsum board was selected as a surrogate.

Appendix C – Bill of Materials

		Assembly Group						
Construction Material	**Units**	**Foundation**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
#15 Organic Felt	m2	-	-	-	-	9,841.40	37,437.39	47,278.79
1/2" Fire-Rated Type X Gypsum Board	m2	-	-	-	1,191.36	-	-	1,191.36
1/2" Moisture Resistant Gypsum Board	m2	-	-	-	-	4,946.01	5,590.30	10,536.31
24 Ga. Steel Roof (Commercial)	m2	-	-	-	-	2,273.92	-	2,273.92
5/8" Fire-Rated Type X Gypsum Board	m2	-	-	-	36,443.51	1,077.12	5,224.77	**42,745.40**
5/8" Moisture Resistant Gypsum Board	m2	-	-	-	2,197.76	-	-	2,197.76
5/8" Regular Gypsum Board	m2	-	-	-	11,372.32	4,222.58	-	15,594.90
6 mil Polyethylene	m2	5,982.91	-	-	114.33	7,481.94	8,944.24	22,523.42
Air Barrier	m2	-	-	-	-	4,061.01	714.90	4,775.91
Aluminum	Tonnes	-	-	-	82.19	82.82	-	165.01
Ballast (aggregate stone)	kg	-	-	-	-	-	325,458.00	**325,458.00**
Batt. Fiberglass	m2 (25mm)	-	-	-	41,470.79	5,686.70	4,876.11	52,033.60
Batt. Rockwool	m2 (25mm)	-	-	-	5,542.03	29,798.92	3,591.30	38,932.24
Cold Rolled Sheet	Tonnes	-	-	-	-	-	1.40	1.40
Commercial(26 ga.) Steel Cladding	m2	-	-	-	-	7,590.21	1,110.78	8,701.00
Concrete 30 MPa (flyash 35%)	m3	4,324.92	-	5,021.50	1,233.70	444.89	958.98	**11,983.99**
Concrete 30 MPa (flyash av)	m3	-	730.95	-	-	-	-	730.95
Concrete 60 MPa (flyash av)	m3	-	-	-	736.13	100.92	-	837.05
Concrete Blocks	Blocks	-	-	-	15,237.51	-	-	15,237.51
Concrete Brick	m2	-	-	-	-	-	1,883.76	1,883.76
EPDM membrane (black, 60 mil)	kg	-	-	-	5,435.93	6,897.69	-	12,333.61
Expanded Polystyrene	m2 (25mm)	-	-	-	-	1,666.12	-	1,666.12
Extruded Polystyrene	m2 (25mm)	5,865.59	-	-	-	4,781.16	7,614.52	18,261.27
Fiber Cement	m2	-	-	-	-	2,395.62	2,334.69	4,730.31
Foil Facer	m2	-	-	-	-	762.32	-	762.32
Galvanized Decking	Tonnes	-	-	23.58	-	-	3.67	27.24

		Assembly Group						
Construction Material	**Units**	**Foundation**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
Galvanized Sheet	Tonnes	-	-	-	17.40	3.56	19.85	40.81
Galvanized Studs	Tonnes	-	-	-	58.73	23.38	6.64	88.75
Glass Facer	m2	-	-	-	-	-	10,672.39	10,672.39
Glazing Panel	Tonnes	-	-	-	38.19	171.58	-	209.77
GluLam Sections	m3	-	32.28	-	-	-	-	32.28
Hollow Structural Steel	Tonnes	-	0.85	-	-	-	-	0.85
Joint Compound	Tonnes	-	-	-	51.10	10.23	5.21	66.54
Modified Bitumen membrane	kg	-	-	-	-	53,744.60	158,469.76	**212,214.36**
Mortar	m3	-	-	-	290.80	-	34.98	325.78
Nails	Tonnes	0.35	-	-	6.42	3.51	3.20	13.49
Paper Tape	Tonnes	-	-	-	0.59	0.12	0.06	0.76
Polyethylene Filter Fabric	Tonnes	-	-	-	-	-	0.21	0.21
Polyiso Foam Board (unfaced)	m2 (25mm)	-	-	-	-	13,213.12	40,071.55	53,284.67
Rebar, Rod, Light Sections	Tonnes	8.61	345.48	286.49	90.71	14.37	53.21	**798.86**
Roofing Asphalt	kg	-	-	-	-	-	47,012.08	47,012.08
Screws Nuts & Bolts	Tonnes	-	1.26	1.47	2.48	2.48	1.09	8.78
Small Dimension Softwood Lumber, kiln-dried	m3	-	-	-	18.50	-	53.62	72.13
Softwood Plywood	m2 (9mm)	-	-	-	378.12	-	3,187.85	3,565.97
Solvent Based Alkyd Paint	L	-	-	-	82.83	705.80	525.30	1,313.93
Standard Glazing	m2	-	-	-	5,389.49	2,801.07	-	8,190.55
Stucco over metal mesh	m2	-	-	-		713.91	-	713.91
Water Based Latex Paint	L	-	-	-	39,301.21	11,172.06	3,359.80	53,833.07
Welded Wire Mesh / Ladder Wire	Tonnes	5.26	-	-	-	-	-	5.26
Wide Flange Sections	Tonnes	-	25.43	114.82	-	-	25.39	165.64

Appendix D - Impact Category Tables

			Assembly Group						
Life Cycle Stage	**Process**	**Acidification Potential**	**Foundations**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
Manufacturing	Material	moles of H+ eq	3.35E+05	1.46E+05	4.71E+05	5.02E+05	5.93E+05	2.27E+05	2.27E+06
	Transportation	moles of H+ eq	1.95E+04	4.71E+03	2.49E+04	1.58E+04	5.62E+03	7.31E+03	7.78E+04
	Total	moles of H+ eq	**3.55E+05**	**1.51E+05**	**4.96E+05**	**5.17E+05**	**5.98E+05**	**2.34E+05**	**2.35E+06**
Construction	Site Preparation	moles of H+ eq							
	Material	moles of H+ eq	1.18E+04	1.78E+03	3.03E+04	1.82E+04	4.90E+03	7.31E+03	7.43E+04
	Transportation	moles of H+ eq	1.69E+04	3.96E+03	2.27E+04	1.66E+04	1.04E+04	1.20E+04	8.26E+04
	Total	moles of H+ eq	**2.87E+04**	**5.74E+03**	**5.31E+04**	**3.47E+04**	**1.53E+04**	**1.93E+04**	**1.57E+05**
Maintenance	Material	moles of H+ eq	0.00E+00	0.00E+00	0.00E+00	3.41E+05	3.44E+05	6.80E+04	7.53E+05
	Transportation	moles of H+ eq	0.00E+00	0.00E+00	0.00E+00	5.48E+03	7.67E+03	1.95E+03	1.51E+04
	Total	moles of H+ eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**3.46E+05**	**3.52E+05**	**6.99E+04**	**7.68E+05**
End-of-Life	Material	moles of H+ eq	3.98E+03	8.68E+02	4.89E+03	2.03E+03	5.43E+02	1.04E+03	1.33E+04
	Transportation	moles of H+ eq	8.22E+03	1.69E+03	9.82E+03	5.75E+03	1.84E+03	3.42E+03	3.07E+04
	Total	moles of H+ eq	**1.22E+04**	**2.56E+03**	**1.47E+04**	**7.78E+03**	**2.38E+03**	**4.46E+03**	**4.41E+04**
Operating Energy	Annual	moles of H+ eq	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.45E+04
	Total	moles of H+ eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**3.72E+06**
		Total	**3.96E+05**	**1.59E+05**	**5.64E+05**	**9.06E+05**	**9.68E+05**	**3.28E+05**	**7.04E+06**

			Assembly Group						
Life Cycle Stage	**Process**	**Eutrophication Potential**	**Foundations**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
Manufacturing	Material	kg N eq	2.45E+02	5.56E+02	8.27E+02	4.88E+02	3.59E+02	2.67E+02	2.74E+03
	Transportation	kg N eq	2.13E+01	5.14E+00	2.72E+01	1.72E+01	6.13E+00	7.99E+00	8.50E+01
	Total	kg N eq	**2.66E+02**	**5.61E+02**	**8.54E+02**	**5.06E+02**	**3.65E+02**	**2.75E+02**	**2.83E+03**
Construction	Site Preparation	kg N eq							
	Material	kg N eq	9.09E+00	1.07E+00	3.04E+01	1.73E+01	4.67E+00	6.98E+00	6.95E+01
	Transportation	kg N eq	1.84E+01	4.31E+00	2.48E+01	1.80E+01	1.13E+01	1.30E+01	8.99E+01
	Total	kg N eq	**2.75E+01**	**5.38E+00**	**5.51E+01**	**3.53E+01**	**1.60E+01**	**2.00E+01**	**1.59E+02**
Maintenance	Material	kg N eq	0.00E+00	0.00E+00	0.00E+00	9.81E+01	1.94E+02	2.61E+01	3.18E+02
	Transportation	kg N eq	0.00E+00	0.00E+00	0.00E+00	5.96E+00	8.36E+00	2.12E+00	1.64E+01
	Total	kg N eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**1.04E+02**	**2.02E+02**	**2.83E+01**	**3.35E+02**
End-of-Life	Material	kg N eq	3.98E+00	8.70E-01	4.90E+00	2.03E+00	5.45E-01	1.04E+00	1.34E+01
	Transportation	kg N eq	7.76E+00	1.60E+00	9.28E+00	5.43E+00	1.74E+00	3.23E+00	2.90E+01
	Total	kg N eq	**1.17E+01**	**2.47E+00**	**1.42E+01**	**7.47E+00**	**2.28E+00**	**4.28E+00**	**4.24E+01**
Operating Energy	Annual	kg N eq	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.62E+00
	Total	kg N eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**4.81E+02**
		Total	**3.05E+02**	**5.69E+02**	**9.24E+02**	**6.53E+02**	**5.86E+02**	**3.27E+02**	**3.84E+03**

			Assembly Group						
Life Cycle Stage	**Process**	**Fossil Fuel Consumption**	**Foundations**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
Manufacturing	Material	MJ	6.45E+06	7.20E+06	1.38E+07	1.19E+07	1.08E+07	1.35E+07	6.36E+07
	Transportation	MJ	8.84E+05	1.97E+05	1.12E+06	7.04E+05	2.52E+05	3.31E+05	3.49E+06
	Total	MJ	**7.33E+06**	**7.40E+06**	**1.49E+07**	**1.26E+07**	**1.10E+07**	**1.38E+07**	**6.71E+07**
Construction	Site Preparation	MJ							
	Material	MJ	3.42E+05	2.22E+05	1.05E+06	4.75E+05	1.28E+05	2.23E+05	2.44E+06
	Transportation	MJ	7.17E+05	1.71E+05	9.82E+05	7.12E+05	4.51E+05	5.16E+05	3.55E+06
	Total	MJ	**1.06E+06**	**3.94E+05**	**2.03E+06**	**1.19E+06**	**5.79E+05**	**7.39E+05**	**5.99E+06**
Maintenance	Material	MJ	0.00E+00	0.00E+00	0.00E+00	5.20E+06	8.13E+06	6.44E+06	1.98E+07
	Transportation	MJ	0.00E+00	0.00E+00	0.00E+00	2.32E+05	3.36E+05	8.38E+04	6.53E+05
	Total	MJ	**0.00E+00**	**0.00E+00**	**0.00E+00**	**5.44E+06**	**8.47E+06**	**6.52E+06**	**2.04E+07**
End-of-Life	Material	MJ	1.10E+06	2.40E+05	1.35E+06	5.62E+05	1.50E+05	2.88E+05	3.69E+06
	Transportation	MJ	3.48E+05	7.18E+04	4.16E+05	2.44E+05	7.78E+04	1.45E+05	1.30E+06
	Total	MJ	**1.45E+06**	**3.12E+05**	**1.77E+06**	**8.05E+05**	**2.28E+05**	**4.33E+05**	**4.99E+06**
Operating Energy	Annual	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.15E+06
	Total	MJ	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**1.58E+08**
		Total	**9.84E+06**	**8.10E+06**	**1.87E+07**	**2.01E+07**	**2.03E+07**	**2.15E+07**	**2.56E+08**

			Assembly Group						
Life Cycle Stage	**Process**	**Global Warming Potential**	**Foundations**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
Manufacturing	Material	kg CO2 eq	9.91E+05	4.30E+05	1.41E+06	1.20E+06	1.01E+06	6.78E+05	5.72E+06
	Transportation	kg CO2 eq	3.88E+04	1.30E+04	5.22E+04	3.74E+04	1.33E+04	1.68E+04	1.71E+05
	Total	kg CO2 eq	**1.03E+06**	**4.43E+05**	**1.46E+06**	**1.24E+06**	**1.02E+06**	**6.95E+05**	**5.89E+06**
Construction	Site Preparation	kg CO2 eq							
	Material	kg CO2 eq	2.31E+04	1.63E+04	7.09E+04	3.45E+04	9.29E+03	1.62E+04	1.70E+05
	Transportation	kg CO2 eq	5.48E+04	1.16E+04	6.72E+04	5.01E+04	3.04E+04	3.58E+04	2.50E+05
	Total	kg CO2 eq	**7.79E+04**	**2.79E+04**	**1.38E+05**	**8.46E+04**	**3.97E+04**	**5.20E+04**	**4.20E+05**
Maintenance	Material	kg CO2 eq	0.00E+00	0.00E+00	0.00E+00	4.36E+05	5.98E+05	1.40E+05	1.17E+06
	Transportation	kg CO2 eq	0.00E+00	0.00E+00	0.00E+00	1.72E+04	2.05E+04	5.96E+03	4.37E+04
	Total	kg CO2 eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**4.53E+05**	**6.19E+05**	**1.46E+05**	**1.22E+06**
End-of-Life	Material	kg CO2 eq	7.39E+04	1.61E+04	9.09E+04	3.77E+04	1.01E+04	1.94E+04	2.48E+05
	Transportation	kg CO2 eq	2.68E+04	5.52E+03	3.20E+04	1.87E+04	5.99E+03	1.11E+04	1.00E+05
	Total	kg CO2 eq	**1.01E+05**	**2.17E+04**	**1.23E+05**	**5.65E+04**	**1.61E+04**	**3.05E+04**	**3.48E+05**
Operating Energy	Annual	kg CO2 eq	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E+05
	Total	kg CO2 eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**9.16E+06**
		Total	**1.21E+06**	**4.92E+05**	**1.72E+06**	**1.84E+06**	**1.69E+06**	**9.23E+05**	**1.70E+07**

			Assembly Group						
Life Cycle Stage	**Process**	**Human Health Respiratory Effects**	**Foundations**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
Manufacturing	Material	kg PM10 eq	4.81E+03	1.22E+03	5.89E+03	9.47E+03	1.57E+04	3.08E+03	4.02E+04
	Transportation	kg PM10 eq	2.56E+01	6.15E+00	3.27E+01	2.07E+01	7.37E+00	9.60E+00	1.02E+02
	Total	kg PM10 eq	**4.84E+03**	**1.23E+03**	**5.92E+03**	**9.49E+03**	**1.57E+04**	**3.09E+03**	**4.03E+04**
Construction	Site Preparation	kg PM10 eq							
	Material	kg PM10 eq	5.44E+00	1.12E+01	2.20E+01	1.11E+01	2.99E+00	5.25E+00	5.79E+01
	Transportation	kg PM10 eq	2.20E+01	5.16E+00	2.96E+01	2.16E+01	1.36E+01	1.56E+01	1.07E+02
	Total	kg PM10 eq	**2.74E+01**	**1.64E+01**	**5.16E+01**	**3.26E+01**	**1.66E+01**	**2.08E+01**	**1.65E+02**
Maintenance	Material	kg PM10 eq	0.00E+00	0.00E+00	0.00E+00	8.85E+03	8.72E+03	1.39E+03	1.90E+04
	Transportation	kg PM10 eq	0.00E+00	0.00E+00	0.00E+00	7.12E+00	1.00E+01	2.54E+00	1.97E+01
	Total	kg PM10 eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**8.86E+03**	**8.73E+03**	**1.40E+03**	**1.90E+04**
End-of-Life	Material	kg PM10 eq	5.33E+01	1.16E+01	6.55E+01	2.72E+01	7.28E+00	1.40E+01	1.79E+02
	Transportation	kg PM10 eq	1.07E+01	2.20E+00	1.28E+01	7.47E+00	2.39E+00	4.44E+00	3.99E+01
	Total	kg PM10 eq	**6.39E+01**	**1.38E+01**	**7.82E+01**	**3.47E+01**	**9.66E+00**	**1.84E+01**	**2.19E+02**
Operating Energy	Annual	kg PM10 eq	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E+02
	Total	kg PM10 eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**1.30E+04**
		Total	**4.93E+03**	**1.26E+03**	**6.05E+03**	**1.84E+04**	**2.45E+04**	**4.53E+03**	**7.26E+04**

			Assembly Group						
Life Cycle Stage	**Process**	**Ozone Depletion Potential**	**Foundations**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
Manufacturing	Material	kg CFC-11 eq	5.78E-03	1.25E-03	6.71E-03	5.18E-03	8.49E-03	6.10E-03	3.35E-02
	Transportation	kg CFC-11 eq	1.61E-06	5.25E-07	2.15E-06	1.53E-06	5.42E-07	6.87E-07	7.04E-06
	Total	kg CFC-11 eq	**5.78E-03**	**1.25E-03**	**6.71E-03**	**5.18E-03**	**8.49E-03**	**6.10E-03**	**3.35E-02**
Construction	Site Preparation	kg CFC-11 eq							
	Material	kg CFC-11 eq	0.00E+00	6.37E-07	2.42E-07	1.26E-09	1.15E-09	4.37E-08	9.24E-07
	Transportation	kg CFC-11 eq	2.18E-06	4.63E-07	2.68E-06	2.00E-06	1.21E-06	1.43E-06	9.97E-06
	Total	kg CFC-11 eq	**2.18E-06**	**1.10E-06**	**2.93E-06**	**2.00E-06**	**1.22E-06**	**1.47E-06**	**1.09E-05**
Maintenance	Material	kg CFC-11 eq	0.00E+00	0.00E+00	0.00E+00	2.02E-03	5.93E-03	4.01E-04	8.35E-03
	Transportation	kg CFC-11 eq	0.00E+00	0.00E+00	0.00E+00	6.86E-07	8.23E-07	2.38E-07	1.75E-06
	Total	kg CFC-11 eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**2.03E-03**	**5.93E-03**	**4.01E-04**	**8.35E-03**
End-of-Life	Material	kg CFC-11 eq	3.23E-06	7.05E-07	3.97E-06	1.65E-06	4.41E-07	8.46E-07	1.08E-05
	Transportation	kg CFC-11 eq	1.07E-06	2.20E-07	1.28E-06	7.47E-07	2.39E-07	4.44E-07	3.99E-06
	Total	kg CFC-11 eq	**4.30E-06**	**9.25E-07**	**5.25E-06**	**2.40E-06**	**6.80E-07**	**1.29E-06**	**1.48E-05**
Operating Energy	Annual	kg CFC-11 eq	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E-07
	Total	kg CFC-11 eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**7.23E-06**
		Total	**5.79E-03**	**1.25E-03**	**6.72E-03**	**7.21E-03**	**1.44E-02**	**6.51E-03**	**4.19E-02**

			Assembly Group						
Life Cycle Stage	**Process**	**Smog Potential**	**Foundations**	**Columns & Beams**	**Floors**	**Interior Walls**	**Exterior Walls**	**Roofs**	**Building Total**
Manufacturing	Material	kg 03 eq	1.20E+05	3.38E+04	1.46E+05	1.09E+05	1.17E+05	4.63E+04	5.71E+05
	Transportation	kg 03 eq	1.10E+04	2.57E+03	1.40E+04	8.75E+03	3.12E+03	4.08E+03	4.35E+04
	Total	kg 03 eq	**1.31E+05**	**3.63E+04**	**1.60E+05**	**1.18E+05**	**1.20E+05**	**5.04E+04**	**6.15E+05**
Construction	Site Preparation	kg 03 eq							
	Material	kg 03 eq	5.32E+03	2.28E+02	1.72E+04	9.86E+03	2.66E+03	3.95E+03	3.92E+04
	Transportation	kg 03 eq	9.00E+03	2.14E+03	1.23E+04	8.90E+03	5.63E+03	6.45E+03	4.44E+04
	Total	kg 03 eq	**1.43E+04**	**2.37E+03**	**2.95E+04**	**1.88E+04**	**8.29E+03**	**1.04E+04**	**8.36E+04**
Maintenance	Material	kg 03 eq	0.00E+00	0.00E+00	0.00E+00	4.04E+04	4.51E+04	6.56E+03	9.21E+04
	Transportation	kg 03 eq	0.00E+00	0.00E+00	0.00E+00	2.93E+03	4.19E+03	1.05E+03	8.17E+03
	Total	kg 03 eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**4.34E+04**	**4.93E+04**	**7.61E+03**	**1.00E+05**
End-of-Life	Material	kg 03 eq	3.86E+02	8.43E+01	4.75E+02	1.97E+02	5.28E+01	1.01E+02	1.30E+03
	Transportation	kg 03 eq	4.37E+03	9.00E+02	5.22E+03	3.06E+03	9.76E+02	1.82E+03	1.63E+04
	Total	kg 03 eq	**4.75E+03**	**9.85E+02**	**5.69E+03**	**3.25E+03**	**1.03E+03**	**1.92E+03**	**1.76E+04**
Operating Energy	Annual	kg 03 eq	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.82E+02
	Total	kg 03 eq	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**4.41E+04**
		Total	**1.50E+05**	**3.97E+04**	**1.95E+05**	**1.83E+05**	**1.79E+05**	**7.03E+04**	**8.60E+05**