Project ID: GFS-1802

A Comparison of Traditional Construction Estimating Practices to BIM-Based Estimating Process for Early Design

Submitted to the Faculty of the Worcester Polytechnic Institute In partial fulfillment of the requirements for the Degree of Bachelor of Science in Civil Engineering by:

Jacob Swaim
Advised by Professor Guillermo F. Salazar

August 21, 2019

Abstract

Designers are using Building Information Modeling (BIM) to model their buildings and to document their designs. BIM promotes better communication and collaboration through 3D digital tools and allows for automated quantification of work. However, the construction industry still uses traditional methods of estimating from 2D drawings. This study compares BIM based estimates with traditional methods used at the early stages of design using information for the WPI Foisie Innovation Studio. BIM-based estimates take less time with similar results to the traditional cost estimating.

Capstone Design Statement

Designers are using Building Information Modeling (BIM) to model their buildings and to document their designs. BIM promotes better communication through 3D digital tools and allows for early collaboration on projects. BIM also allows for automated quantification of work and specification for material quality, since this information, that is necessary, to prepare cost estimates is already contained in the BIM model. By using a BIM models instead of drawings, the takeoffs, counts, and measurements can be generated directly from the model.

The purpose of this study was to analyze the impact that BIM-based estimating has on assisting the design process at the early stages of design by comparing against cost estimates generated by traditional estimating processes. The documentation from the early design stages of the Foisie Innovation Studio was used to prepare these estimates. This project then discussed how incrementing the Level of Development (LOD) in the design model improves the scope definition and the accuracy of the cost estimates. The proposed suggestion considers constraints, including social, economic, and constructability.

Social

The acceleration of the models LOD will require the Design and Construction teams to work collaboratively during the early stages of preconstruction. This environment of collaboration leads to a positive social experience between the teams and a better project outcome.

Economic

The acceleration of the Model's LOD will require the Design and Construction teams to make early design decision that impact cost and maintain budgets. This ultimately leads to more accurate bids, buyout, project estimating limiting variability.

Constructability

The acceleration of the Model's LOD will require the Design and Construction teams to provide constructability comments earlier reducing field delays in non-constructible details.

Professional Licensure Statement

A Professional Engineering License gives an engineer the authority to prepare, sign and seal construction drawings. An engineer's stamp certifies an engineer's professional work and ensures that the design adheres to the standards of care and practices of civil engineering, as well as adhering to federal, state and local government codes.

To obtain a Professional Engineering License, an individual must get a Civil Engineering degree from a university with an accredited engineering academic program and pass the Fundamentals of Engineering exam (FE). The exam includes questions from all disciplines of civil engineering. After passing the FE an engineer becomes an Engineer in Training (EIT). To become a Professional Engineer (PE), an EIT works under the supervision of a Professional Engineer for four years depending on the state and then takes the PE exam. After successfully completing the PE exam, engineers then become a Professional Engineer and can officially stamp drawings hereby becoming responsible for the design.

Acknowledgements

I would like to thank my advisor, Professor Salazar, whose patience with me was invaluable throughout my WPI experiences, will never be forgotten. Additional thanks to Annika Isaac, Tom and Carol Swaim for supporting me through all my endeavors. Without these individuals this project would not be what it is today.

List of Tables and Figures

Table of Contents

1 Introduction

The estimating process has always been an area surrounded by uncertainty for the construction industry. The level of accuracy of cost estimates depends greatly on the level of scope definition in the design. The accuracy also depends on other factors such as variable calculations, design changes, design errors and omissions in design, labor and materials market price variability and other issues. Many clients are skeptical of an estimator forecast, especially if empirical studies show that construction is characterized by uncertainties that are inevitable and difficult predict.

Designers are using Building Information Modeling (BIM) to model their buildings and to document their designs. BIM promotes better communication through 3D digital tools and allows for early collaboration on projects. BIM also allows for automated quantification of work and specification for material quality, since this information, that is necessary, to prepare cost estimates is already contained in the BIM model. By using a BIM models instead of drawings, the takeoffs, counts, and measurements can be generated directly from the model.

The purpose of this study was to analyze the impact that BIM-based estimating has on project estimates at the early stages of design by comparing with cost estimates generated by traditional estimating processes. The documentation from the early design stages of the Foisie Innovation Studio was used to prepare these estimates.

Foisie Innovation Studio (FIS) is located on the main campus of Worcester Polytechnic Institute, between Higgins Laboratories and Harrington Auditorium. Foisie opened its doors in fall 2018, after breaking ground in May 2016. Design started in the fall of 2015. The first and second floors of the 78,000-square-foot residential and classroom facility include a teaching laboratory a makerspace, high-tech classrooms, the Center for Innovation and Entrepreneurship, and a cafe. A three-floor residence hall occupies levels three through six and supports one hundred forty students. The building total installed cost for WPI was around $49 million.

The study created four estimates using different methods and compared the results of each estimate. The first estimate was generated using traditional cost per square foot based on RSMeans online software. The second, also a traditional estimate, was generated using On Screen Take-Off, hereafter referred to as OST and unit cost data from RSMeans online software. The third estimate utilized the BIM model created by Gensler the project's architectural firm and used unit costs from RSMeans. The final estimate was provided by the construction managers for this project, Shawmut Design and Construction (Hereafter referred to as SDC)**.** This was a schematic design estimate based on SDC's quantifications of work and their own cost database. The first three cost estimates were then compared against the SDC for relative differential in cost prediction.

The Cost Estimates for this study are limited to several systems or work packages on the Foisie Innovation Studio and each work package estimate is based on the scope as defined on the available project documentation (2D or 3D). These systems of work include the Structure, Enclosure, Interior Finishes, Mechanical, Electrical and Plumbing (MEP) Systems, Site work, and Construction Management (CM) Cost. The Site work ($1,736,500) million and CM Costs ($10,801,902) are taken from SDC Design and Construction's Allowances built in the estimate.

The total value of Traditional OST estimate equaled $31,915,257.22 The RSMeans total cost estimate was $31,452,192.89. The total cost estimation of the BIM models was $30,104,859.27. The total construction cost from SDC schematic design estimate was $31,484,182.

When the cost of the structure generated by OST was compared against the SDC cost for the structural system, the estimates were separated by $772,497.18. This represents a two percent variance from the total schematic design estimate from SDC. The enclosure cost differed by $310,476.20 favoring the SDC. This represents a one percent variance from the total bid cost from SDC. The total estimates when the excluded systems of work were supplemented by SDC cost estimate varied by two percent.

The RSMeans estimating tool matched the SDC total design cost estimate with a variance of $31,989.11. This is less than one percent below the SDC estimate. The structure estimate from RSMeans was $1,366,603.70 while SDC's estimate was around $3,397,500.00. This represents a variance of six percent. Even with this discrepancy, the total estimates matched showing that conceptual estimates can be used as a reliable tool for estimating but refined estimates are needed to actualize the cost.

The total cost estimation of the BIM models was $30,102,859.27. This estimate shows minimum variances for individual systems of work but lacked the detail needed to provide a comprehensive estimate for all systems.

This study shows that OST can provide specific and detailed quantities based on the needs of estimators and the quality of the 2D drawings but is dependent on the skill of the estimator. RSMeans allows a for accurate conceptual estimates but does not accurately estimate individual scopes of work. Revit allows estimator to keep pace with constant design changes but requires an updated design model to reflect the construction documents.

Given the wide range of variability, typical of early cost estimates, this study showed that BIM based estimating methods produce results that are within 5 percent to the ones that were generated by the construction managers for this project. BIM-based estimates are also close to the ones produced using cost per square foot approaches, which is the method typically used when the design scope is broadly defined.

BIM-based cost estimates take less time than the traditional estimating process used by construction managers but require specific information defined at an LOD of 300 or higher to be effective. Models produced at the early stages of design typically have a lower LOD and do not have the information required to create refined estimates. More time needs to be invested earlier to create models with higher LOD.

2 Backgroun

The purpose of this chapter is to define how a project is designed and delivered and the impact on the cost of the project during different phases of design. The phases of Design and how they impact the cost estimating process as shown by the MacLeamy Curve is included, as well as the different project delivery methods, cost accuracy at different stages of design, and how Building Information Modeling (BIM) effects the process.

2.1 Design and Cost Estimating

Design is the realization of a concept, idea or theory into a drawing, plan, specification, and model that ultimately allows a series of objectives to be achieved or resolved. In terms of construction, design is the process of creating a solution to a problem and then preparing instructions allowing a solution to be constructed. (Strate – School of Design)

Cost estimating is the practice of forecasting the cost of completing a project within a defined scope. It is the primary element of project cost management. Knowledge in this that involves planning, monitoring, and controlling a project's monetary costs. (Smart Sheet) The total cost estimate is used to approve a project's budget and manage its costs. The accuracy of the estimate depends heavily on the level of project scope. As the design and conditions of the project become better defined, so do the estimated cost values.

Building design is a separated into multiple phases: conceptual, schematic, design development, construction documents, and construction. (See figure below for graph of design phases and how much design control is available at each phase) This allows for gradual development of design.

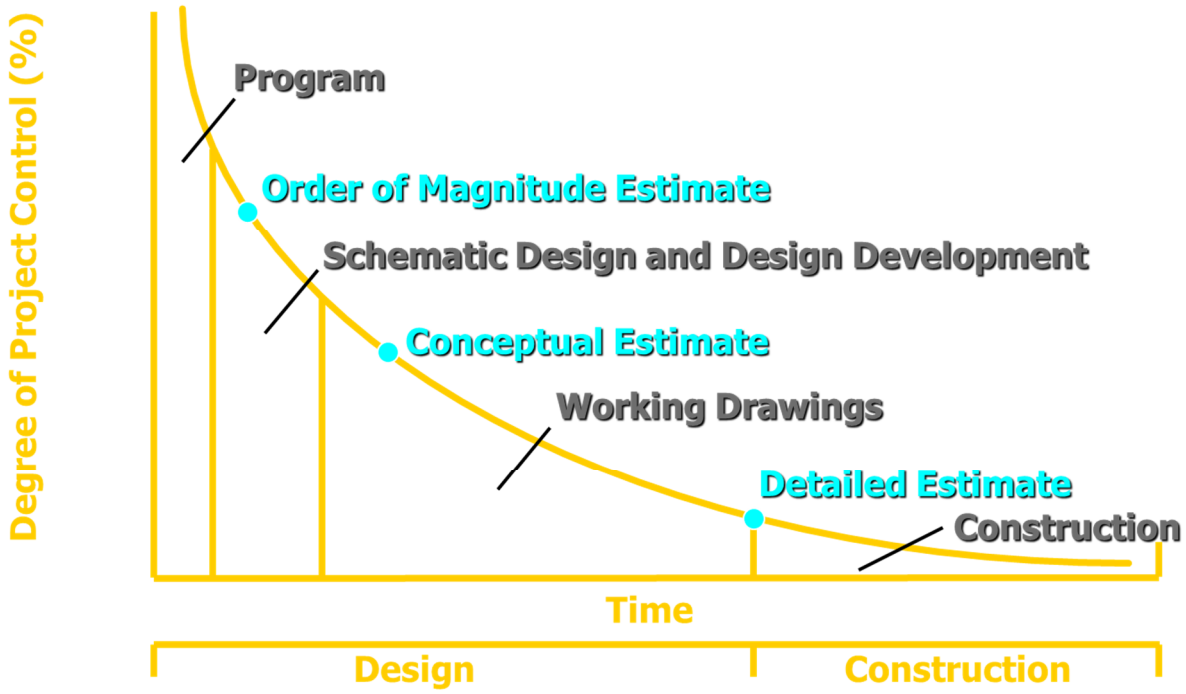


Figure 1: Degree of Project Control at Each Design Phase

Architectural programming is the research and decision-making process that identifies the scope of work to be designed. This is the first phase of design and provides the architect a basis of intent for design.

Conceptual Design is an early phase of the design process. Broad outlines of function and form of the building are involved in this phase. Estimates at this phase function as broad guidelines and are not intended for project budgets. They are used to guide the owner and design team to define the project scope and budget. Designs at this phase are malleable and while changes have significant impacts on the cost of the project. Adding square footage or adding additional floors, are low cost adjustments. This encourages the designers to make changes early frequently in the project. This fluctuation adds range of variability to the cost estimating process.

Schematic design translates the project into the first iteration of physical drawings. This most often includes spatial relationships as well as basic. Teams determine the area physical requirements (Total square footage and the total project budget are associated to overall physical dimensions and are accompanied by a schedule). Schematic design includes a general description of building system parameters (structural, mechanical, HVAC, plumbing and electrical), interior and exterior finishes and the building site. Estimates at this phase are the basis of the project budget but still need to be developed along with the design.

The Design Development Phase improves upon the Schematic design phase. The drawings go from general to specific definition of dimensions, type of materials and equipment. The primary purpose is to define and describe all important aspects of the project. All that remains is the formal documentation step of construction contract documents. These formal documents are used by construction managers to make project estimates that predict the total cost of the project. The cost to adjust design at this phase is significantly more expensive than the previous two phases. The goal of this phase is to finalize the design.

The Construction Documents phase the architect and engineers will finalize all the technical drawing and engineering including detailing. Heating and air conditioning and ventilation systems, plumbing, electrical, gas, energy calculations, and all products and materials are selected, included and scheduled. The architect produces multiple drawing sets, including a filing set for approval from the Building Department and a separate set of Construction Drawings for the General Contractor (This includes documents for general conditions). Cost estimates as this phase are refined from the design development phase and locked into contracts that bind subcontractors. Estimates at this phase are complete and do not change.

The Construction phase is the implementation of the design and follows the project budget and estimate. The project is managed to maintain budget and building design intent. Changes to design at this stage increase project cost significantly and required a change in the contract value called changed orders.

2.2 Early Design Decisions and Cost Impact

Given the nature of the design process of constructed facilities, early decisions have a major impact on the ultimate cost. The MacLeamy Curve (Shown below in Figure 2) shows the impact of the Traditional Design process vs Preferred design process along with the Ability to impact cost and cost of design changes curves.

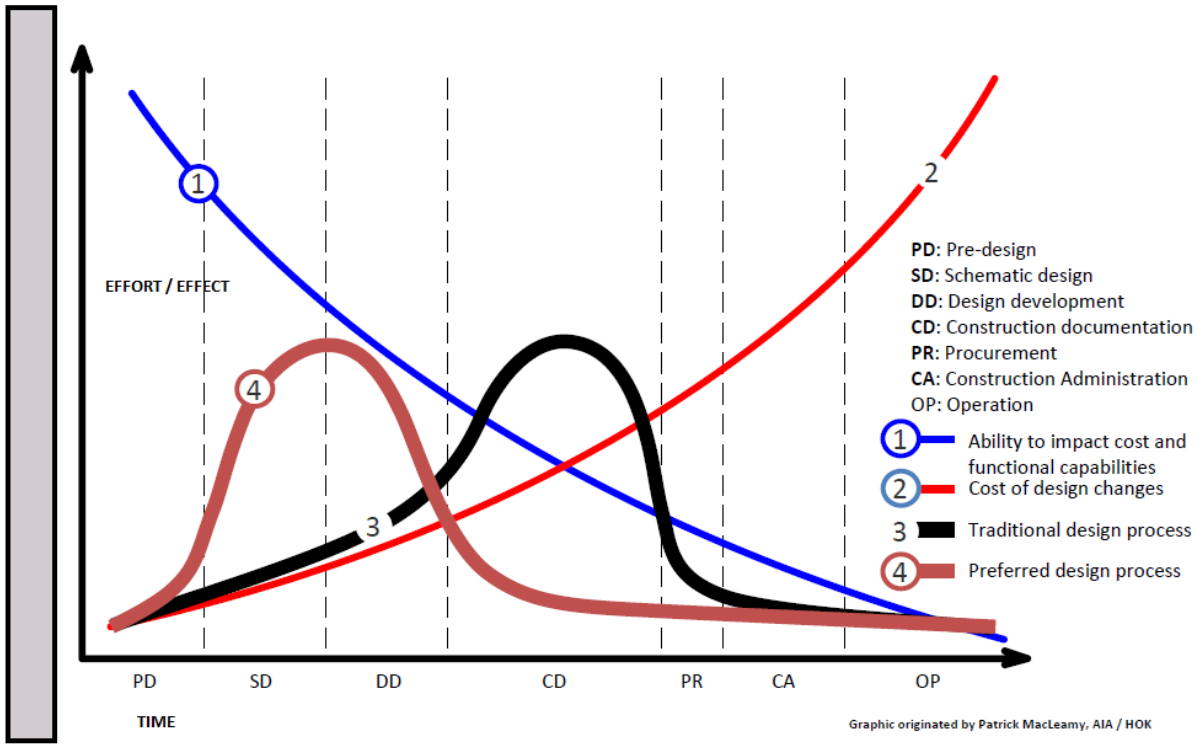


Figure 2: MacLeamy Curve

The ability to impact cost is shown by the red curve. Early in the design stages (shown on the x-axis), the cost to impact design is low and increases exponentially as the design progresses. The inverse is true for the ability to impact cost of design. Early in the design phases, the ability to impact the scope of the project and consequently its final cost is high and decreases exponentially as the design progresses. The traditional design process (Shown in black) shows that design scope changes gradually throughout the early stages up to the point in which Construction Documentation is produced. At that time, builders are invited to present bids for the construction of the project. Once construction bids are accepted any design change will be more costly to implement. On the preferred design process (shown in brown) a Construction Manager comes on board before construction begins and a final construction estimate is produced and includes constructability changes in the design to ensure the project can be built. It is under the Preferred Design Process (Shown in Brown) when implementation of a BIM based design approach produces its greater benefits. It facilitates earlier design decisions and shifts the effort of the design in that direction. This decreases costs to change in design and provides better designs earlier in the design stages. This in turns helps the estimating process get more accurate estimates.

2.3 Project Delivery Methods and Cost Estimating

Project delivery for construction is the means by which a building, a bridge or any type of project is designed, constructed, and delivered to an owner. The method by which a project is delivered is an important consideration prior to beginning a project, as it has a significant impact on cost, risk and the overall schedule.

Projects are delivered in the way the owner chooses. To limit the number of project delivery methods to the three most common methods, the Associated General Contractors of America (Hereby referred to as AGC) defines three project delivery styles. They are Design-Bid-Build (Traditional), CM-At-Risk, and Design-Build. The AGC goes on to acknowledge the existence of other project delivery methods but relegates them to the category of "hybrids" which are some combination of the three primary project delivery methods as shown in figure 3 below.

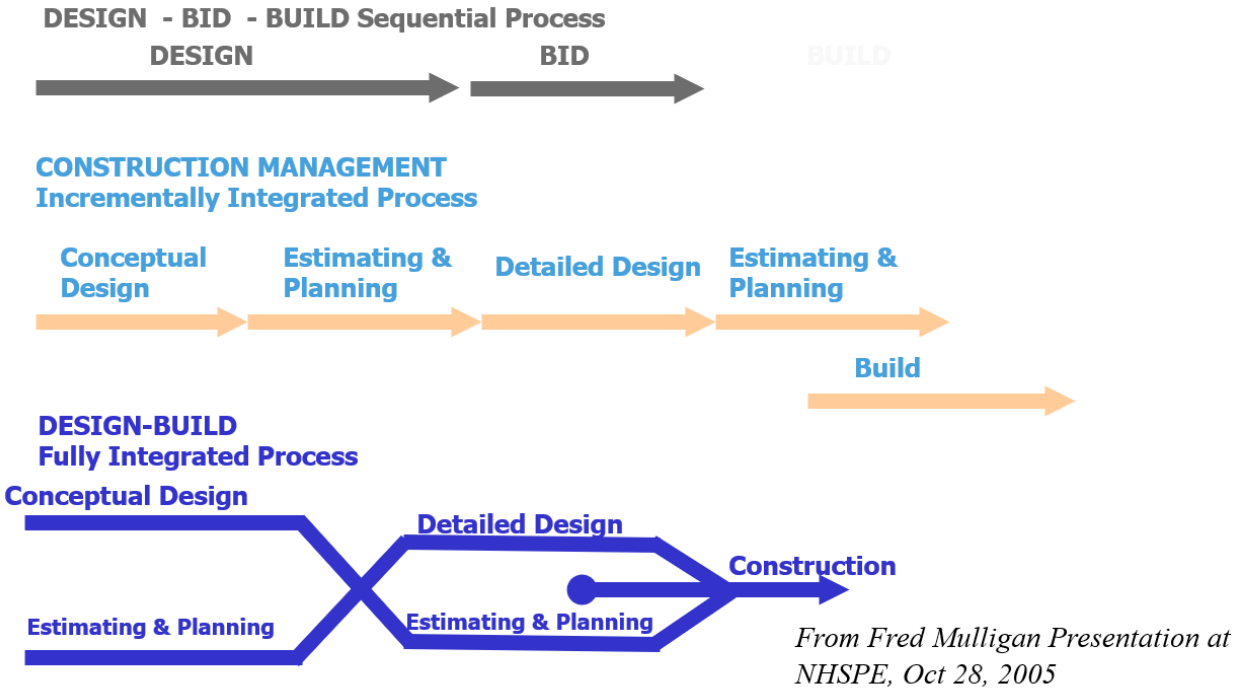


Figure 3: Design and Cost Estimating Sequence

Design-Bid-Build also known as hard bid or the low bid method is considered the traditional project delivery method for design and construction. In this project delivery method, the design precedes the construction and the contract provides either a lump sum or unit price bid to obtain the work. Typically, the lowest responsible and responsive bidder wins the contract and performs the construction. The quality, price, and completion date of the contract are all established by the contract requirements and there is little to no ability to impact design once the contract is signed. As seen on the MacLeamy Curve, as the design is moved further along in the design stages, the cost to change the design increases, making any design changes in this form of project delivery expensive the ability to impact the cost is difficult. In summary, this system requires a completed design before the project is sent to the potential builders and any changes to the design once construction begins will have larger cost impacts.

Construction-Management-at-Risk (CMAR) has some characteristics similar to the design-bid-build method in that the owner contracts separately with both a designer and a construction manager with pre-construction services. The construction manager is brought into the design process early to provide input into the design and provides cost estimating services throughout the design. During the construction phase the construction manager will assist the owner in finding and managing the activities of the subcontractors brought in to perform the work. The construction manager can assist in creating cost effective designs and limiting the scope of work to fit the owners budget. Involving the construction manager and designers early allows for a project to be more efficient and gives the estimators more involvement in the project design. This early access makes the project estimates more accurate.

Design-Build (DB) method is where the owner contracts with a single entity (typically a combined design and construction firm or a joint venture) to provide the design and construction services for a project. This method has the advantage that the construction can begin prior to the completion of the design allow for an overlap of the design and construction phases. Because the design-builder is provided integrated services, the owner can take advantage of the contractor's expertise during the design phase of the project and the architect/engineer's expertise during the construction phase. Having the design integrated with the construction managers input allows for the most impact on design for the project at the lowest cost creating better and more accurate estimates.

2.4 Design Scope and Cost Estimating Accuracy

Cost estimating is an essential task for budgeting and bid preparation for any construction project. A good estimate depends on many factors including time given to the estimator, scope/design definition, estimator's experience, and a wide range of assumptions regarding the project (Jrade and Alkass, 2007). Construction cost estimating involves collecting, analyzing, and summarizing all available data for a project.

In traditional cost estimation the estimator divides the project into individual work items and estimates the quantities of materials for each work item based on 2D drawings. This is also known as quantity takeoff. Labor, equipment, and material needed for executing a work item are then determined based on the specification and the construction method.

Project scope definition drives the accuracy of the estimate. As the design includes more definition throughout the phases of design the more accurate the cost estimate will be. At each phase of design there will be a level of uncertainty and where there is uncertainty the owner will apply contingencies. Contingencies are costs to handle unforeseen circumstances, usually based on the type of estimate and design stage (See Figure 4 below).

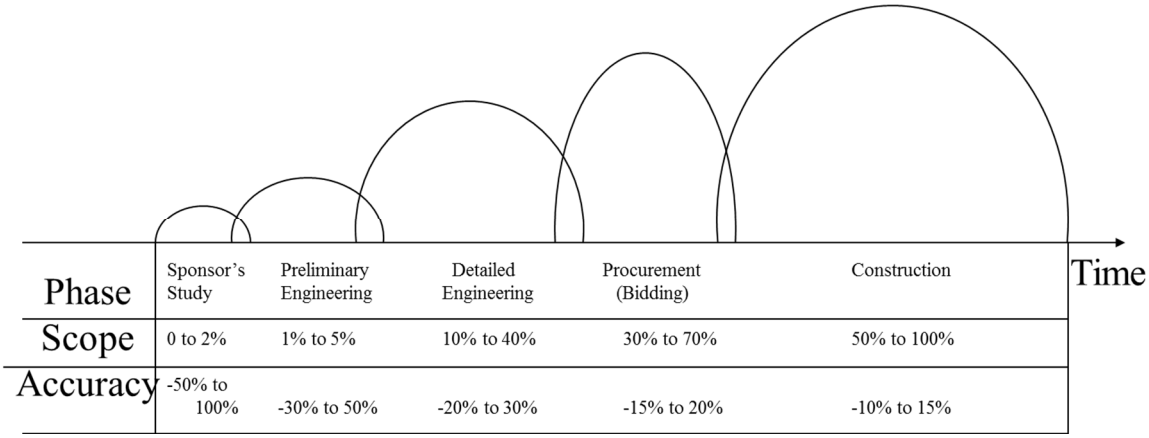


Figure 4: Construction Cost Estimates Accuracy for Stages of Design

2.4.1 RSMeans Cost Data Book

Most Contractors and designers create and maintain their own cost databases that are developed over the course of a firm. However, these are proprietary as they provide a competitive advantage. For this project RSMeans is used for the cost data base. RSMeans is a resource for construction project managers and is used by construction professionals to create budgets, estimate projects and validate their own cost data. RSMeans contains construction costs that are comprised of material, labor and equipment prices and can be referenced at the unit, assembly or square foot level of detail (RSMeans). The data is updated and published annually. This resource has been adopted as the only source of cost information for this project.

RSMeans can generate a Cost Per SF Estimate for any project. By imputing the design constraints such as number of floors, type of structural material, and design intent (such as lab space, dorm, industrial building, etc.) total square footage, and other data, RSMeans will generate a conceptual estimate for the defined parameters.

A Cost per SF cost estimate for the project that included Foundations, Structure, Interiors, Systems (Services), and Equipment. Contractor fees and Architectural Fees were included in this estimate to be compared to the SDC Cost estimate. This functions as the traditional conceptual Estimate.

2.4.2 On-Screen Takeoff Software (OST)

On-Screen Takeoff (OST) is a construction estimating and takeoff solutions for contractors and construction professionals utilizing 2D drawings. It accelerates the traditional cost estimation process for an estimator through computer aided functions such as Auto-Count Object, Multi-condition Takeoff, Overlay, and Intelligent Paste Logic (On Center Software 2018). The quantities can be automatically accumulated and processed to be view in Excel spreadsheets. This allows for quicker cost estimates of 2D drawings. This approach was used to show the traditional Estimating method.

2.5 Building Information Modeling and Cost estimating

BIM is an acronym for Building Information Modeling. A highly collaborative process, BIM, allows multiple stakeholders and AEC (architecture, engineering, construction) professionals to collaborate on the planning, design, and construction of a building within one 3D model. This data allows owners and stakeholders to make decisions based on pertinent information derived from the model— even after the building is constructed.

BIM objects, the components that make up a BIM model, are intelligent, have geometry, and store data. If any element is changed, BIM software updates the model to reflect that change. This allows the model to remain consistent and coordinated throughout the entire process so that structural engineers, architects, MEP engineers, designers, project managers, and contractors can work in a more collaborative environment.

BIM technology can automatically extract information from defined models. Due to this automation, Building Information Modeling (BIM) offers great advantages over traditional cost estimating procedures while exerting significantly less effort. Cost engineers and estimators can use BIM technology to calculate the quantity of the model and use standard measurement methods to automate cost estimation processes. (Jamin Wood, Kreingsak Panuwtwnich, Jeung-Hwan Doh 2017).

Using BIM to supplement the estimating process provides greater accuracy for the estimate earlier in the design as shown by the MacLeamy Curve. This increases the level of accuracy in an estimate earlier in the project and reduces the amount of contingency needed at all stages of design as shown below.

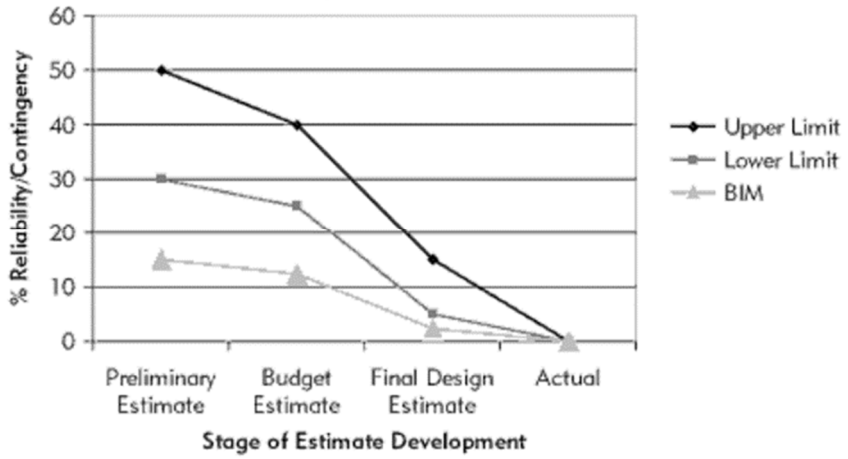


Figure 5: Contingency/Reliability as a Function of Project Phase (Eastman et al. 2008)

The Level of Development (LOD) is a critical aspect of 3D BIM cost estimating. The Level of Design is a measure of how well defined a BIM model is based on the architect's intent. The lower the LOD the less defined the model is.

As the LOD increase the accuracy of the estimate and the effort required to model that system increases as well. Designers optimized their efforts by focusing on system of work that require higher levels of development and allowing some systems of work to have a lower level of

development. For example, Civil work and underground utilities have little interaction with other areas of work in the project while systems of work such as the steel structured and mechanical equipment interact with almost all systems of work. The systems of work that have a higher impact and generally require a higher of LOD and systems that have less of an impact have a lower LOD. This additional effort by the design team to have a higher LOD allows for BIM based tools to be used to create an accurate Estimate.

Levels of accuracy required for construction management estimates ranges from 250-350 bases on the system of work. Below is description of each LOD.

LOD 100 - Conceptual - Here there are no geometric info in the model elements, only symbols with attached approximate info.

LOD 200 - Design development - Now the elements are generic placeholders for elements and equipment to be - They may be recognizable objects or space allocations for coordination between the disciplines.

LOD 300 - Documentation - This level should be suitable for design intent to support processes like costing and bidding. These models will be used to generate construction documents and shop drawings. You should now be able to take measurements from the models and drawings and locations should be accurate.

LOD 350 – Model Coordination - This level defines proper cross trade coordination and will include connections and interfaces between disciplines.

LOD 400 - Construction - This level supports detailing, fabrication and installation/ assembly. The contractor will be able to split construction requirements and assign to sub-contractors.

LOD 500 - Facilities Management - This level will have suitable geometry and information to support operations and maintenance. Geometry and data should be as-built and field verified.

Building information modeling (BIM) software is widely used by many construction businesses and are driving building work and construction management of today to more efficiency and transparency. The function of BIM systems goes beyond just a computer-aided design (CAD). When you utilize its features properly, it can help you reduce costs, spot and fix errors before they happen in the actual construction and accelerate construction schedules. You can see in the visual below the many advantages and benefits you gain from using a BIM solution. The most common BIM software that we will be using for this project are Revit and Navisworks.

2.5.1 Autodesk Revit Software

Revit is a software for Building Information Modeling (BIM) that creates smart 3D models of buildings which can then be used at all points of the design and construction process. An important feature in the construction process is the integration of multiple designs simultaneously. This allows for faster coordination of design (Autodesk 2018). Revit can help the cost estimation process by using the material quantity takeoff function. The limitation with accuracy of the quantities derived from Revit are only limited by level of development (LOD). The model used

for this project contains high level of development (above 350) that it can provide a reasonable and precise quantity for estimators to evaluate the cost of FIS. (BIM Forum)

2.5.2 Autodesk Navisworks Software

Navisworks is a 3D design review software that allows for coordination and review of several models to create a Federated Model. Within a project, multiple disciplines such as construction managers, architects, engineers, and subcontractors can review integrated models ensure a coordinated a project. This project used the material calculation process.

3 Methodology

The purpose of this study is to analyze the impact that BIM based estimating has on the accuracy of a projects estimate and compare it to the traditional estimating processes. This study uses a traditional based estimate via On Screen Take-Off with RSMeans for cost data on the Foisie Innovation Studio. Another estimate is taken using the conceptual estimation feature from RSMeans. A BIM based estimate is then be generated using tools such as Revit and Navisworks combined with RSMeans for cost data to create a BIM based estimate for the Foisie Innovation Studio. These estimates is then be compared against each other and to the actual costs for the Foisie Innovation Studio provided by the construction manager firm SDC Design & Construction.

Foisie Innovation Studio (FIS) is located on the main campus of Worcester Polytechnic Institute, between Higgins Laboratories and Harrington Auditorium. Foisie opened its doors in fall 2018, after breaking ground in May 2016. Design started in the fall of 2015. The first and second floors of the 78,000-square-foot residential and classroom facility include a teaching laboratory a makerspace, high-tech classrooms, the Center for Innovation and Entrepreneurship, and a cafe. A three-floor residence hall occupies levels three through six and supports one hundred forty students. The building total installed cost for WPI was around $49 million.

The Cost Estimates for this study are limited to several systems or work packages on the Foisie Innovation Studio and each work package estimate is based on the scope as defined on the available project documentation (2D or 3D). These systems of work include the Structure, Enclosure, Interior Finishes, Mechanical, Electrical and Plumbing (MEP) Systems, Site work, and Construction Management (CM) Cost. The Site work ($1,736,500) million and CM Costs ($10,801,902) are taken from SDC Design and Construction's allowances listed in appendix 9.5.3 Foisie Innovation Studio (FIS).

BIM software such as Revit and Navisworks were utilized in this study to establish the cost estimate for the Foisie Innovation Studio (FIS). Revit was used by the designer of the Foisie Innovation Studio, Gensler. The CM used Navisworks.

3.1 Cost Per SF Using RSMeans Process.

A conceptual cost estimate was created using the per square foot estimation tool of the RSMeans online resource. Two separate estimates were made based on the two main types of building used: The Laboratory/Classroom space and the dormitory space. The estimates were located and sized according to the total area of each function used (33,000 SF Lab space, 45,000 SF Dorm space). These estimates were then combined to create the total cost estimate of the project. These estimates were then organized to match the systems of work. This estimate came out to $31,452,193. (See Diagrams in Appendix 9.5.4)

3.2 Quantity Calculation from On-Screen Takeoff

On-Screen Takeoff is a quantity takeoff software that allows the user to take counts and measurements off 2D drawings in order to determine scope of each element in the project. From the 2D drawings, conditions are created to quantify the totals. A Condition is a measurable object such as a floor, wall, window, etc. A Condition includes information about the object such as: Name, Dimensions (wall height, for example), Layer, Quantity results, and Appearance settings. This information allows the user to create unique conditions for each object in the drawings. There are four conditions in OST: Linear, Area, Count, and Attachment. (On Center Software Manuel)

Linear Conditions: These describe objects such as walls, foundations, curbs, piping, wiring, rafters, etc. - anything that typically is measured by linear feet, inches, meters, etc.

Area Conditions: These describe objects such as slabs, ceiling tiles, flooring, roofs, and facades that require a measurement for total square footage. An Area Condition can calculate volume for objects by assigning a thickness.

Count Conditions: These describe takeoff objects best quantified as an each, such as a footing, column, or fixture.

Attachment Conditions: These are special count conditions that attach to a parent condition. For example, a parent could be a linear condition such as a wall and the attachment could be a window or a door that 'attaches' to and affects the linear or square footage results of the parent takeoff object (a window or door, for example, would reduce its parent object's square footage, its linear footage, or both). Another example is when you have drawn an area, such as an acoustical tile ceiling, as the parent, you use attachments for lights or other fixtures to reduce the number of tiles or square footage of ceiling material needed.

Each unique object on a drawing must coincide with a separate condition. For example, to quantify the various walls in a project, a condition is created for each Type of wall such as 8'00" 1 Hour Fire Rated, Exterior Wall, 10' Demising 2 Hr. Wall, etc. Each change in height requires a separate Condition. These conditions are then tabulated.

To show how On-Screen Takeoff (OST) is used, a foundation example was used to extract quantities (Appendix 9.1). This process was then used on the Foisie Innovation Studio project. (Appendix 9.2)

3.3 Quantity Calculations from Revit

Revit is a database driven 3D modeling software that encompasses information in every element. Using this information rich model (BIM) we can leverage the data in these elements to create schedules and then to create cost estimates of elements in a building. These schedules show the quantities for any system in the Model in tabular form. These schedules quantities can be applied to a cost data base and estimate generated for the scheduled system of work. For example, a wall schedule can be created in Revit and all wall types, surface area, length, and any other parameter can be applied to the schedule. Costs for each wall type are applied through RSMeans and the cost for all the walls in a project are then estimated.

3.4 Quantity Calculations from Navisworks

When considering using Navisworks for model quantity takeoff, you are most interested in models that are rich in metadata. Navisworks will only take off model geometry when the model has metadata associated with it. This is important to keep in mind when reviewing DWG formatted files and other file types that may not have quantity data associated with them. To take off model geometry, select the geometry you wish to take off. A sustainable method would be to create a search set for model groups. For example, you might create a search set for footings, foundations, walls, doors, and so on. An alternative method that is often employed is the use of the Select Same tool, a great tool to use when taking off a similar object. Similar to Revit, the quantity takeoff can be exported to Excel and cost applied through RSMeans. It is important to note that this estimate is only effective with well-defined elements. The take-off requires elements to be grouped into systems such as floors, walls, foundations, etc. If model elements are not grouped into the correct families the take-off will not necessarily be accurate.

4 Quantity Take-Off (QTO) Procedures for Foisie Innovation Studio

The purpose of this chapter to provide the basis for both the traditional estimate and BIM based estimate through quantity take offs (QTO). The quantities derived from OST (Traditional Estimating Process) and Revit/Navisworks (BIM Based Estimating) are stated here. The final section of this chapter applies unit cost data from RSMeans for cost to the QTO.

4.1 QTO Using OST

On Screen Take-off was used to generate the quantities for each system of work. The 2D drawings in PDF Format provided for the Foisie Innovation Studio and presented in detail in Appendix 9.2.1. These drawings were uploaded to the OST program and conditions were created for each system of work that was being estimated. The systems of work for the OST estimate included structure, enclosure, and interior finishes. All quantities listed below were taken from the 2D drawings using OST. The detailed process is fully documented in detail in Appendix 9.2.2.

4.1.1 QTO (FIS): Structure

The QTO of the structural included structural steel, piers, foundation wall, footings, slab on grade, and slab on deck. The quantities obtained for steel of beams, columns, and braces were 344.7 tons, 70.5 tons, and 21.6 tons respectively. The details of the whole structure quantity takeoff (QTO) are shown in Appendix 9.2.3.

4.1.2 QTO (FIS): Enclosure

The enclosure included metal panels, roofing, doors, curtain walls, windows, masonry, and insulation. The details of the whole enclosure QTO are shown in Appendix 9.2.4.

4.1.3 QTO (FIS): Interior Finishes

The interior finishes included interior doors, partition walls, and windows. There were 217 interior doors, with a partition wall area of 168,860 square feet. The details of the interior are shown in Appendix 9.2.5.

4.2 Quantity Calculations from Revit & Navisworks BIM models

To create a QTO from Revit, schedules were created for each system of work estimated. These systems of work included structure and interior finishes. For the structural QTO, two Revit models were used in the cost estimation. One model was created by students of WPI and the other model was created by the design company (Gensler) of the FIS project. For the interior finishes QTO, the Navisworks model was used in conjunction with the Revit to create an accurate QTO.

4.2.1 The Student Model

Figure 6 below, shows the model created by the students that was used to calculate the steel quantities by using the material takeoff function in Revit. The total steel used in the model was 395.71 tons. The concrete used was 2916.31 cubic yards. (See quantity details in the Appendix 9.3.3.)

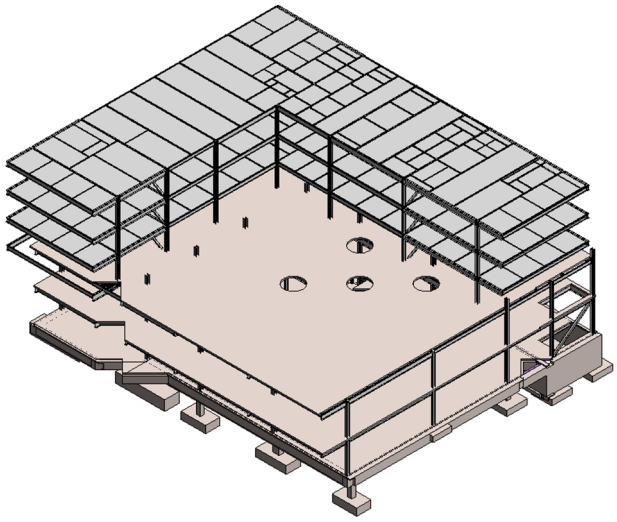


Figure 6: Student Model

4.2.2 The Gensler Model

Figure 9 Below shows, the Gensler structure model which was more accurate than the student model because it was the final construction document. The total steel in the model was 395.65 tons. The concrete used was 3294.04 cubic yards. (See quantity details in the Appendix 9.3.4.)

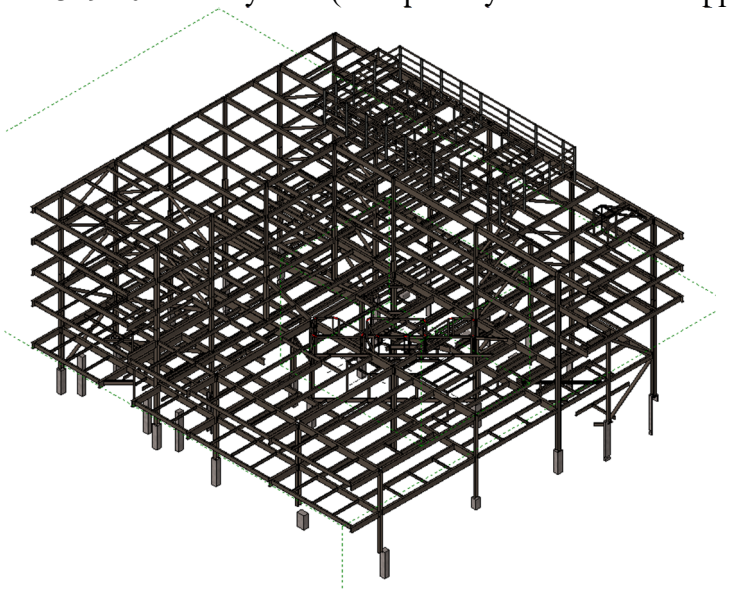


Figure 7: Gensler Model

4.3 Navisworks

The Navisworks model was also used to calculate the QTO for interiors in this project. Navisworks models are exported from Revit models and can only replicate the information included in the original model. The Navisworks Model used for this project was provided by SDC. The Gensler REVIT model was originally used to create the SDC Navisworks model. However, SDC updated the content of the model as the construction of the project took place. In creating this model, In Navisworks, a QTO is done by using the quantification feature. Quantification helps make material estimates, measure areas and count building components. This information is summarized and shown in Figure 10 below and documented in detail in Appendix 9.4.2.

Row Labels	ModelLength	ModelWidth	ModelThickness	ModelPerimeter	ModelArea	ModelVolume	Count	Sum of Height
⊟Ceiling Finishes								
⊞Basic Ceiling				3229.500832	24199.43188		14	0
⊞Compound Ceiling			24.75	12414.31888	35489.07371	7748.569419	115	0
⊟Floor Finishes								
⊞Floor			9	3728.10603	82512.7028	123769.0542	6	0
⊟Interior Doors								
⊟Door - Single Plain Panel - Hollow Metal Frame-U								
⊞3'-0" x 7'-0" - Exterior		12	0.583333333		182.3064236	19.2536169	4	28
⊞3'-0" x 8'-0" - Interior		3	0.145833333		40.08398438	4.48969184	1	7.833333333
⊞36" Wide x 96" Tall		228	11.08333333		3046.382813	341.2165799	76	595.3333333
⊞Door CW - Double - Offset Pivot Hinge - Single Swing - w Rails		6.25	0		50	3.164577693	1	8
⊞Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles		41.171875	0.541666667		314.6117622	29.55119466	13	98.95833333
⊞Door CW - Single - Sliding - w Rails & Stiles		17.6215072	0		152.9463731	13.95634826	6	52.16666667
⊞Door Type H4 - Sectional		40	0.666666667		553.0546875	28.4068287	4	32
⊞Door-NanaWall-WD66		24	0.65625		1330.084804	102.1890222	3	29.5
⊟Double - Plain Panel - Hollow Metal Frame (1)								
⊞6'-0" x 8'-0" - Interior		48	1.166666667		643.5017361	73.25491898	8	62.66666667
⊟Double - Plain Panel - Hollow Metal Frame (2)								
⊞6'-0" x 7'-0" - Exterior		24	0.583333333		288.2022569	32.72757523	4	28
⊞6'-0" x 8'-0" - Interior		30	0.729166667		337.6942274	40.43023003	5	39.16666667
⊞Hafele Barn Door		24	0		197.8333333	28	2	16
⊟Single - Plain Panel - Hollow Metal Frame								
⊞3'-0" x 7'-0" - Exterior		27	1.3125		325.2871094	36.2796224	9	63
⊞3'-0" x 8'-0" - Interior		3	0.145833333		40.08398438	4.48969184	1	7.833333333

Figure 8: QTO Interior For Navisworks

4.4 The Unit Cost Data

The unit cost data from RSMeans Data Gordian 2018 Online was used for all the QTO. For each condition in OST or schedule item in Revit/Navisworks a unit price was applied based on the value RSMeans had for that item. This unit price was then multiplied by the total amount of that item and given a subtotal. Shown below is an example of how the Interior finishes were estimated using this process. (Appendix 9.4.1)

	Gensler					OST					Navisworks				
Items	QTO	Unit	Price	SUBTOTAL	COMMENTS	QTO	Unit	Price	SUBTOTAL	COMMENTS	QTO	Unit	Price	SUBTOTAL	COMMENTS
Partition Walls Area	50495.48	SF	$5.34	$269,645.86	092116330500	47,495	SF	$5.34	$253,626	092116330500	42241.79	SF	$5.34	$225,571.16	092116330500
Doors	125.00	EA	$1,388.00	$173,500.00	081413103020	217	EA	$1,388.00	$301,196	081413103020	137	EA	$1,388.00	$190,156.00	081413103020
Floor	-										82512.7	SF	$6.49	$535,874.15	096813106100
Ceilings	-					-					59688.5	SF	$16.64	$993,216.64	095133100140
Windows	49.04	SF	$67.80	$3,324.91	085250102060	-					-				
Stairs						156.00	Riser	$700.59	$109,292.04	055113500200					
						1.00	EA	$45,000.00	$45,000.00	n/a	-				
PARTION WALLS															
Basic Wall: Generic 18" Wall	1620.07	SF	$6.23	$10,093.04	092116339200	-					1620.07	SF	$6.23	$10,093.04	092116339200
Basic Wall: Generic 18" Yellow Feature Wall	1541.84	SF	$6.23	$9,605.66	092116339200						1541.84	SF	$6.23	$9,605.66	092116339200
Basic Wall: Generic 22" Yellow Feature Wall	380.94	SF	$6.23	$2,373.26	092116339200						380.94	SF	$6.23	$2,373.26	092116339200
Material - Sheathing - Gypsum Wall Board	302252.95	SF	$6.23	$1,883,035.88	092116339200	79,038	SF	$6.23	$492,407	092116339200	-	SF			
Material - Stud - Metal	15881.48	SF	$3.41	$54,155.85	050523871200	72,342	SF	$3.41	$246,686	050523871200	-	SF			
Basic Wall: Stadium Seating	818.20	SF	$6.23	$5,097.39	092116339200	818	SF	$6.23	$5,097		818.20	SF	$6.23	$5,097.39	092116339200
Continous Acoustical Sealant	-					98,312	SF	$1.29	$126,822	092910305500	-				
Sound Attenuation Blanket	-					84,430	SF	$4.25	$358,828	098116103400	-				
Wall Finish as Scheduled	-					73,490	SF	$0.55	$40,420	099123740340	-				
Type "X" Gypsum Board	-					35,810	SF	$0.71	$25,425	071213201000	-				
Gypsum Liner Panel	-					17,028	SF	$8.85	$150,698	092116230060	-				
CEILINGS															
Ceiling - ACT 24"x24"	11480.87	SF	$3.80	$43,627.31	095123101175	11,281	SF	$3.80	$42,867	095123101175	-				
Ceiling - ACT 24"x48"	2095.52	SF	$3.80	$7,962.98	095123101175	1,999	SF	$3.80	$7,594	095123101175	-				
Ceiling - Gypsum Board	13350.91	SF	$8.12	$108,409.39	092910307085	11,351	SF	$8.12	$92,169	092910307085	-				
Stud - Metal	14147.35	SF	$3.41	$48,242.46	050523871200	13,747	SF	$3.41	$46,878	050523871200	-				
Aluminum	796.44	SF	$16.64	$13,252.76	095133100140	796	SF	$16.64	$13,253	095133100140	-				
Total:				$2,632,326.74					$2,358,258.93					$1,971,987.29	

Figure 9: Comparison of Interior of FIS by Gensler, OST, and Navisworks

5 Cost Estimates

This chapter creates four estimates using methods discussed in section 4.4 and compares the results of each estimate. The first estimate was generated using RSMeans cost per square foot data. The second estimate was generated using OST and unit cost from RSMeans. The third estimate utilized the BIM model and unit cost from RSMeans. The final estimate was provided by SDC. This was a schematic design estimate based on SDC's quantifications of work and their own cost database. The first three cost estimates were then compared against the SDC for relative differential in cost prediction.

The comparative exercise looks at the cost involving building systems: structure, enclosure, and interiors. The values for the other building systems were taken from the SDC schematic design estimate are as follows:

Enclosure	$ 3,661,750
MEP Systems	$ 8,116,825
Equipment & Furnishings	$ 215,750
Site Cost	$ 1,736,500
Allocations	$10,801,982

SDC used the allocations to account for the accuracy of drawings at this stage of deign (Schematic: -30% to 50% as shown in figure 4). The allocations from SDC cost estimate consisted of 33 percent of the total budget. This was assumed to represent contractor fees, architect fees, and project contingency. These numbers were carried as constraints in all budgets and represented 66 percent of the total construction cost estimate.

5.1 Cost Estimation using the RSMeans Cost per Square Foot Method

The building systems estimated through RSMeans included structure, enclosure, interior finishes, systems cost, and equipment & furnishings. Site Work was the only system of work not estimated and the value of $1,736,500 was carried.

The Foisie Innovation Studio is a mixed function building with both a lab/academic space and dormitory space. In order to create an accurate estimate from RSMeans, both to these functions were separated out into two distinct estimates. RSMeans uses the number of floors a building has, the average height of each floor, whether or not a basement in included, and the total square footage of the building to generate an estimate. These estimates are then combined to create the total estimate for the Foisie building.

The square footage for the dorm space had 45,000 SF with three floors and floor height of 11 feet 8 inches. The basement was included as a part of this estimate. The lab/academic space was 33,000 SF with two floors that are 16 feet high. This estimate did not include a basement. Each estimate considered Contractors fees and architect fees which are defined as allocations in SDC schematic design estimate. The estimate for the dormitory space was $16,506,653. The estimate for the lab space was $13,209,039. The total combined cost estimate from RSMeans was $31,452,192 (See appendix 9.5.4). See below for breakdown.

		RSMeans
Items		**Cost**
STRUCTURE		$1,366,603.70
ENCLOSURE		$4,325,101.16
INTERIOR		$3,210,309.40
SYSTEMS COST		$11,260,314.15
EQUIPMENT & FURNISHINGS		$418,573.08
SITE COST	Assumed from SDC Estimate	**$1,736,500.00**
ALLOCATIONS		$9,134,791.40
TOTAL CONSTRUCTION COST		$31,452,192.89

Figure 10: Total Cost Using RSMeans

A cost per square foot estimate can be developed based on the gross square footage of the building and this takes a day to develop. (See Figure 14) It is typically used at the conceptual phase of design when often little is known about the scope of the project. However, at this stage, floor areas per use of the space have been well defined in the scope.

5.2 Cost Estimation Using OST

OST was used to estimate the structure, enclosure, and interior finishes. The other building systems (MEP systems costs, equipment & furnishings, site costs, and allocations) were not estimated using OST because the drawings presented did not have enough information to quantify those systems of work. However, the designer provided the design intent at that stage which was used by SDC to estimate the cost of these components. The values of these systems of work are as follows:

MEP Systems	$ 8,116,825
Equipment & Furnishings	$ 215,750
Site Cost	$ 1,736,500
Allocations	$10,801,982

The total value of the cost estimate after the assumed allocations from SDC schematic design estimate was $31,915,257. (See details in Appendix 9.5.1.) The figure below shows the total cost estimate for OST.

		OST
Items		**Cost**
STRUCTURE		$4,169,997.18
ENCLOSURE		$3,351,273.80
INTERIOR		$3,522,929.24
SYSTEMS COST	Assumed from SDC Estimate	**$8,116,825.00**
EQUIPMENT & FURNISHINGS	Assumed from SDC Estimate	**$215,750.00**
SITE COST	Assumed from SDC Estimate	**$1,736,500.00**
ALLOCATIONS	Assumed from SDC Estimate	$10,801,982.00
TOTAL CONSTRUCTION COST		$31,915,257.22

Figure 11: Total Cost of OST QTO

A cost estimate using OST requires 2D drawings. This estimating approach is ideal for schematic and design development phases of the design. In this exercise, the estimator spent close to 200 hrs for the QTO and 200 hrs to research and apply the unit prices. This is based on the amount of time a typical estimator takes using this process. (See Figure 14)

5.3 BIM Cost Estimation of FIS

The building systems estimated using the BIM Models included structure and interior finishes. These systems were estimated off the Gensler model and not the Student model. The student model was not used as the model did not match the drawings used in construction. The Gensler model was based on the design intent and drawings from the design team and therefore creates a better model to estimate from. All the other building systems were taken from the SDC estimate as follows:

Enclosure	$ 3,661,750
MEP Systems	$ 8,116,825
Equipment & Furnishings	$ 215,750
Site Cost	$ 1,736,500
Allocations	$10,801,982

The total cost estimation of the BIM models was $30,104,859. (See details in Appendix 9.5.2.) The figure below shows the total cost estimate of the BIM based systems.

			Gensler
Items			**Cost**
STRUCTURE			$2,939,725.53
ENCLOSURE	Assumed from SDC Estimate		**$3,661,750.00**
INTERIOR			$2,632,326.74
SYSTEMS COST	Assumed from SDC Estimate		**$8,116,825.00**
EQUIPMENT & FURNISHINGS	Assumed from SDC Estimate		**$215,750.00**
SITE COST	Assumed from SDC Estimate		**$1,736,500.00**
ALLOCATIONS	Assumed from SDC Estimate		$10,801,982.00
TOTAL CONSTRUCTION COST			$30,104,859.27

Figure 12: Total Cost of Using Gensler Model

A cost estimate using a BIM models requires a 3D model at LOD 300. Once this model is established, quantities can be derived quickly. The LOD of the Gensler Model was separated by the building systems estimated. As the Gensler model did not state what LOD it was published at, the LOD for the building systems estimated in this process (Structure and Interiors) were evaluated to have an LOD above 300. This evaluation was supported by the fact that the drawings were generated from the BIM model. In this exercise, the estimator spent 40 hrs for the QTO and 200 hrs to research and apply the unit prices. This is based on the amount of time a typical estimator takes using this process. (See Figure 14)

5.4 Cost Estimation from SDC Design & Construction (SDC)

The SDC estimate was provided by the general contractor for the project. The total construction cost was $31,484,182. (See details in Appendix 9.5.3.)

Space Left Intentionally Blank

			SDC
Items			Cost
STRUCTURE	A10 FOUNDATION	$1,132,500.00	$3,397,500.00
	B10 SUPERSTRUCTURE	$2,265,000.00	
ENCLOSURE	B20 EXTERIOR WALLS	$2,453,750.00	$3,661,750.00
	B30 ROOFING	$1,208,000.00	
INTERIOR			$3,553,875.00
SYSTEMS COST		Assumed from SDC Estimate	**$8,116,825.00**
EQUIPMENT & FURNISHINGS		Assumed from SDC Estimate	**$215,750.00**
SITE COST		Assumed from SDC Estimate	**$1,736,500.00**
ALLOCATIONS		Assumed from SDC Estimate	$10,801,982.00
TOTAL CONSTRUCTION COST			$31,484,182.00

Figure 13: Total Cost of SDC Bid

SDC cost estimate was schematic based on market feedback. The SDC estimator would have spent 400 hrs for the QTO and 400 hrs to research and secure subcontractor feedback. (See Figure 14)

6 Cost Estimates Comparisons

This chapter compares each estimate using a side by side. Figure 14 shows how each estimate system of work compares to the other estimate. The SDC estimates are used as the basis of the comparison (Highlighted in yellow). The Estimated hours of QTO and Pricing were derived from an interview with the Head Preconstruction Manager from Suffolk Construction (Swaim, T).

	RSMeans	OST	Gensler	SDC
	Cost/ SF	Traditional	Bim Based	Bid Based
SYSTEMS OF WORK	Cost	Cost	Cost	Cost
STRUCTURE	$1,366,604	$4,169,997	$2,939,726	$3,397,500
ENCLOSURE	$4,325,101	$3,351,274	$3,661,750	$3,661,750
INTERIOR	$3,210,309	$3,522,929	$2,632,327	$3,553,875
MEP SYSTEMS COST	$11,260,314	$8,116,825	$8,116,825	$8,116,825
EQUIPMENT & FURNISHINGS	$418,573	$215,750	$215,750	$215,750
SITE COST	$1,736,500	$1,736,500	$1,736,500	$1,736,500
ALLOCATIONS	$9,134,791	$10,801,982	$10,801,982	$10,801,982
TOTAL CONSTRUCTION COST	$31,452,193	$31,915,257	$30,104,859	$31,484,182
% VARIATION TO SDC ESTIMATE	0.10%	-1.37%	4.38%	0.00%
*ESTIMATED HOURS OF QTO	4 hr	200 hr	40 hr	400 hr
*ESTIMATED HOURS OF PRICING	4 hr	200 hr	200 hr	400 hr

* Based on Industry Standard Guidelines

Figure 14: Side By Side Comparison Of Estimates

6.1 RSMeans Cost Per SF Estimate

The RSMeans estimate when compared to the SDC schematic design estimate had a variance of less than one percent below the SDC total schematic design estimate. (See Figure below)

Space Left Intentionally Blank

	RSMeans	SDC	
	Cost/ SF	Bid Based	
SYSTEMS OF WORK	Cost	Cost	Variance
STRUCTURE	$1,366,604	$3,397,500	-59.78%
ENCLOSURE	$4,325,101	$3,661,750	18.12%
INTERIOR	$3,210,309	$3,553,875	-9.67%
MEP SYSTEMS COST	$11,260,314	$8,116,825	38.73%
EQUIPMENT & FURNISHINGS	$418,573	$215,750	94.01%
SITE COST	$1,736,500	$1,736,500	n/a
ALLOCATIONS	$9,134,791	$10,801,982	-15.43%
TOTAL CONSTRUCTION COST	$31,452,193	$31,484,182	-0.10%
*ESTIMATED HOURS OF QTO	4 hr	400 hr	
*ESTIMATED HOURS OF PRICING	4 hr	400 hr	

* Based on Industry Standard Guidelines

Figure 15: Comparison Of RSMeans Estimate

However, the level of accuracy for building systems varied widely. For example, the building system structure varied by 59.78%. Even with this discrepancy, the total estimates matched. The disparity in the structural building system was made up by the MEP systems. This is exemplifying the inaccuracy of estimates at this stage for individual building systems. RSMeans does not use any design intent outside of total square footage and design narratives. As such it pulls information based on historical data and creates a "best guess estimate" for each system. This shows that conceptual estimates can be used as a reliable tool for estimating the total value of the project, but more refined estimates are needed to defined individual building systems. This estimate can be done quickly with little effort. This estimate is effective at the conceptual design phase when determining overall funding for the project.

6.2 On Screen Takeoff (OST) Estimating Method

The OST estimate when compared to the SDC schematic design estimate had a variance of less than two percent. (See Figure below)

Space Left Intentionally Blank

	OST	SDC	
	Traditional	Bid Based	
SYSTEMS OF WORK	Cost	Cost	Variance
STRUCTURE	$4,169,997	$3,397,500	22.74%
ENCLOSURE	$3,351,274	$3,661,750	-8.48%
INTERIOR	$3,522,929	$3,553,875	-0.87%
MEP SYSTEMS COST	$8,116,825	$8,116,825	n/a
EQUIPMENT & FURNISHINGS	$215,750	$215,750	n/a
SITE COST	$1,736,500	$1,736,500	n/a
ALLOCATIONS	$10,801,982	$10,801,982	n/a
TOTAL CONSTRUCTION COST	$31,915,257	$31,484,182	1.37%
*ESTIMATED HOURS OF QTO	200 hr	400 hr	
*ESTIMATED HOURS OF PRICING	200 hr	400 hr	

* Based on Industry Standard Guidelines

Figure 16: Comparison of OST Estimate

The level of relative difference for building systems were closer to the SDC estimate. The variance for structure was 22.74%, enclosure was 8.48%, and interior was 0.87%. This estimate takes several weeks to develop. But the information it generates if more useful for the design team to evaluate their design. Design teams, during preconstruction, take these estimates to see how and where they can edit the design to most significantly effect cost. For example, if the estimate showed that a building system was three million dollars more expensive than they predicted, the design team can make changes to reduce the cost of that system and directly affect the cost of project. The variance of these numbers can also be due to the cost data base used. SDC either uses and internal cost data based or market-based prices to create their estimate and these prices tend to be more accurate than the RSMeans cost data base. This provides legitimacy to the SDC cost estimate.

There are advantages and disadvantages to using OST. The software allows the estimate to organize information by using conditions to help categorize cost. This makes the estimate understandable and believable. However, Revit and other Autodesk software quantifies scope faster. In OST estimators still need to calculate quantities manually and supplement the information not provided on the drawings. In this study, this issue was highlighted in the foundation example. No scale was provided in the foundation sketch. An adjustment had to be made outside of the program to correctly estimate the foundation material required. This is time consuming.

OST also is limited in how it groups certain scope elements together. Elements such as different wall types and unique concrete elements are usually “one off” special items are time consuming to develop. For example, if a building has four thousand windows, the cost estimator will need to click four thousand unique windows. These windows then need to be compiled outside of the program to get a comprehensive estimate of the window scope. Expand this to a full-scale project and you are looking at hundreds of hours of work.

This estimate is effective at the schematic and design development phase helping the construction team understand what individual building systems are worth.

6.3 BIM Based Estimate

The BIM based estimate when compared to the SDC schematic design estimate had a variance of 4.38%. (See Figure below)

	Gensler	SDC	
	BIM Based	Bid Based	
SYSTEMS OF WORK	Cost	Cost	Variance
STRUCTURE	$2,939,726	$3,397,500	-13.47%
ENCLOSURE	$3,661,750	$3,661,750	n/a
INTERIOR	$2,632,327	$3,553,875	-25.93%
MEP SYSTEMS COST	$8,116,825	$8,116,825	n/a
EQUIPMENT & FURNISHINGS	$215,750	$215,750	n/a
SITE COST	$1,736,500	$1,736,500	n/a
ALLOCATIONS	$10,801,982	$10,801,982	n/a
TOTAL CONSTRUCTION COST	$30,104,859	$31,484,182	-4.38%
*ESTIMATED HOURS OF QTO	40 hr	400 hr	
*ESTIMATED HOURS OF PRICING	200 hr	400 hr	

* Based on Industry Standard Guidelines

Figure 17: Comparison of BIM Based Estimate

The variance for building systems were stronger than the OST cost estimate when the LOD was more defined as the drawings were produced from this Model. The variance for structure was 13.47% and interior was 25.93%. This estimate takes less time than the OST estimate to develop, and the information it generates if more useful for the project team.

The variances for OST and BIM based estimates were compared against each other. The LOD of for the steel was LOD 250 based on my evaluation of the model and how accurate they were to the drawings. However, the interiors were developed in more detail on the drawings than in the model and thus had an LOD of 200.

	OST	Gensler
	Traditional	BIM Based
SYSTEMS OF WORK	Variance	Variance
STRUCTURE	22.74%	13.47%
ENCLOSURE	8.48%	n/a
INTERIOR	0.87%	25.93%
MEP SYSTEMS COST	n/a	n/a
EQUIPMENT & FURNISHINGS	n/a	n/a
SITE COST	n/a	n/a
ALLOCATIONS	n/a	n/a
TOTAL CONSTRUCTION COST	1.37%	-4.38%

Figure 18: Comparison of Variance of The BIM Based Estimate to OST Estimate

The method by which quantities can be extracted from the model requires significantly less time than OST. More time may need to be spent enhancing models that are not at LOD 250. If this time, if spent early in the design stages, will save cost over the span of the job (As shown in MacLeamy curve) and increase the estimate's accuracy at the schematic and design phase. This did not need to be done for the Gensler model in regards to structure.

The Revit model was not developed enough to represent an accurate project estimate as only a few systems of work were developed to a high enough LOD (above 250) to be estimated. The discrepancy was magnified by the disparity between the model and the drawings. The 2D drawings had more detail and allowed for a more holistic estimate of the project. The Revit model was able to establish a comprehensive estimate with its limited systems of work that were developed to a LOD of 250.

This estimate is effective at the any phase of design when the model can be advanced to LOD 250. Usually at the conceptual phase a model is not available. At the schematic phase, the design team generally produces a model at LOD 100 and drawings at LOD 200. This causes an OST approach to be more accurate than a BIM based approach. At the design development phase, the model is usually advanced to LOD 250 making the BIM based approach possible.

7 Conclusions and Recommendations

Designers are using Building Information Modeling (BIM) to model their buildings and to document their designs. BIM promotes better communication through 3D digital tools and allows for early collaboration on projects. By using a BIM models instead of drawings, the takeoffs, counts, and measurements can be generated directly from the model.

The purpose of this study was to analyze the impact that BIM-based estimating has on project estimates at the early stages of design by comparing with cost estimates generated by the traditional, BIM based, and RSMeans estimating processes. The documentation from the Foisie Innovation Studio was used to prepare these estimates.

As shown in figure 4, early cost estimates can vary drastically. This study showed that BIM based estimating methods produce results that are within 5 percent to the ones generated by the SDC. The BIM-based estimates are also close to the ones produced using the cost per square foot approach, which is the method typically used early in the design when the scope lacks definition.

BIM-based cost estimates take less time than the traditional estimating process used by construction managers but requires an LOD of 300 to be effective. Models produced at the early stages of design have a lower LOD don't have the information required to create refined estimates. More time needs to be invested earlier to create models with higher LOD.

This section summarizes advantages and disadvantages of traditional costs estimates examined in this project and discusses the implications for cost estimating of providing a model with LOD 300 earlier in the project to produce effective estimates and save project money.

The results from comparing the cost estimation methods—On-Screen Takeoff, RSMeans, and Revit— used to price the Foisie Innovation Studio are as follows.

- On-Screen Takeoff (OST)

  OST can assist the estimator in calculating detailed quantities of work based on the needs of estimators and the quality of the 2D drawings. However, because of the difference in estimating skills and knowledge in the use of the software, different estimators will likely obtain different quantity results when calculating the quantities. The OST program used to evaluate Foisie Innovation Studio had the most accurate number to the SDC Design & Construction bid. The quality of the estimate is based on the amount of time put into the program and estimators with high experience levels will be able to create detailed estimates with very little variance.

- RSMeans

  RSMeans allows a for conceptual estimates. A total cost of the building and rate at which cash is spent throughout the project can be derived using this estimation method but individual systems require in-depth investigations in order to actualize. This is shown by the variance between the superstructures in SDC's and RSMeans estimates. RSMeans allows for an early estimate that shows total project cost.

- Revit

Revit allows estimator to keep pace with constant design changes. As the model changes, estimators can program their estimates to change in unison. This save the estimator time that they may have spent counting individual elements that Revit counts automatically. This process is held up the by the Level of Development (LOD) of the model. If the model is still in the conceptual phase quantities pulled from that model will only estimate the value of that conceptual design. A cost engineer or estimator would have to the know the deficiencies of the model in order to supplement his cost analysis. The quantity takeoff of Revit depends on the level of development of a model.

Another issue Revit brings in the inability to track current design documentation and status. What this means is, that if a subcontractor bids from a model or quantities from a model on day "A" and another contractor bids from the model dated day "B" and there is a difference between the two bidder information, this can cause problems with bids or provide one bidder with and advantage over the other. This is also true for 2D documentation. Models or Drawings need to be updated as design changes take place.

For this project, information in the model was limited and only a structural cost estimate could be derived from it. This estimate was more accurate than the OST estimate but, the Revit model could not, as a project, provide a more accurate estimate as the information was not at the correct LOD.

Based on these observations, the more details provided, the more accurate the cost estimation. As the LOD of the 3D model improved, Revit could produce a more accurate cost estimation with little time in less time than the OST method.

Revit can be more accurate as it reduces human error and provides quantities that might not have been recognized even by the most experienced of estimators. For projects with unprecedented designs and distinct surfaces, Revit is the preferred choice. However, this is entirely dependent the quality of work produced by the architect and engineer. As of now, the industry has not been able to meet the modeling level required to provide estimators with an adequate model early enough in the project. Architect and engineers create drawings and pictures for estimators to create bids from and don't consider constructability or workflow when creating the model. In order for the BIM based estimating systems to work, the model must be built in collaboration with the construction managers, architects, engineers, and owners. This collaboration early reduces cost impacts to the project and allows for clear and concise information from all parties to allow for a smother project. This is the Design to Cost approach.

Design to Cost will allow models to approach the level of design required for accurate estimates to be pulled out of the model. Early input from the construction team not only reduces potential design inconsistency but also allows for architects to create models and drawings that work into the estimator's skill sets.

When teams work collaboratively, changes are inevitable and by making the changes earlier you can reduce their cost impact to the project. The more collaboration early on, the faster the LOD develops. This is key for efficient estimate. Once the LOD of the drawings and the Model reach around 350, the model can be used reliably for estimation (BIM Forum). However, the construction

industry does not embrace this approach to construction and still prefer to work in silos during design. This will impede the speed that the LOD Develops at and keep estimators from fully embracing the BIM methods of estimating.

Eventually, BIM will become the industry standard for estimation with proper training and experience. The LOD of 300 needs to arrive earlier to the construction team then the industry currently provides. This requires more modeling effort earlier in the design. Then the workflow for utilizing the live model in construction as well as bidding being developed with legal standards, BIM will be used more frequently outside of the architect's office and used by entry level engineers in General contracting companies to subcontractors. Until then, programs like OST and Navisworks can help bridge the gap and provide consistent accurate project estimates that owners can rely on.

8 Bibliography

Autodesk. Navisworks 2018. Retrieved April 08, 2018. https://www.autodesk.com/products/navisworks/overview

Autodesk. Revit 2018. Retrieved January 08, https://www.autodesk.com/products/Revit-family

Christian Doskocil, Michael Vaitkunas. *The Role of BIM in a Collaborative Approach for Design and Construction at the Foisie Innovation Studio*. Major Qualifying Project Report, Department of Civil Engineering, Worcester, Mass: Worcester Polytechnic Institute, 2017.

Mike Mahoney. *Dormitory Building C & D* Technical Report No. 1 September 21, 2012 https://www.engr.psu.edu/ae/thesis/portfolios/2013/mdm5274/Tech1/Mahoney_Tech1.pdf

Carmel Ford. *Cost of Constructing a Home* NAHB Economics and Housing Policy Group. December 1, 2017 https://www.nahbclassic.org/generic.aspx?genericContentID=260013/

Wiley. RSMeans Online. Retrieved January 08, 2019 https://www.RSMeansonline.com/SearchData

Jamin Wood, Kriengsak Panuwatwanich, Jeung-Hwan Doh. *Using LOD in structural cost estimation during building design stage: Pilot study* 2014 https://ac.els-cdn.com/S1877705814019481/1-s2.0-S1877705814019481-main.pdf?_tid=73e294ff-83c6-4200-b282-858e502ffe93&acdnat=1550757974_b829874bb7a3935b9d4820c9d616c40d

Suffolk construction Stonehill Res Hall Budget June 17 2008

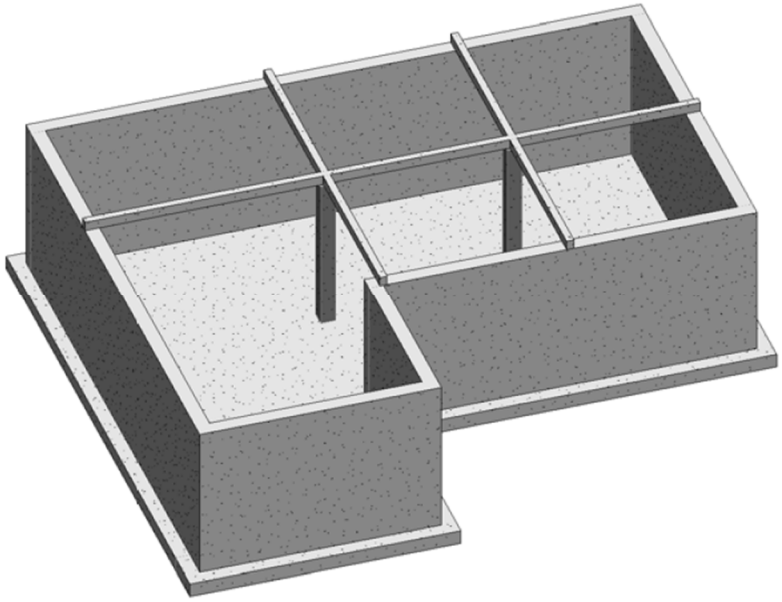
Strate School of Design 2018 *What is Design* https://www.strate.education/gallery/news/design-definition

Smart Sheet *The Ultimate Guide to Project Cost Estimating* January 2019 https://www.smartsheet.com/ultimate-guide-project-cost-estimating

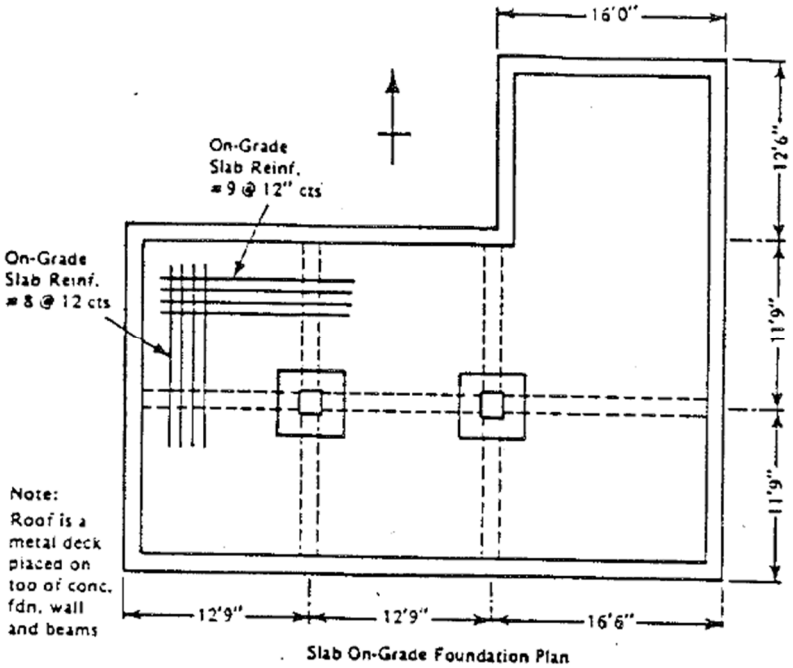
Swaim, T., 2019 Head Preconstruction Manager for Suffolk Construction, Personal Interview, Boston MA

9 Appendixes

9.1 Case 1— Quantity Takeoff of a Foundation

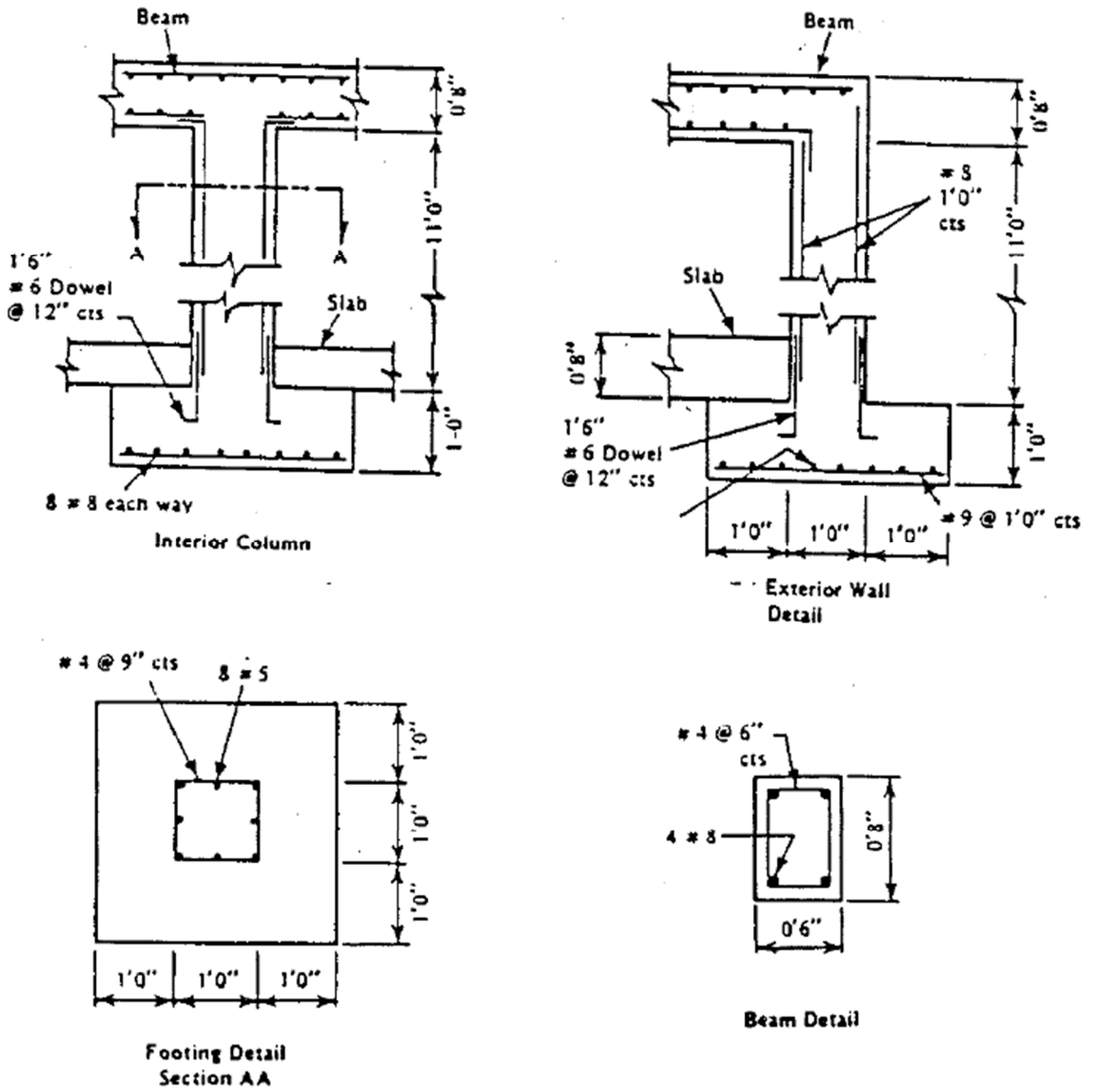


Foundation Example 3D Model

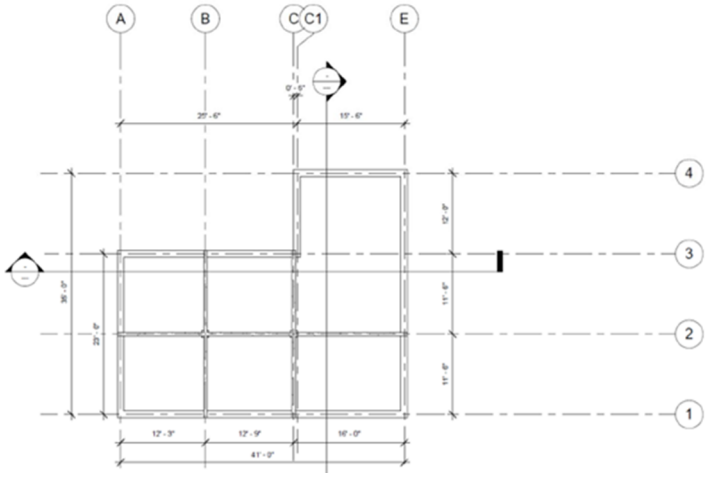


Slab On-Grade Foundation Plan

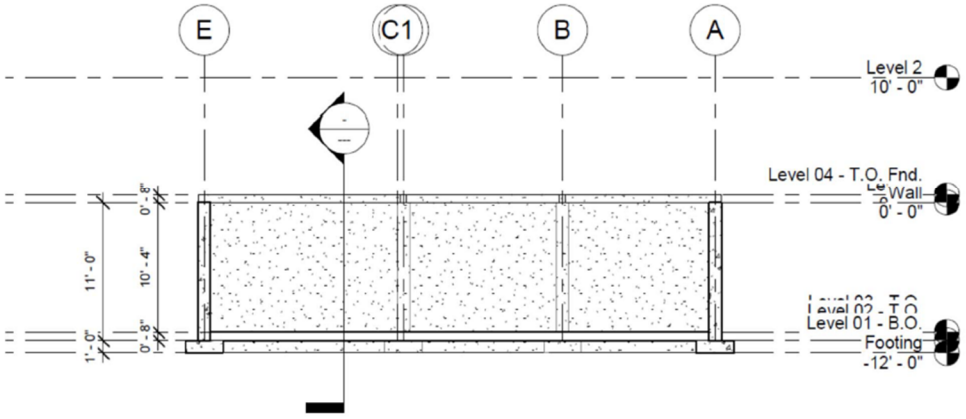
2D Drawing Part 1 of the Foundation Example



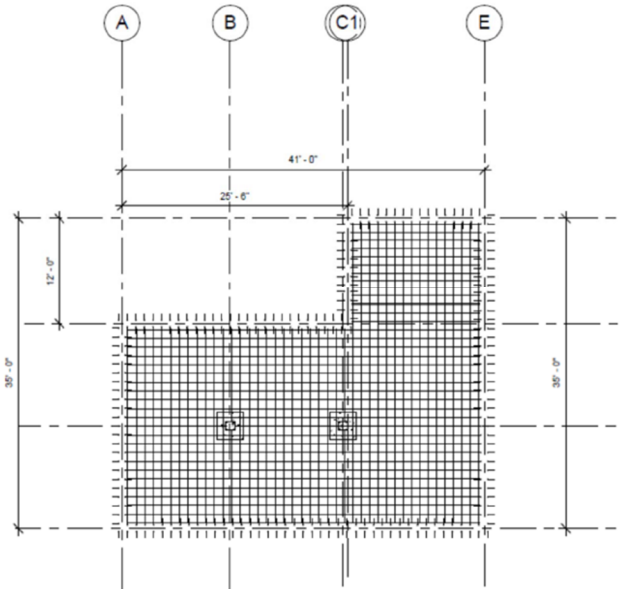
2D Drawing Part 2 of the Foundation Example



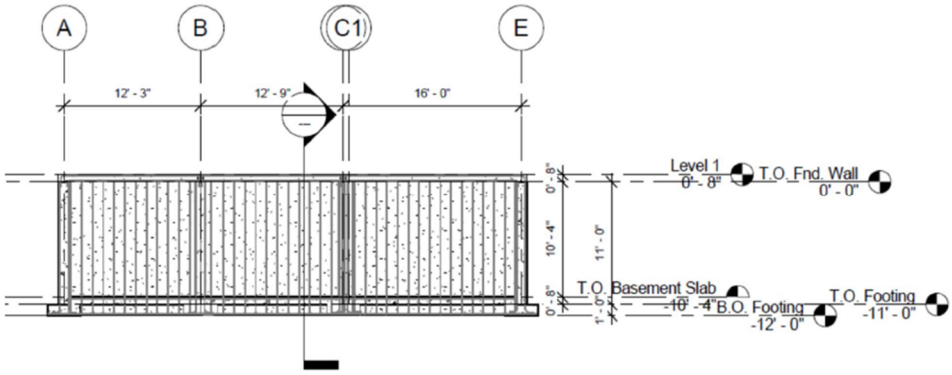
Plan View of the Foundation Example



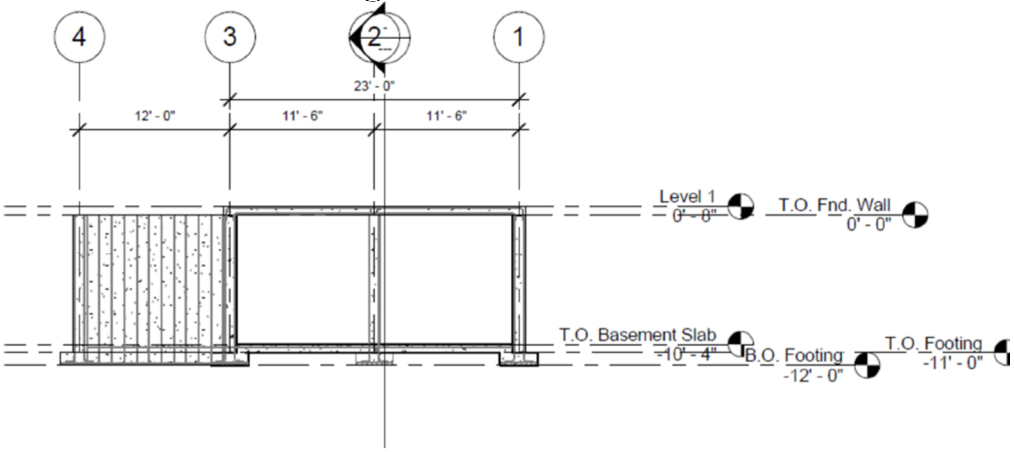
Vertical Cross Section of the Foundation Example



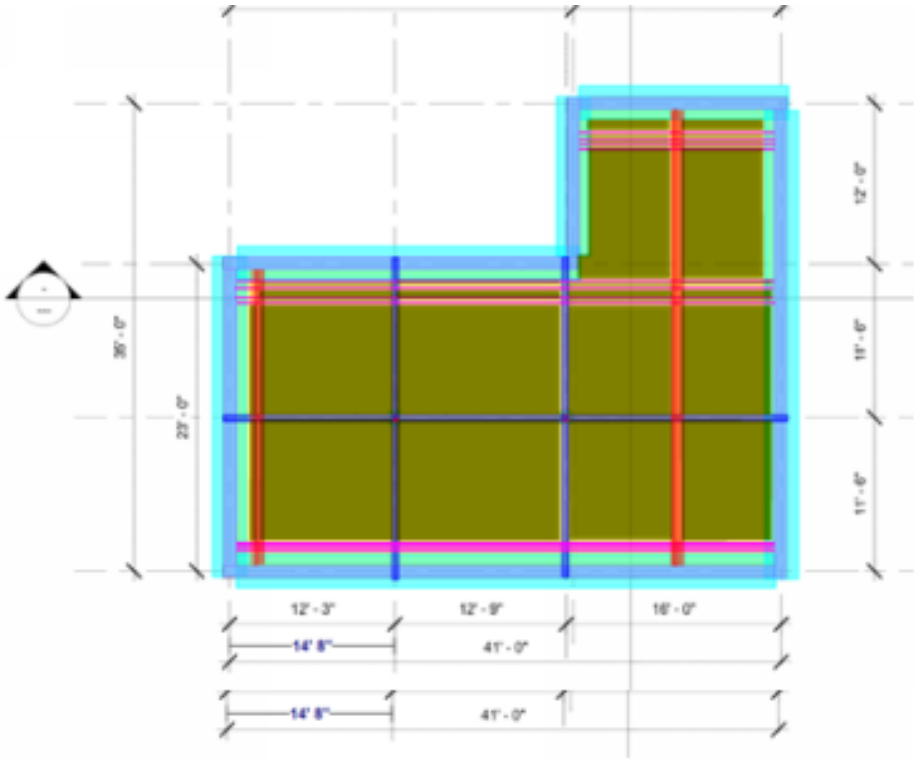
Reinforcing Steel Plan View of the Foundation Example



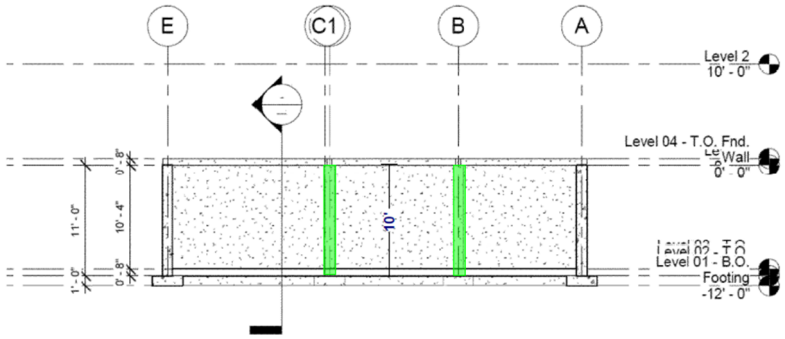
Reinforcing Steel Vertical Cross Section 1



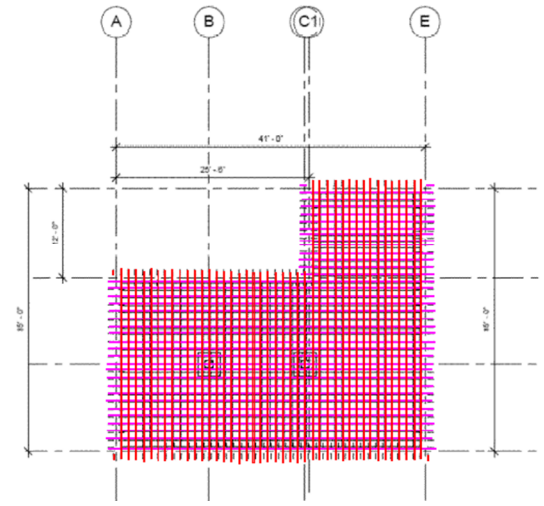
Reinforcing Steel Vertical Cross Section 2



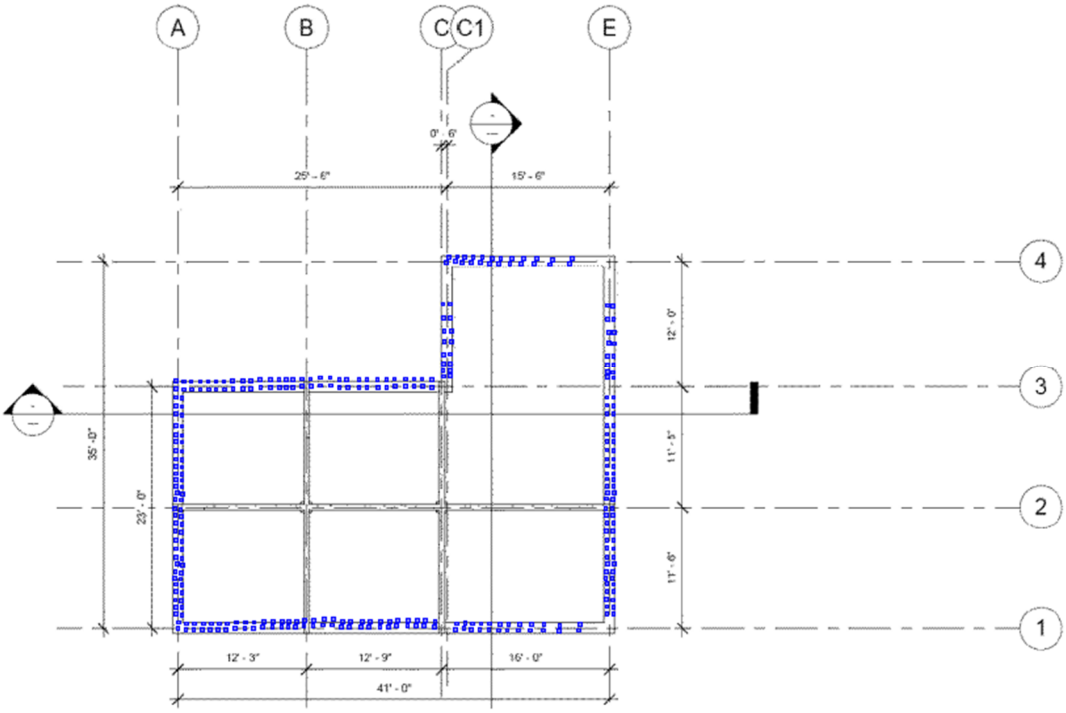
Foundation Walls, Footings, and Beam QTO by Using OST



Columns QTO by Using OST



Rebar in Slab QTO by Using OST



Vertical Rebar QTO by Using OST

Takeoff Tab

Foundation Example

Bid No. 18

No.	Name	Height	Area	Quantity1	UOM1	Quantity2	UOM2	Quantity3	UOM3
(unassigned)									
1	Continious Footings	1' 0"	(unassigned)	182	LF	546	CF	0	
2	Spread Footings	3' 0"	(unassigned)	2	LF	7	CF	0	
3	Slab On-Grade	0"	(unassigned)	1496	SF	997	CF	0	
4	Foudation Wall	11' 0"	(unassigned)	180	LF	1983	SF	1983	CF
5	Beams	8"	(unassigned)	106	LF	0		0	
6	Columns	11' 0"	(unassigned)	20	LF	474	SF	474	CF
7	Slab Reinf.= 9@12"	0"	(unassigned)	448	LF	0		0	
8	Slab Reinf.=8@12"	0"	(unassigned)	271	LF	0		0	
9	1'6"=6 Dowel @12"	1' 6"	(unassigned)	8	EA	12	LF	0	

Results Generated by OST Automatically

QUANTITY SHEET

Project: MQP

Location: WPI

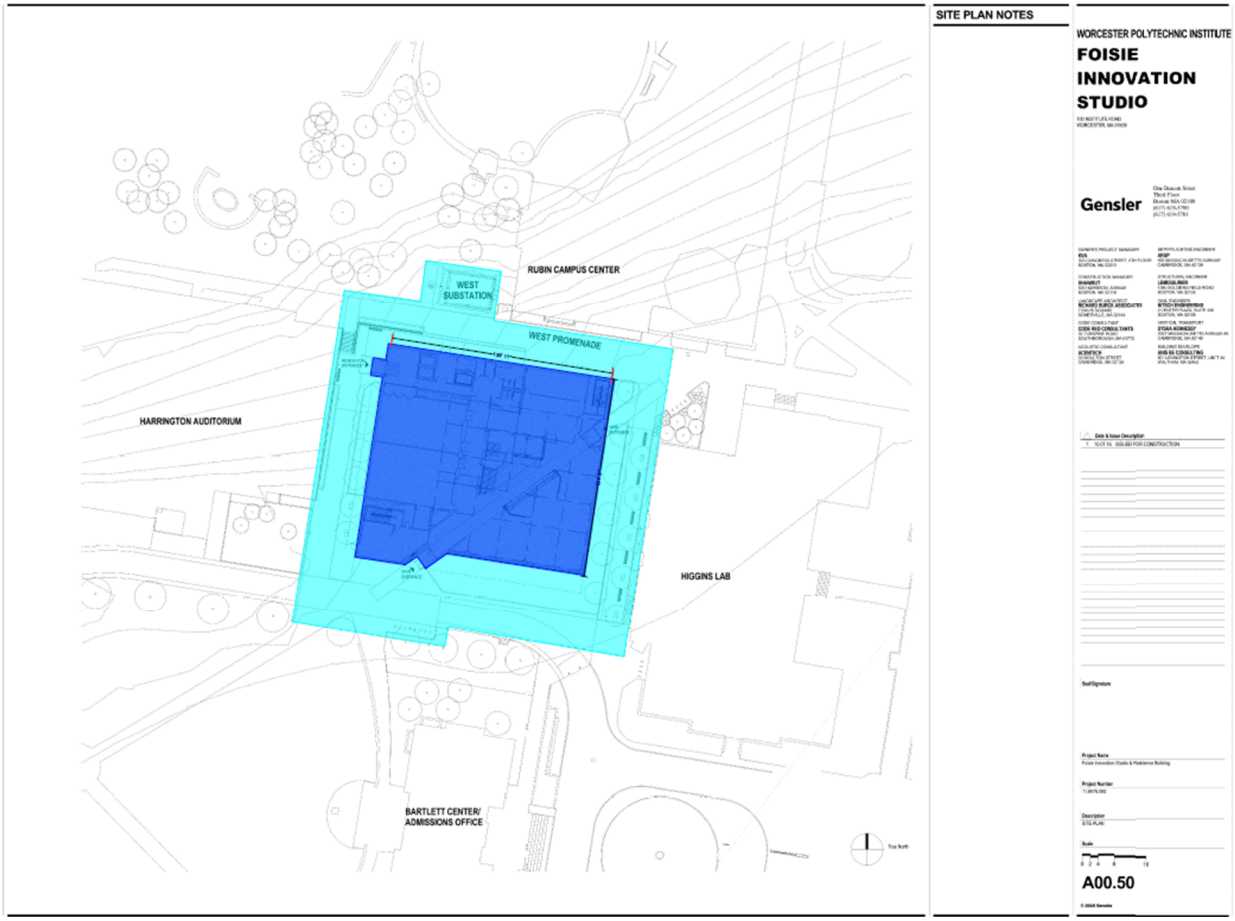
Date: February 2, 2019

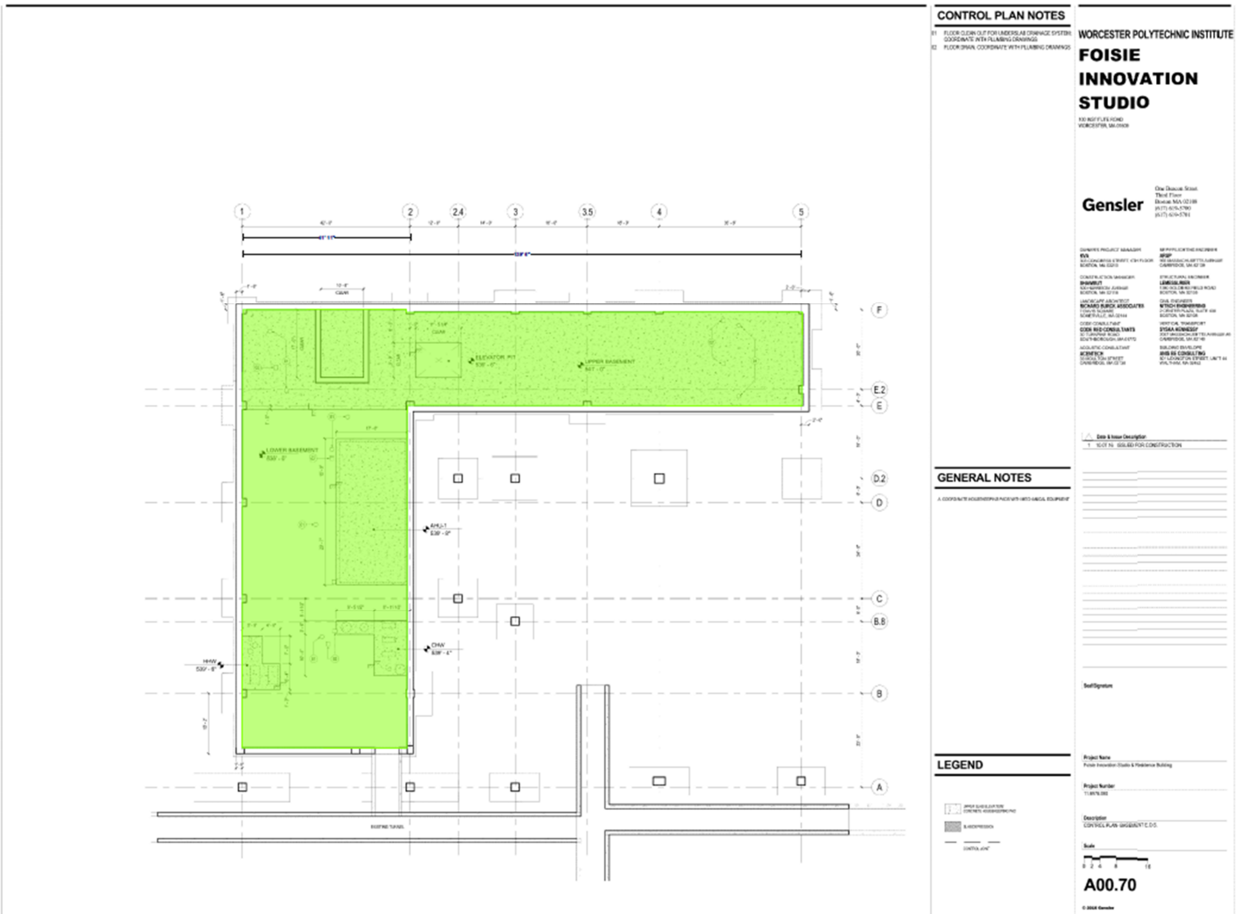
Name	Height(ft)	Thickness(ft)	Area	Quantity 1	UOM1	OST Scale(ft)	Real Scale(ft)	Real Quantity	UOM2	Volumn	UOM3		
Continious Footings	1	3	(unassigned)	182	LF	14.67	12.25	151.98	LF	455.93	CF		
Spread Footings	3	1	(unassigned)	2	LF	14.67	12.25	1.67	LF	5.01	CF		
Slab On-Grade	0		(unassigned)	1496	SF	14.67	12.25	1249.22	LF	833.22	CF		
Foudation Wall	11	1	(unassigned)	180	LF	14.67	12.25	150.31	LF	1653.37	CF		
Columns	11	1	(unassigned)	20	LF	10.00	11	22	LF	242.00	CF		
Subtotal(concrete)										3189.54	**CF**	118.13	**CY**
Beams	0.666667	0.5	(unassigned)	106	LF	14.67	12.25	88.51	LF				
Slab Reinf. =9@12"				448	LF	14.67	12.25	374.10	LF				
Slab Reinf. =8@12"				271	LF	14.67	12.25	226.30	LF				
Dowel of Columns	1.5			12	LF			10.02	LF				

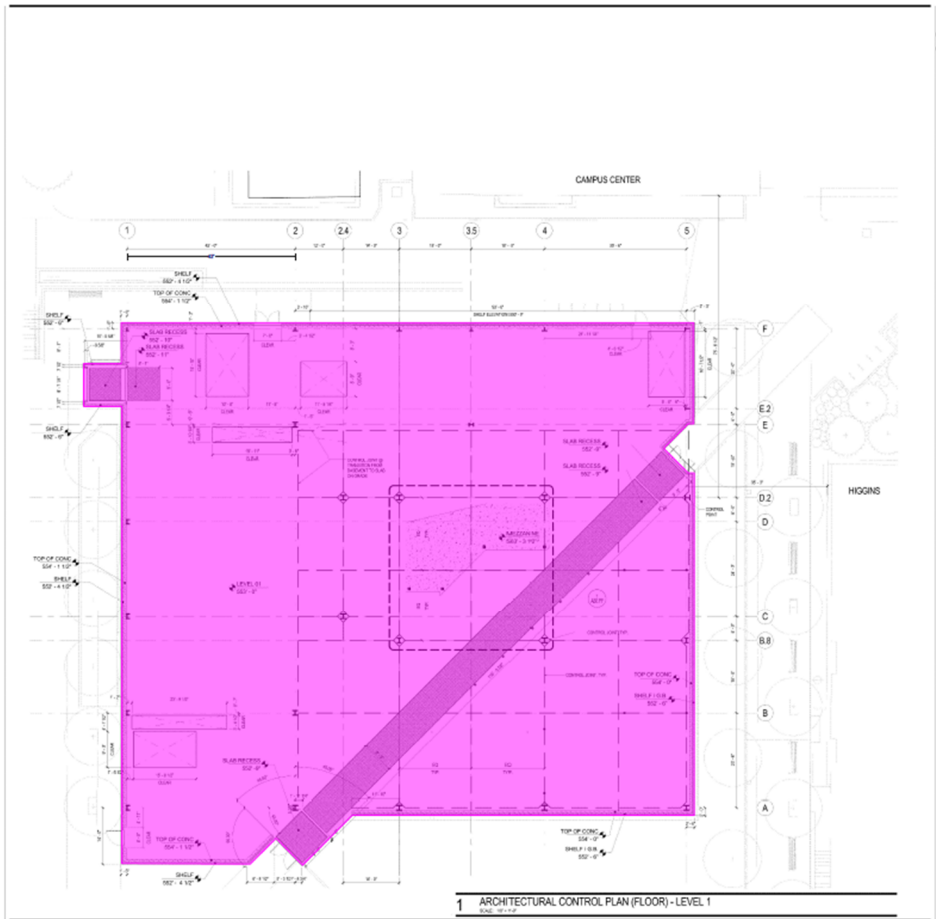
Adjusted Results in Excel

9.2 Quantity Takeoff of FIS by OST

9.2.1 QTO Processes of FIS




CONTROL PLAN NOTES
WORCESTER POLYTECHNIC INSTITUTE
FOISIE
INNOVATION
STUDIO
Gensler
ELEVATOR PIT
UPPER BASEMENT
LOWER BASEMENT
AHU-1
CHW
GENERAL NOTES
LEGEND
A00.70



1 ARCHITECTURAL CONTROL PLAN (FLOOR) - LEVEL 1

SCALE: 1/8" = 1'-0"

CONTROL PLAN NOTES

01 FLOOR DRAIN CUT FOR UNDERSLAB DRAINAGE SYSTEM. COORDINATE WITH PLUMBING DRAWINGS

02 FLOOR DRAIN. COORDINATE WITH PLUMBING DRAWINGS

GENERAL NOTES

LEGEND

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 619-5781
(617) 619-5784

Date & Issue Description
1 10.07.16 ISSUED FOR CONSTRUCTION

Seal/Signature

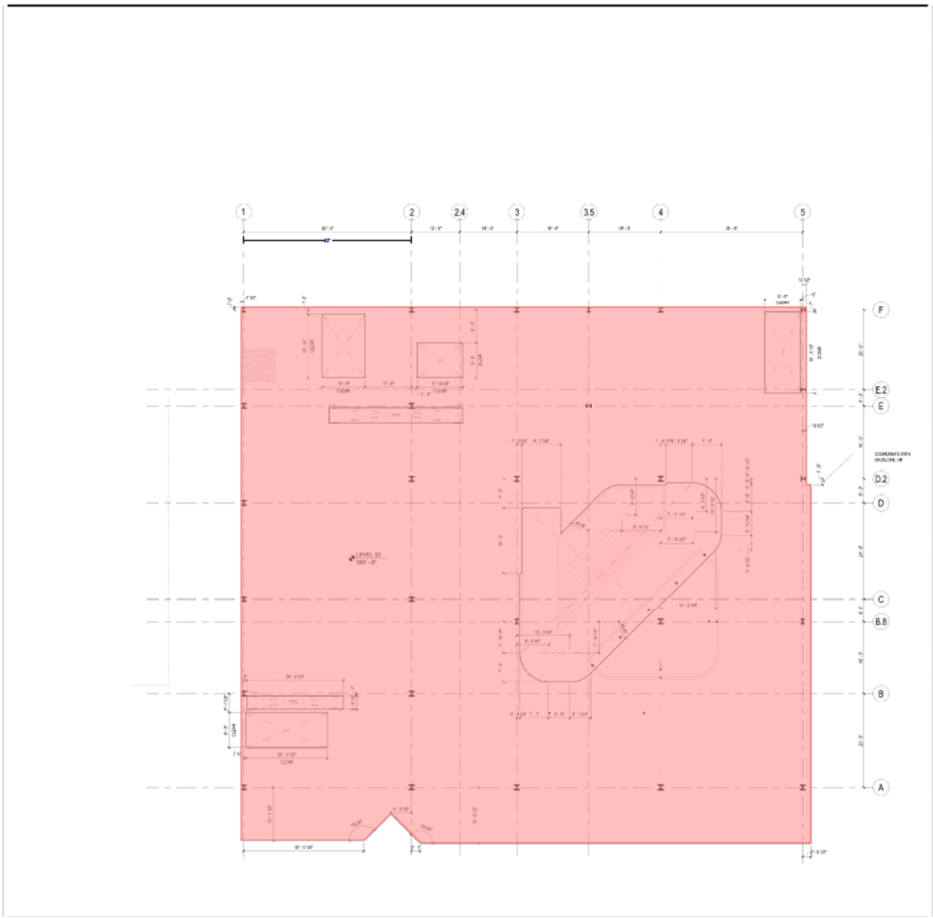
Project Name
Foisie Innovation Studio & Residence Building

Project Number
11.0076.000

Description
CONTROL PLAN - LEVEL 1 | 0.0.5

Scale
0 2 4 8 16

A00.71



LEGEND

WORCESTER POLYTECHNIC INSTITUT

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 619-5790
(617) 619-5791

Date & Issue Description
1 10.07.19 ISSUED FOR CONSTRUCTION

Seal/Signature

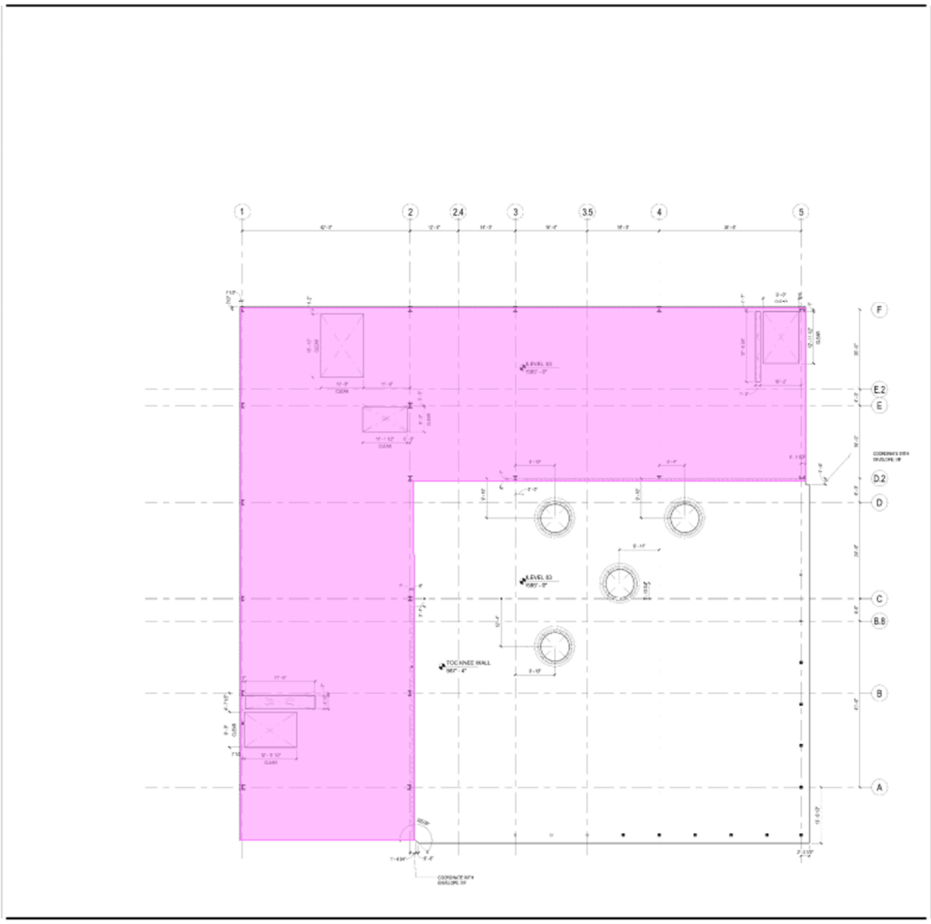
Project Name
Foisie Innovation Studio & Residence Building

Project Number
11.0076.000

Description
CONTROL PLAN - LEVEL 02 C.D.S.

Scale
0 2 4 8 16

A00.72



LEGEND

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 619-1700
(617) 619-1701

Date & Issue Description
1 50% 04 ISSUED FOR CONSTRUCTION

Seal/Signature

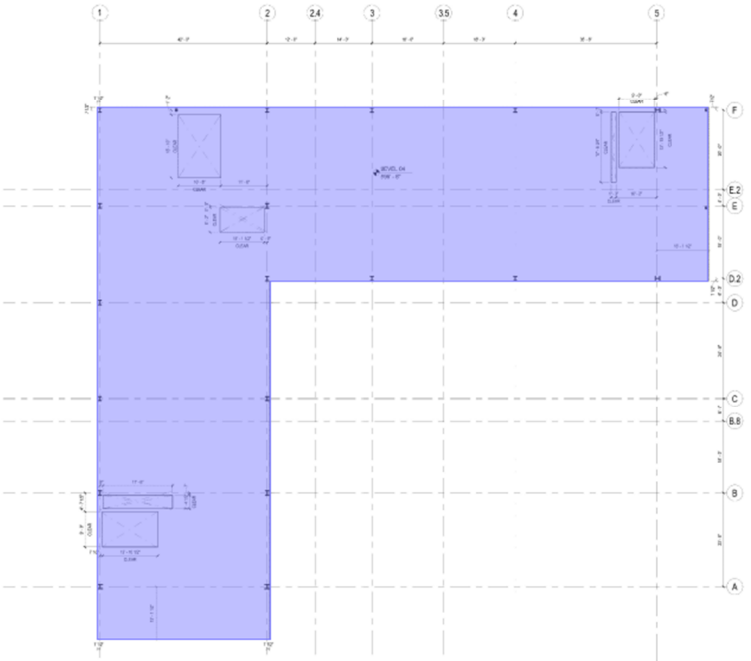
Project Name
Foisie Innovation Studio & Residence Building

Project Number
113878.000

Description
CONTROL PLAN - LEVEL 01 O.S.

Scale
0 2 4 8 16

A00.73



LEGEND

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 574-5780
(617) 574-5781

Date & Issue Description
1 12.07.16 ISSUED FOR CONSTRUCTION

Seal/Signature

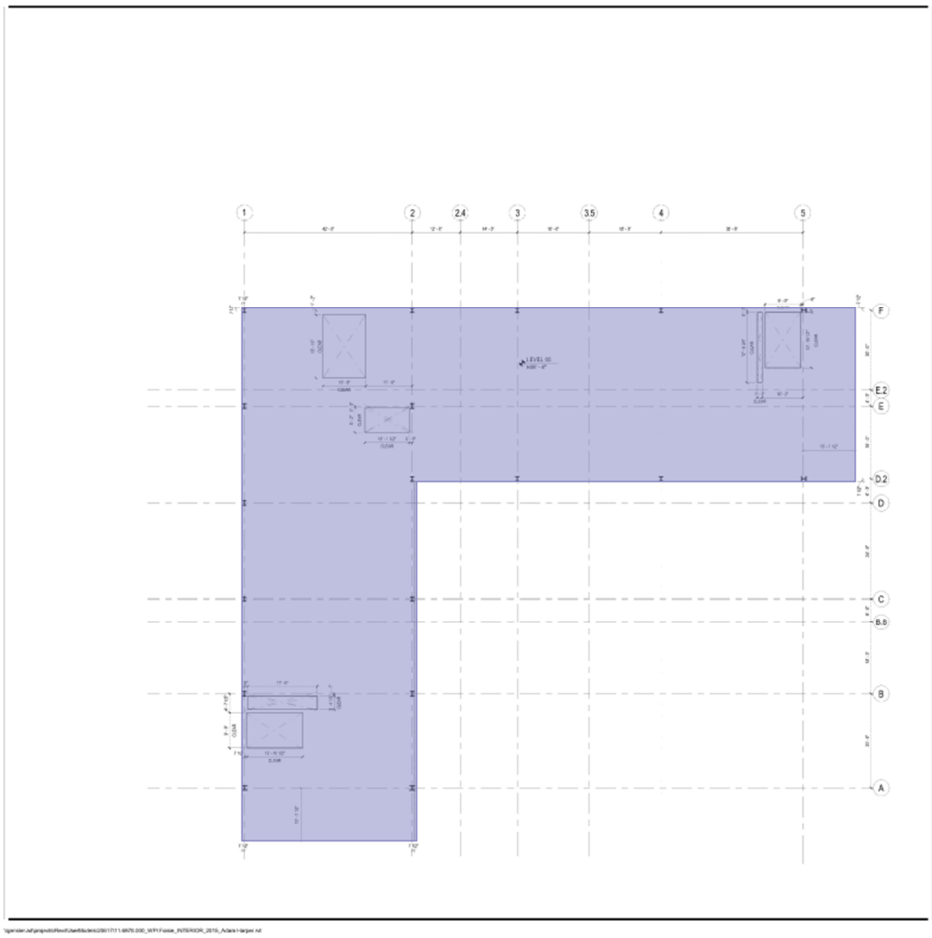
Project Name
Foisie Innovation Studio & Residence Building

Project Number
11.8676.000

Description
CONTROL PLAN - LEVEL 01 O.D.S.

Scale
0 2 4 8 16

A00.74



LEGEND

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 423-5780
(617) 423-5781

No.	Date & Issue Description
1	10.01.16 ISSUED FOR CONSTRUCTION

Seal/Signature

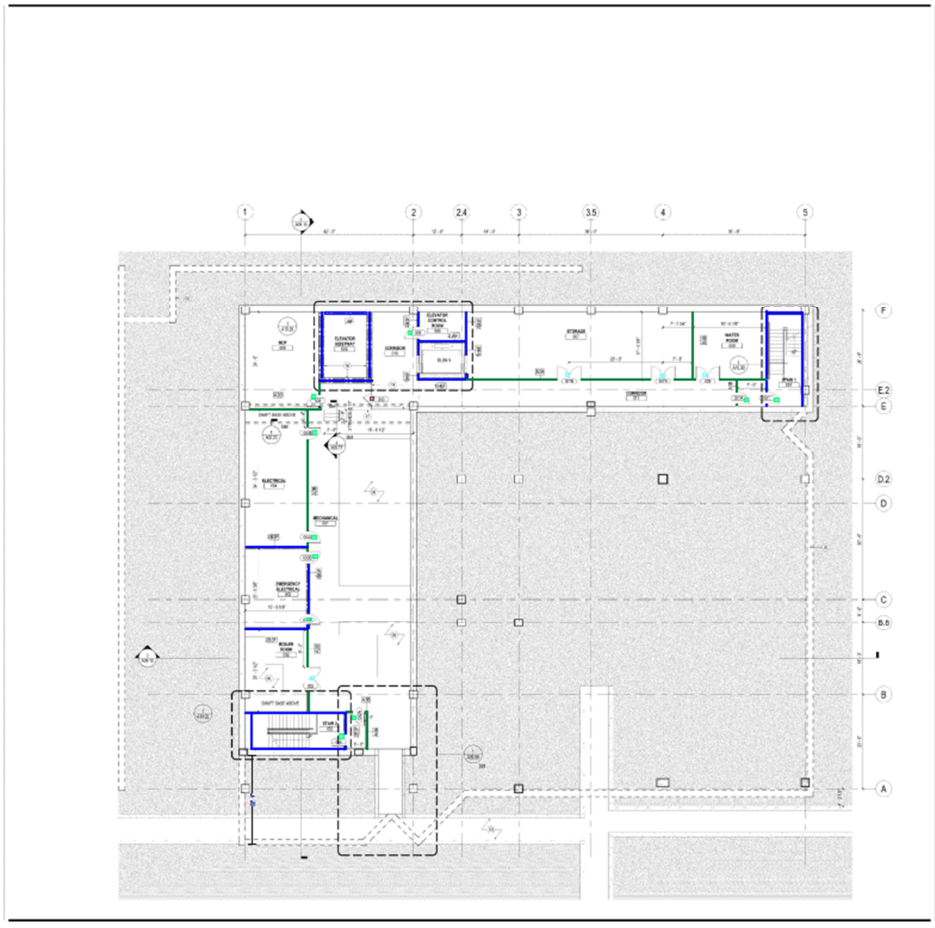
Project Name
Foisie Innovation Studio & Residence Building

Project Number
11.0076.000

Description
CONTROL PLAN - LEVEL 05 E.O.S.

Scale
0 2 4 8 16

A00.75



CONSTR. PLAN NOTES

01 NOT USED
02 FOUNDATION RETAINING WALL ABOVE - SEE STRUCTURAL
03 EXISTING UTILITY TUNNEL
04 MISC METAL FRAMING, REFER TO A06.00
05 REFER TO MEP DRAWINGS
06 NOT USED
07 REMOVABLE GUARDRAIL
08 HOUSEKEEPING PAD, REFER TO A 00.70
09 JOINT IN COPING
10 ROOF / OVERFLOW DRAIN
11 NOT USED
12 OPENING IN SHEETING. COORDINATE LOCATION WITH MECHANICAL EQUIPMENT
13 DUNNAGE - MECHANICAL SCREEN STRUCTURE; PLANS ALL ROOFTOP PENETRATIONS
14 ANCHOR TIE-OFF, REFER TO DETAIL 15
15 NOT USED
16 STANDPIPE
17 GALVANIZED GUARDRAIL
18 CAST-IN-PLACE CONCRETE, REFER TO STRUCTURAL
19 CONTROL METAL MESH PARTITION

GENERAL NOTES

NEW PARTITION
1 HR RATED PARTITION
2 HR RATED PARTITION
SMOKE PARTITION
ALLIGATOR
ALLIGATOR ABOVE
WALL TYPE KEYDENOTE
DOOR REFERENCE NUMBER, REFER TO DOOR SCHEDULE
DOOR TYPE
HARDWARE TYPE
DOOR NUMBER
DOOR TYPE / HARDWARE TYPE
WINDOW REFERENCE NUMBER (REFER TO WINDOW SCHEDULE)

A. REFER TO A00.10 FOR GRAPHIC SYMBOLS.
B. REFER TO A00.11 FOR ABBREVIATIONS AND TYPICAL NOTES.
C. REFER TO A00.20 SERIES FOR PARTITION TYPES AND TYPICAL DETAILS.
D. REFER TO A00.30 SERIES FOR DOOR SCHEDULE AND DOOR TYPES.
E. REFER TO A00.40 SERIES FOR TYPICAL VERTICAL MOUNTING HEIGHTS AND ADA FLOOR CLEARANCES.
F. PROVIDE PARTITION TYPE DIETYPICAL UNLESS NOTED OTHERWISE.
G. SITEWORK, LANDSCAPE/HARDSCAPE SHOWN FOR REFERENCE ONLY. REFER TO CIVIL DRAWINGS (SERIES "C") AND LANDSCAPE DRAWINGS (SERIES "L") FOR ADDITIONAL INFORMATION.

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston, MA 02108
(617) 619-1780
(617) 619-1781

Date & Issue Description
1 10.07.16 ISSUED FOR CONSTRUCTION

Seal/Signature

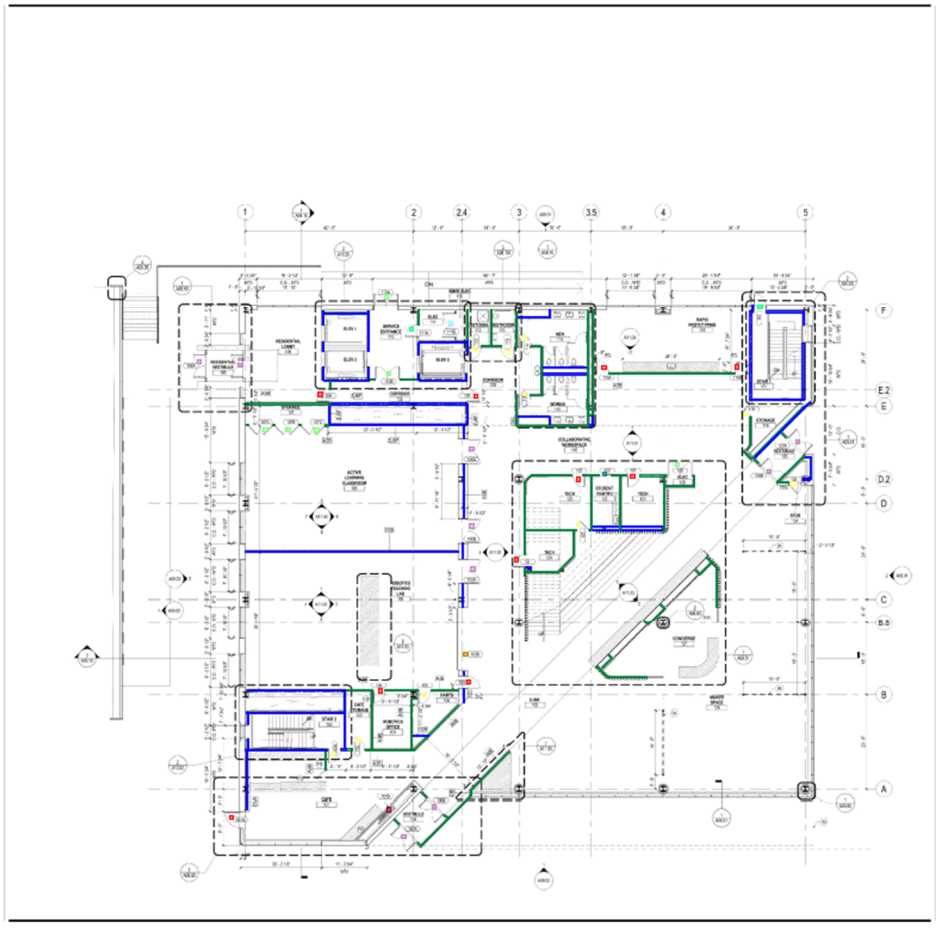
Project Name
Foisie Innovation Studio & Residence Building

Project Number
113876.000

Description
CONSTRUCTION PLAN - BASEMENT (ELEV. 139'-6")

Scale
0 2 4 8 16
1/8" = 1'-0"

A02.00



CONSTR. PLAN NOTES

01 NOT USED
02 FOUNDATION RETAINING WALL ABOVE - SEE STRUCTURAL
03 EXISTING UTILITY TUNNEL
04 MISC METAL FRAMING, REFER TO A06.00
05 REFER TO MEP DRAWINGS
06 NOT USED
07 REMOVABLE GUARDRAIL
08 HOUSEKEEPING PAD, REFER TO A-00.70
09 JOINT IN COPING
10 ROOF OVERFLOW DRAIN
11 NOT USED
12 OPENING IN SHEATING, COORDINATE LOCATION WITH MECHANICAL EQUIPMENT
13 DUNNAGE / MECHANICAL SCREEN STRUCTURE, PLANS ALL ROOFTOP PENETRATIONS
14 ANCHOR TIE-OFF, REFER TO 07.65.70
15 NOT USED
16 STANDPIPE
17 GALVANIZED GUARDRAIL
18 CAST-IN-PLACE CONCRETE, REFER TO STRUCTURAL
19 CONTROL METAL MESH PARTITION

GENERAL NOTES

A. REFER TO A00.10 FOR GRAPHIC SYMBOLS.
B. REFER TO A00.11 FOR ABBREVIATIONS AND TYPICAL NOTES.
C. REFER TO A00.20 SERIES FOR PARTITION TYPES AND TYPICAL DETAILS.
D. REFER TO A00.30 SERIES FOR DOOR SCHEDULE AND TYPICAL DETAILS.
E. REFER TO A00.40 SERIES FOR TYPICAL VERTICAL MOUNTING HEIGHTS AND ADA FLOOR CLEARANCES.
F. PROVIDE FIRESTOP TYPE CW TYPICAL UNLESS NOTED OTHERWISE
G. STRIPPING, LAYOUT, GRADING AND HARDSCAPE DESIGN FOR REFERENCE ONLY. REFER TO CIVIL DRAWINGS (SERIES 1.1) AND LANDSCAPE DRAWINGS (SERIES 1.1) FOR ADDITIONAL INFORMATION.

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston, MA 02108
(617) 619-1700
(617) 619-1701

Date & Issue Description
1 10.07.14 ISSUED FOR CONSTRUCTION

Seal/Signature

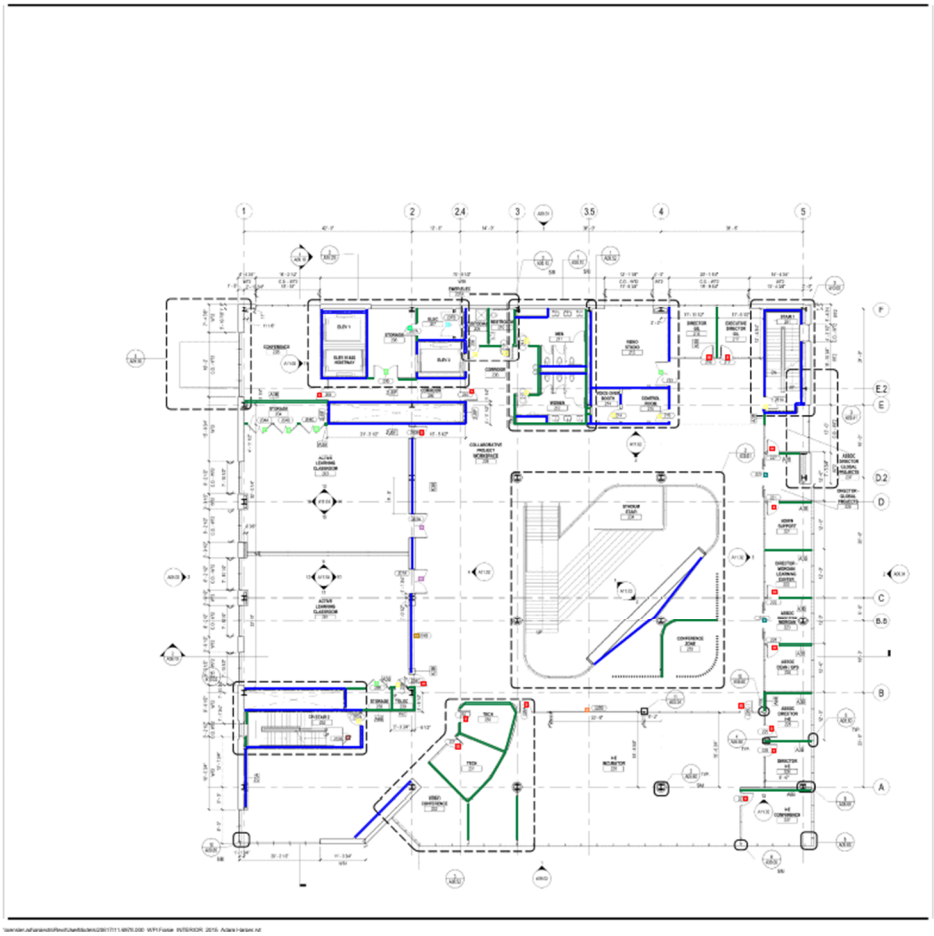
Project Name
Foisie Innovation Studio & Residence Building

Project Number
11.8676.000

Description
CONSTRUCTION PLAN - LEVEL 01 (EQUIV. 1ST FL)

Scale
0 2 4 8 16

A02.01



CONSTR. PLAN NOTES

01 NOT USED
02 FOUNDATION RETAINING WALL ABOVE - SEE STRUCTURAL
03 EXISTING UTILITY TUNNEL
04 MISC METAL FRAMING, REFER TO A06.00
05 REFER TO MEP DRAWINGS
06 NOT USED
07 REMOVABLE GUARDRAIL
08 HOUSEKEEPING PAD, REFER TO A-00.70
09 JOINT IN COPING
10 ROOF OVERFLOW DRAIN
11 NOT USED
12 OPENING IN SHEATING, COORDINATE LOCATION WITH MECHANICAL EQUIPMENT
13 DUNNAGE - MECHANICAL SCREEN STRUCTURE, PLANS ALL ROOFTOP PENETRATIONS
14 ANCHOR TIE OFF, REFER TO DETAILS
15 NOT USED
16 STANDPIPE
17 GALVANIZED GUARDRAIL
18 CAST-IN-PLACE CONCRETE, REFER TO STRUCTURAL
19 CONTRO METAL HIGH PARTITION

GENERAL NOTES

A. REFER TO A00.10 FOR GRAPHIC SYMBOLS.
B. REFER TO A00.11 FOR ABBREVIATIONS AND TYPICAL NOTES.
C. REFER TO A10.00 SERIES FOR PARTITION TYPES AND TYPICAL DETAILS.
D. REFER TO A12.00 SERIES FOR DOOR SCHEDULE AND TYPICAL DETAILS.
E. REFER TO A20.00 SERIES FOR PHYSICAL VERTICAL MOUNTING HEIGHTS AND ADA FLOOR CLEARANCES.
F. WHERE PARTITION TYPE D/B TYPICAL UNLESS NOTED OTHERWISE.
G. SITEWORK, LANDSCAPE/HARDSCAPE SHOWN FOR REFERENCE ONLY. REFER TO CIVIL DRAWINGS (SERIES "C") AND LANDSCAPE DRAWINGS (SERIES "L") FOR ADDITIONAL INFORMATION.

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 619-7760
(617) 619-7761

Date & Issue Description
1 10.27.16 ISSUED FOR CONSTRUCTION

Seal/Signature

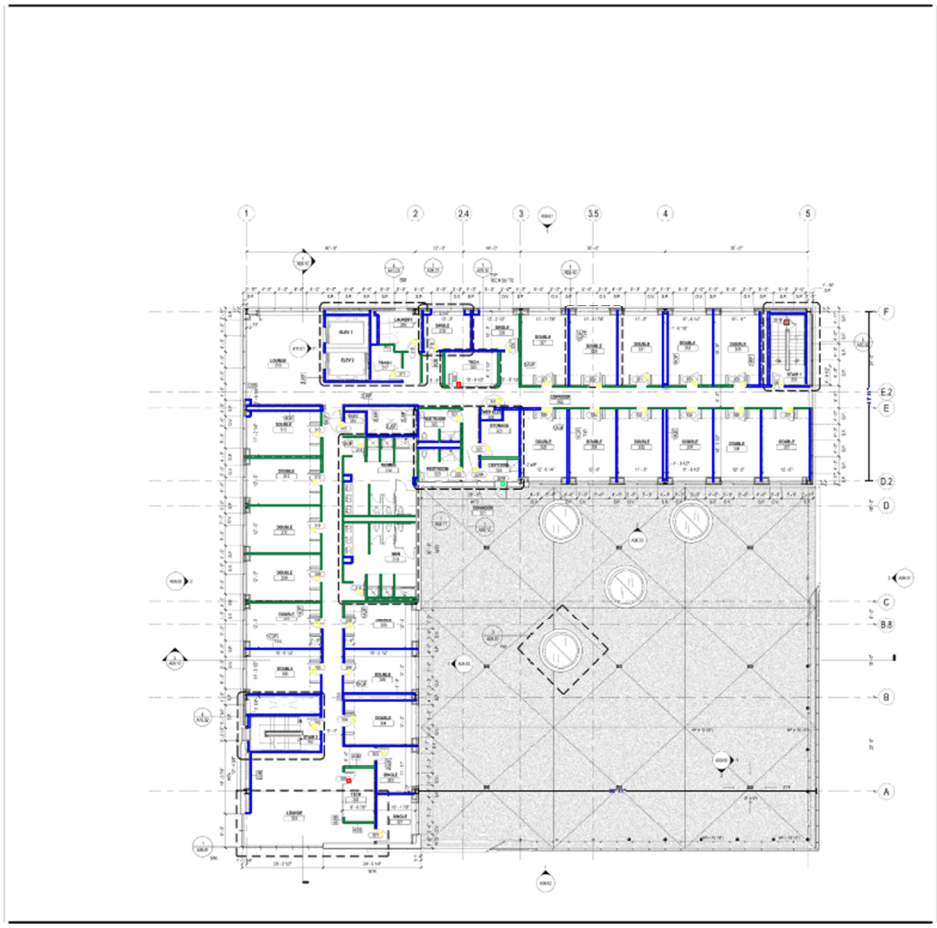
Project Name
Foisie Innovation Studio & Residence Building

Project Number
113876.000

Description
CONSTRUCTION PLAN - LEVEL 02 (CLEV. 197'-0")

Scale
0 2' 4' 8' 16'

A02.02



CONSTR. PLAN NOTES

01 NOT USED
02 FOUNDATION RETAINING WALL ABOVE - SEE STRUCTURAL
03 EXISTING UTILITY TUNNEL
04 MISC METAL FRAMING, REFER TO A06.00
05 REFER TO MEP DRAWINGS
06 NOT USED
07 REMOVABLE GUARDRAIL
08 HOUSEKEEPING PAD, REFER TO A.00.70
09 JOINT IN COPING
10 ROOF OVERFLOW DRAIN
11 NOT USED
12 OPENING IN SHEATHING, COORDINATE LOCATION WITH MECHANICAL EQUIPMENT
13 DUNNAGE / MECHANICAL SCREEN STRUCTURE; PLAN ALL ROOFING PENETRATIONS
14 ANCHOR TIE-OFF, REFER TO 07.60.70
15 NOT USED
16 STANDPIPE
17 GALVANIZED GUARDRAIL
18 CAST-IN-PLACE CONCRETE, REFER TO STRUCTURAL
19 CONTRO METAL, MEGA PARTITION

GENERAL NOTES

NEW PARTITION
1-HR RATED PARTITION
2-HR RATED PARTITION
SHAFT PARTITION
ELEVATION
ELEVATION ABOVE
WALL TYPE REFERENCE
DOOR REFERENCE NUMBER (REFER TO DOOR SCHEDULE)
DOOR TYPE
HARDWARE TYPE
PAINT & FINISH
DOOR TYPE / HARDWARE TYPE
WINDOW REFERENCE NUMBER (REFER TO WINDOW SCHEDULE)

A. REFER TO A00.10 FOR GRAPHIC SYMBOLS.
B. REFER TO A00.11 FOR ABBREVIATIONS AND TYPICAL DETAILS.
C. REFER TO A01.20 SERIES FOR PARTITION TYPES AND TYPICAL DETAILS.
D. REFER TO A01.30 SERIES FOR DOOR SCHEDULE AND TYPICAL DETAILS.
E. REFER TO A02.41 SERIES FOR TYICAL VERTICAL MOUNTING HEIGHTS AND ADA FLOOR CLEARANCES.
F. PROVIDE PARTITION TYPE DSI TYPICAL, UNLESS NOTED OTHERWISE.
G. SITEWORK, LANDSCAPE/HARDSCAPE SHOWN FOR REFERENCE ONLY. REFER TO CIVIL DRAWINGS SERIES "C1" AND LANDSCAPE DRAWINGS (SERIES "L") FOR ADDITIONAL INFORMATION.

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 574-1700
(617) 574-1701

Date & Issue Description
1 10.01.14 ISSUED FOR CONSTRUCTION

Seal/Signature

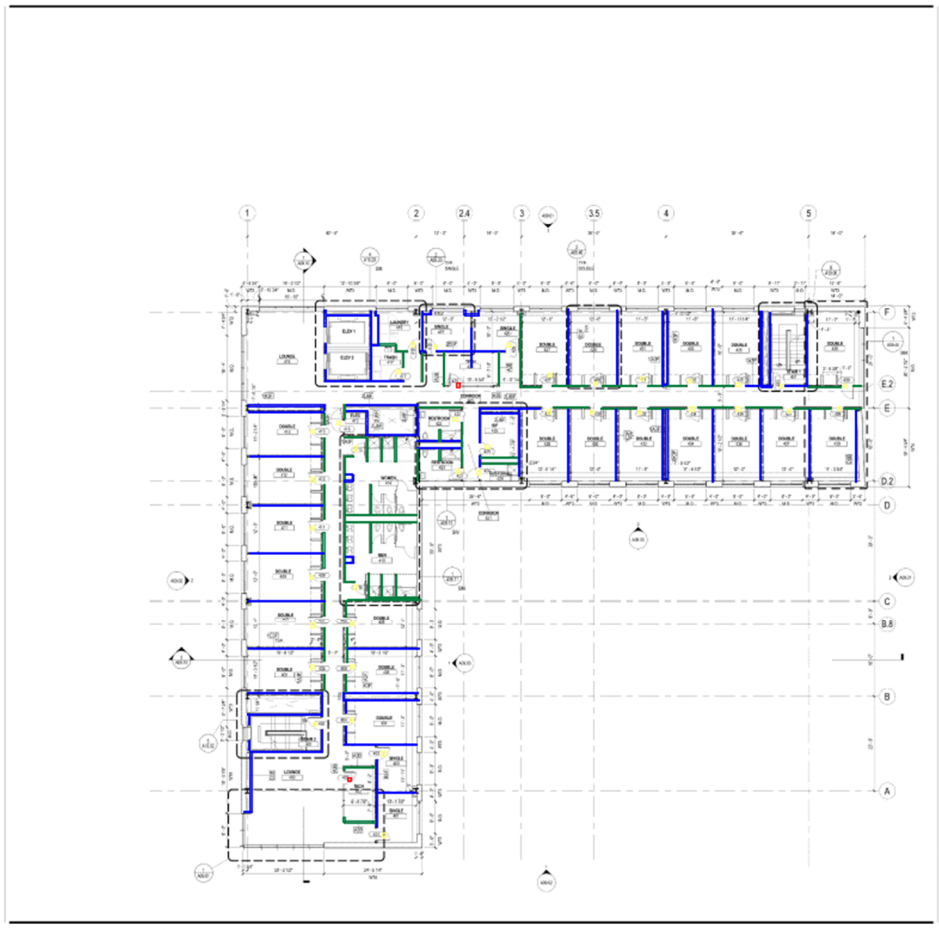
Project Name
Foisie Innovation Studio & Residence Building

Project Number
11.9979.000

Description
CONSTRUCTION PLANS - LEVEL 01 (EQUIV. 100'-0")

Scale
0 2 4 8 16

A02.03



CONSTR. PLAN NOTES

01 NOT USED
02 FOUNDATION RETAINING WALL ABOVE - SEE STRUCTURAL
03 EXISTING UTILITY TUNNEL
04 MISC METAL FRAMING, REFER TO A06.00
05 REFER TO MEP DRAWINGS
06 NOT USED
07 REMOVABLE GUARDRAIL
08 HOUSEKEEPING PAD, REFER TO A-00.70
09 JOINT IN COPING
10 ROOF / OVERFLOW DRAIN
11 NOT USED
12 OPENING IN SHEATING. COORDINATE LOCATION WITH MECHANICAL EQUIPMENT
13 DUNNAGE - MECHANICAL SCREEN STRUCTURE, PLACE ALL ROOFING PENETRATIONS
14 ANCHOR TIE OFF, REFER TO DETAIL 70
15 NOT USED
16 STANDPIPE
17 GALVANIZED GUARDRAIL
18 CAST-IN-PLACE CONCRETE, REFER TO STRUCTURAL
19 CONTED METAL MESH PARTITION

GENERAL NOTES

A. REFER TO A00.10 FOR GRAPHIC SYMBOLS.
B. REFER TO A00.11 FOR ABBREVIATIONS AND TYPICAL NOTES.
C. REFER TO A00.30 SERIES FOR PARTITION TYPES AND TYPICAL DETAILS.
D. REFER TO A00.30 SERIES FOR DOOR SCHEDULE AND TYPICAL DETAILS.
E. REFER TO A00.40 SERIES FOR TYPICAL VERTICAL ASSEMBLIES, REFLECTED CEILING PLANS.
F. ARCHITECTURAL FINISH TYPE (TBD TYPICAL UNLESS NOTED OTHERWISE).
G. SITEWORK, LANDSCAPE/HARDSCAPE SHOWN FOR REFERENCE ONLY. REFER TO CIVIL/LANDSCAPE DRAWINGS (SERIES "C", AND L, RESPECTIVELY).

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 423-7700
(617) 423-7701

Date & Issue Description
1 10.07.24 ISSUED FOR CONSTRUCTION

Seal/Signature

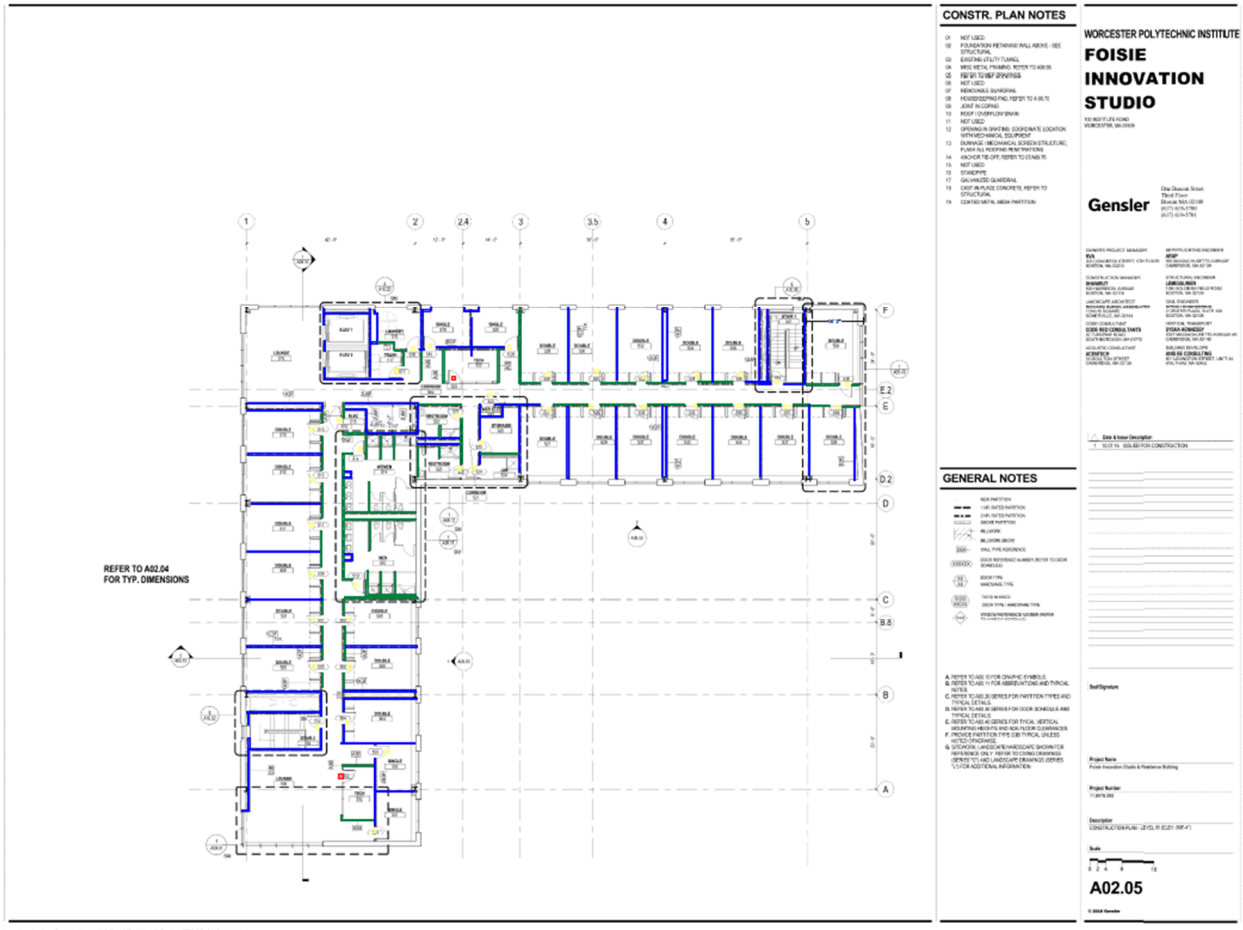
Project Name
Foisie Innovation Studio & Residence Building

Project Number
11.8676.000

Description
CONSTRUCTION PLAN - LEVEL 01 (GF)

Scale
0 2 4 8 16
1/8" = 1'-0"

A02.04



CONSTR. PLAN NOTES

01 NOT USED
02 FOUNDATION RETAINING WALL ABOVE - SEE STRUCTURAL
03 EXISTING UTILITY TUNNEL
04 MISC METAL FRAMING, REFER TO A06.00
05 REFER TO RISE DRAWINGS
06 NOT USED
07 REMOVABLE GUARDRAIL
08 HOUSEKEEPING PAD, REFER TO A 06.70
09 JOINT IN COPING
10 ROOF / OVERFLOW DRAIN
11 NOT USED
12 OPENING IN SHEATHING. COORDINATE LOCATION WITH MECHANICAL EQUIPMENT
13 DUNNAGE - MECHANICAL SCREEN STRUCTURE; PLEASE ALL ROOFING RESTRICTIONS
14 ANCHOR TIE-OFF, REFER TO COMS.70
15 NOT USED
16 STANDPIPE
17 GALVANIZED GUARDRAIL
18 CAST-IN-PLACE CONCRETE, REFER TO STRUCTURAL
19 CONTRO METAL MESH PARTITION

GENERAL NOTES

NON PARTITION
1 HR. RATED PARTITION
2 HR. RATED PARTITION
SMOKE PARTITION
RELATION
RE-LAYDOWN AREAS
WALL TYPE REFERENCE
DOOR REFERENCE NUMBER, REFER TO DOOR SCHEDULE
DOOR TYPE
HARDWARE TYPE
TEMPO W WINDO
DOOR TYPE - HARDWARE TYPE
STUDY REFERENCE NUMBER (REFER TO ROOM SCHEDULE)

A. REFER TO A00.10 FOR GRAPHIC SYMBOLS.
B. REFER TO A00.11 FOR ABBREVIATIONS AND TYPICAL NOTES.
C. REFER TO A02.30 SERIES FOR PARTITION TYPES AND TYPICAL DETAILS.
D. REFER TO A02.40 SERIES FOR DOOR SCHEDULE AND TYPICAL DETAILS.
E. REFER TO A02.40 SERIES FOR TYICAL VERTICAL MOUNTED HEIGHTS AND ADA FLOOR CLEARANCES
F. REFER TO A02.40 FOR TYPE (CB) TYPICAL UNLESS NOTED OTHERWISE.
G. SITEWORK, LANDSCAPE/HARDSCAPE SHOWN FOR REFERENCE ONLY. REFER TO CIVING DRAWINGS (SERIES "C") AND LANDSCAPE DRAWINGS (SERIES "L") FOR ADDITIONAL INFORMATION.

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 574-1700
(617) 574-1701

No.	Date & Issue Description
1	10.07.24 ISSUED FOR CONSTRUCTION

Seal/Signature

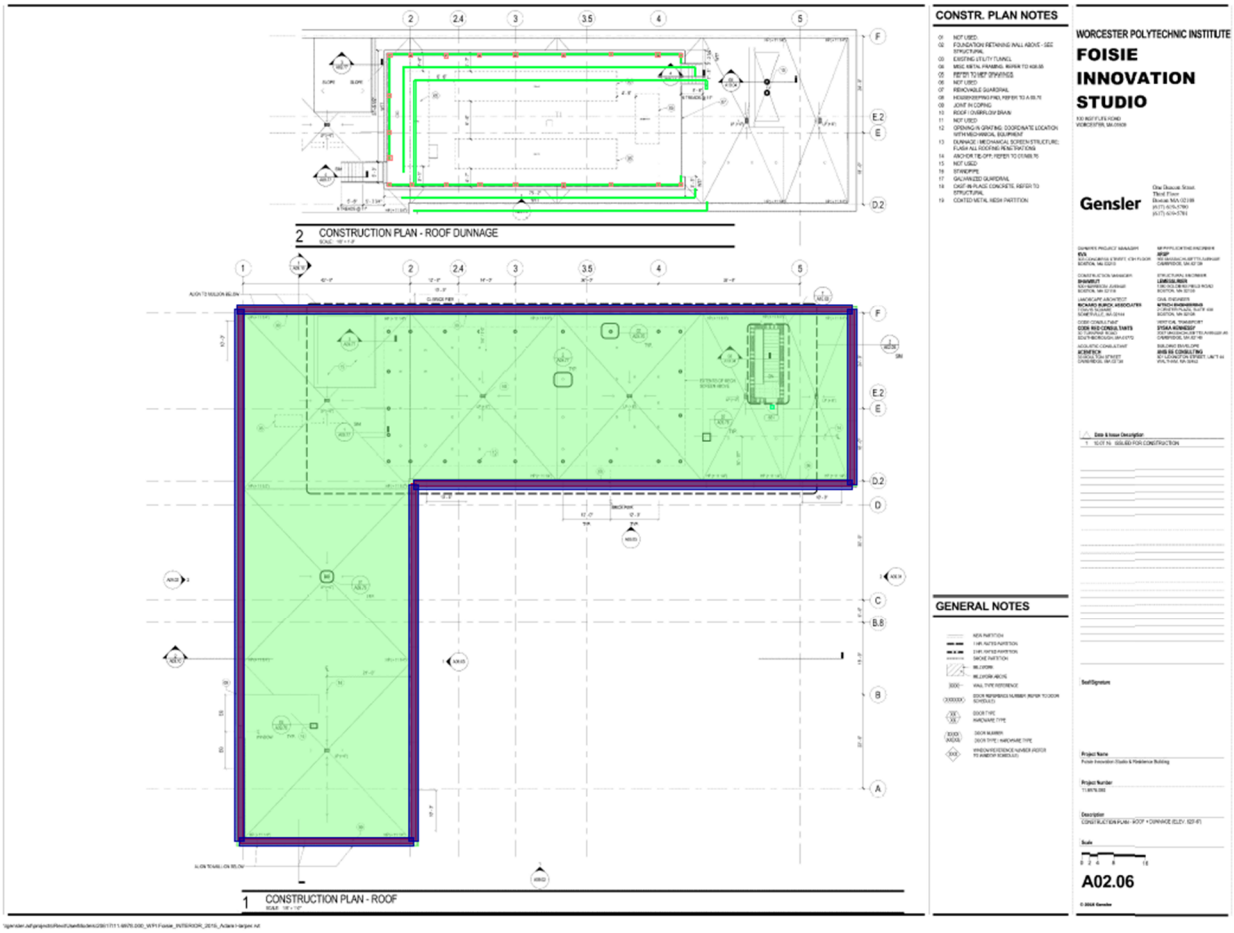
Project Name
Foisie Innovation Studio & Residence Building

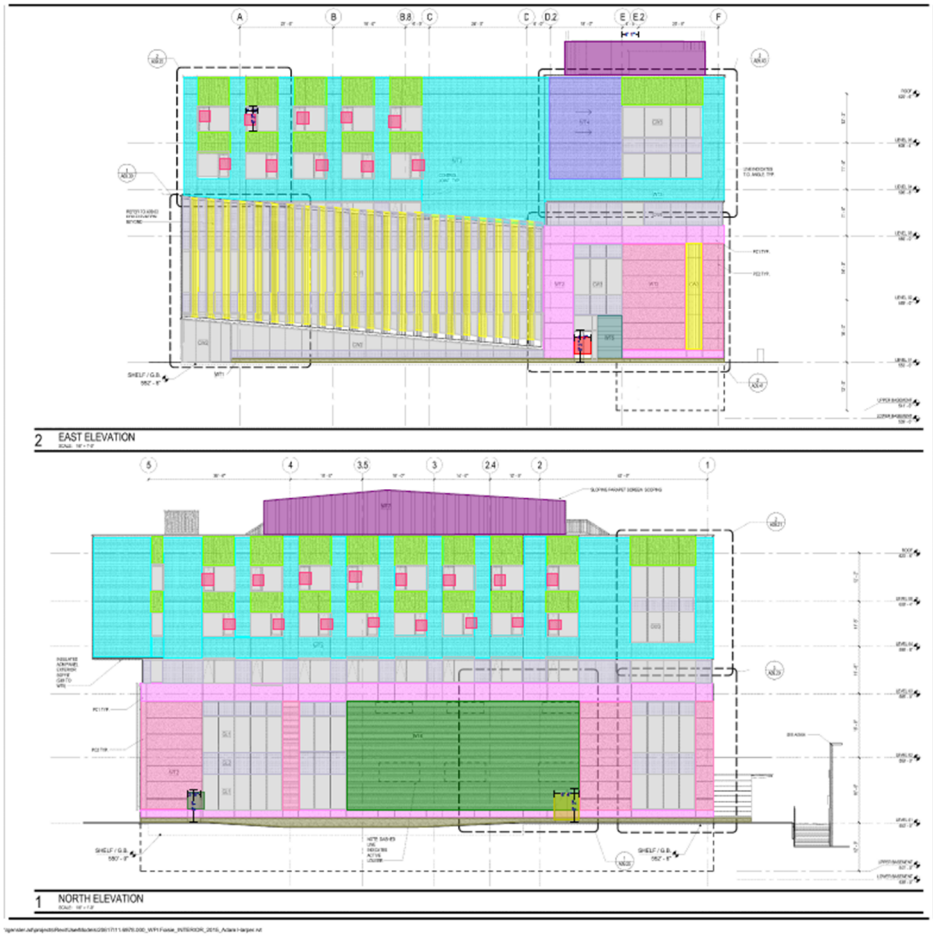
Project Number
113878.000

Description
CONSTRUCTION PLAN - LEVEL 01 (LEV. 1MF-F1

Scale
0 2 4 8 16

A02.05


2 CONSTRUCTION PLAN - ROOF DUNNAGE
1 CONSTRUCTION PLAN - ROOF
CONSTR. PLAN NOTES
GENERAL NOTES
WORCESTER POLYTECHNIC INSTITUTE
FOISIE
INNOVATION
STUDIO
Gensler
A02.06



GENERAL NOTES

WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

Gensler

A09.01

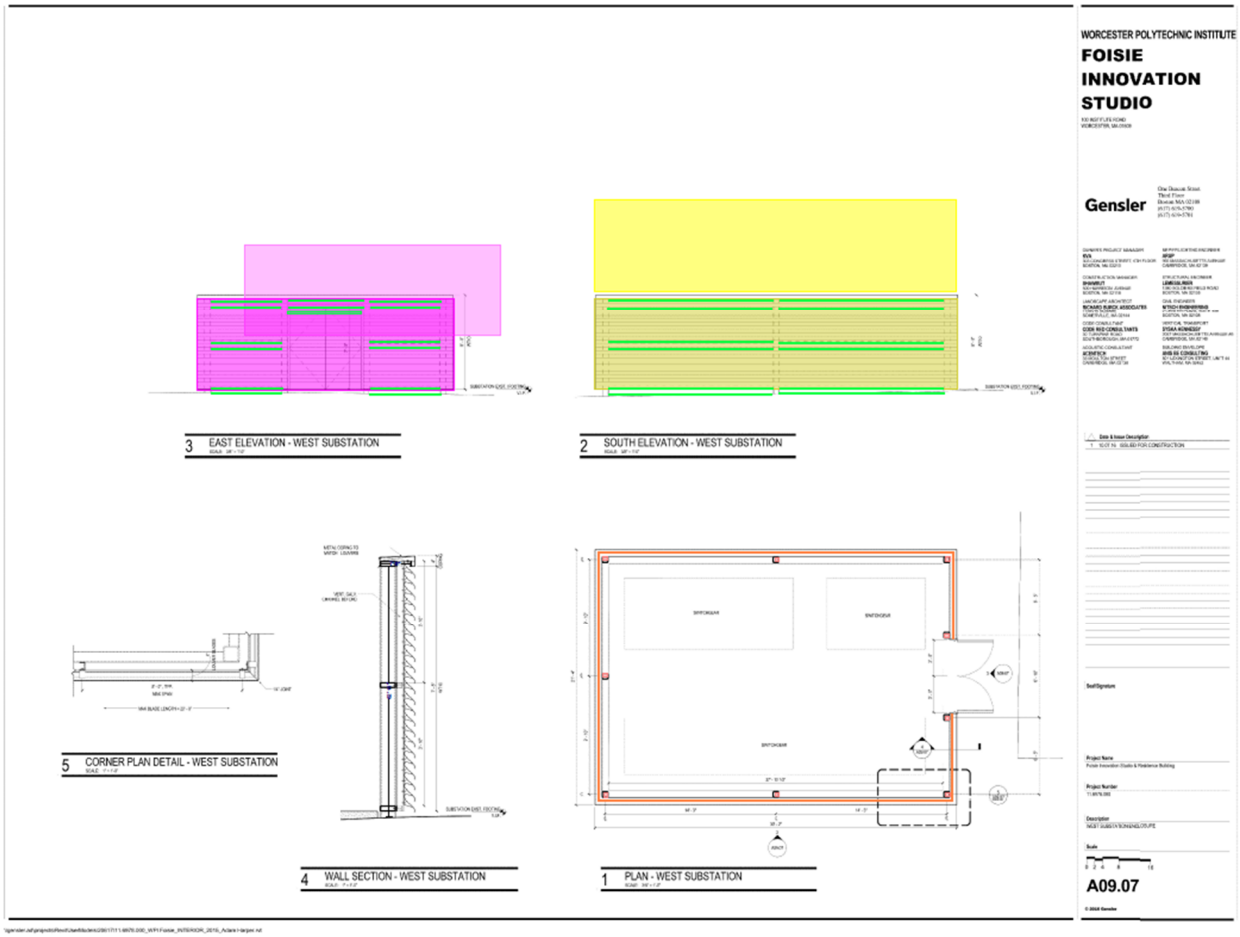
GENERAL NOTES

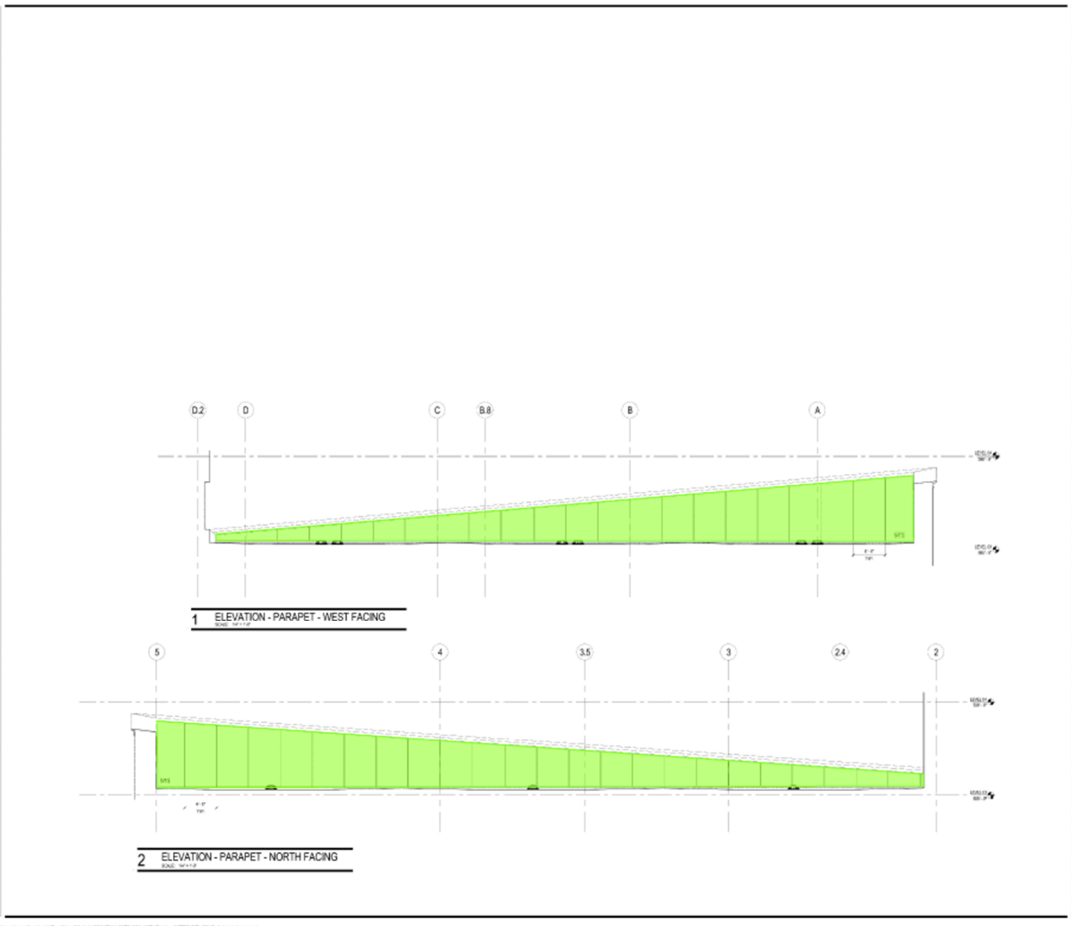
WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

Gensler

A09.02


3 EAST ELEVATION - WEST SUBSTATION
2 SOUTH ELEVATION - WEST SUBSTATION
5 CORNER PLAN DETAIL - WEST SUBSTATION
4 WALL SECTION - WEST SUBSTATION
1 PLAN - WEST SUBSTATION
WORCESTER POLYTECHNIC INSTITUTE
FOISIE INNOVATION STUDIO
Gensler
A09.07



WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 574-7760
(617) 574-7761

Date & Issue Description
1 10.01.14 ISSUED FOR CONSTRUCTION

Seal/Signature

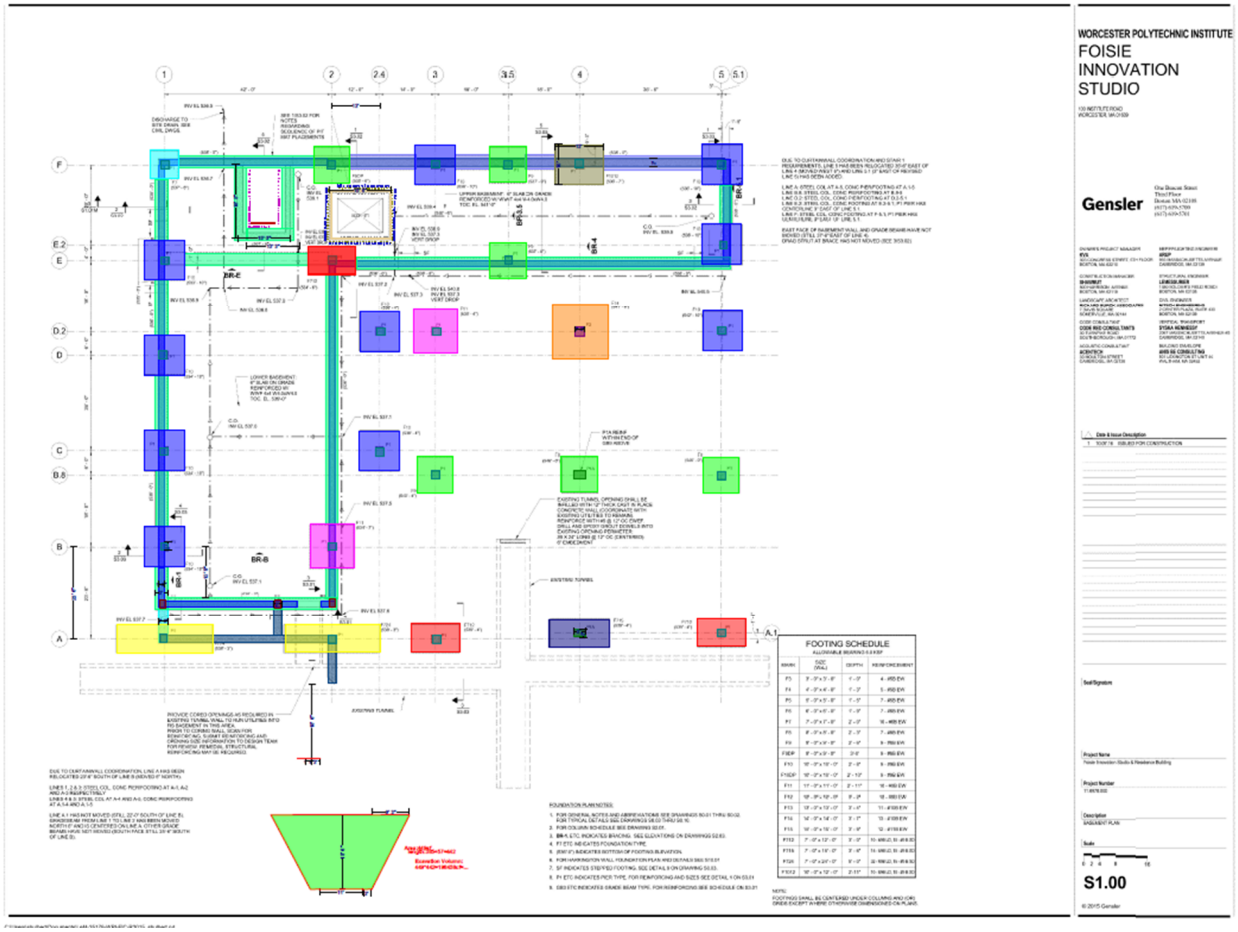
Project Name
Foisie Innovation Studio & Residence Building

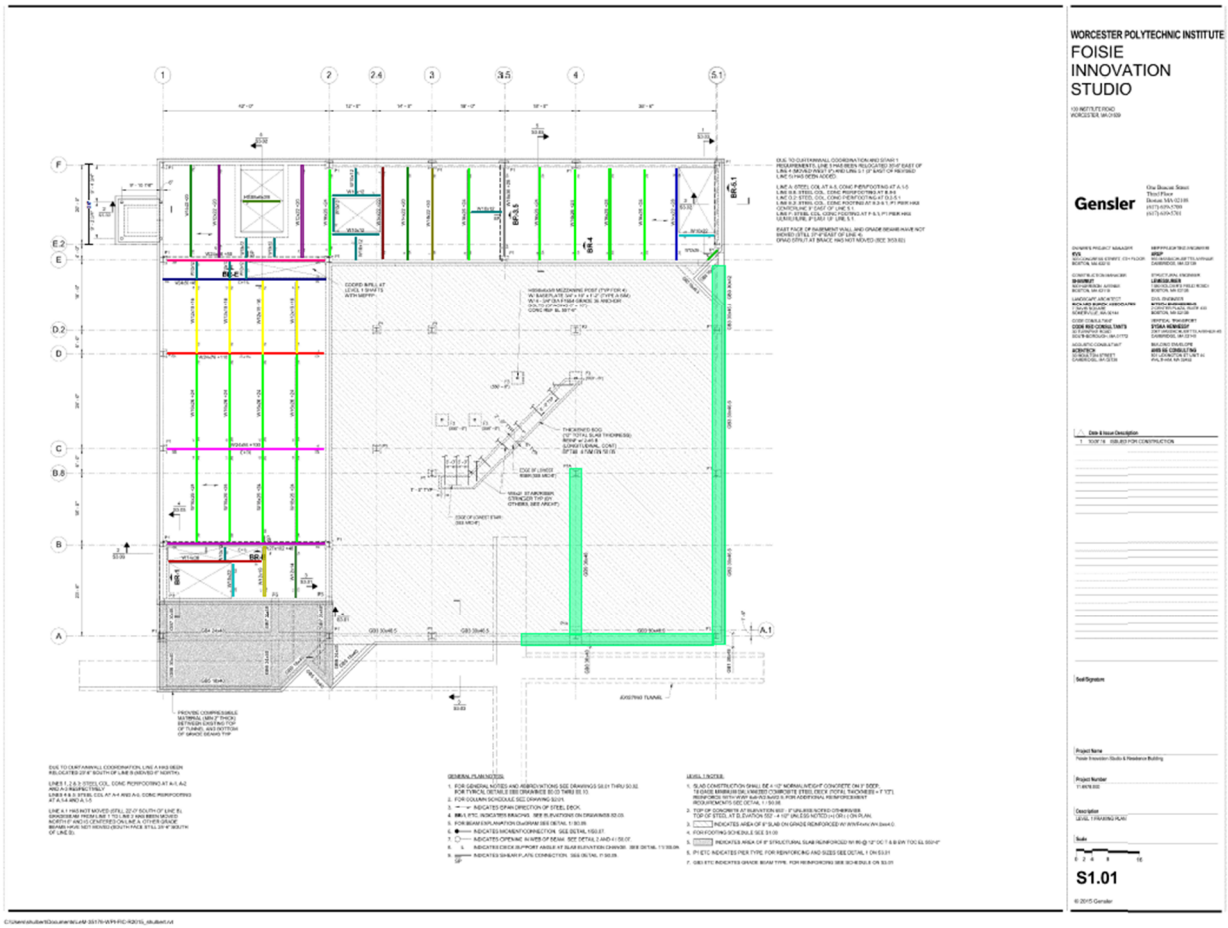
Project Number
11.0876.000

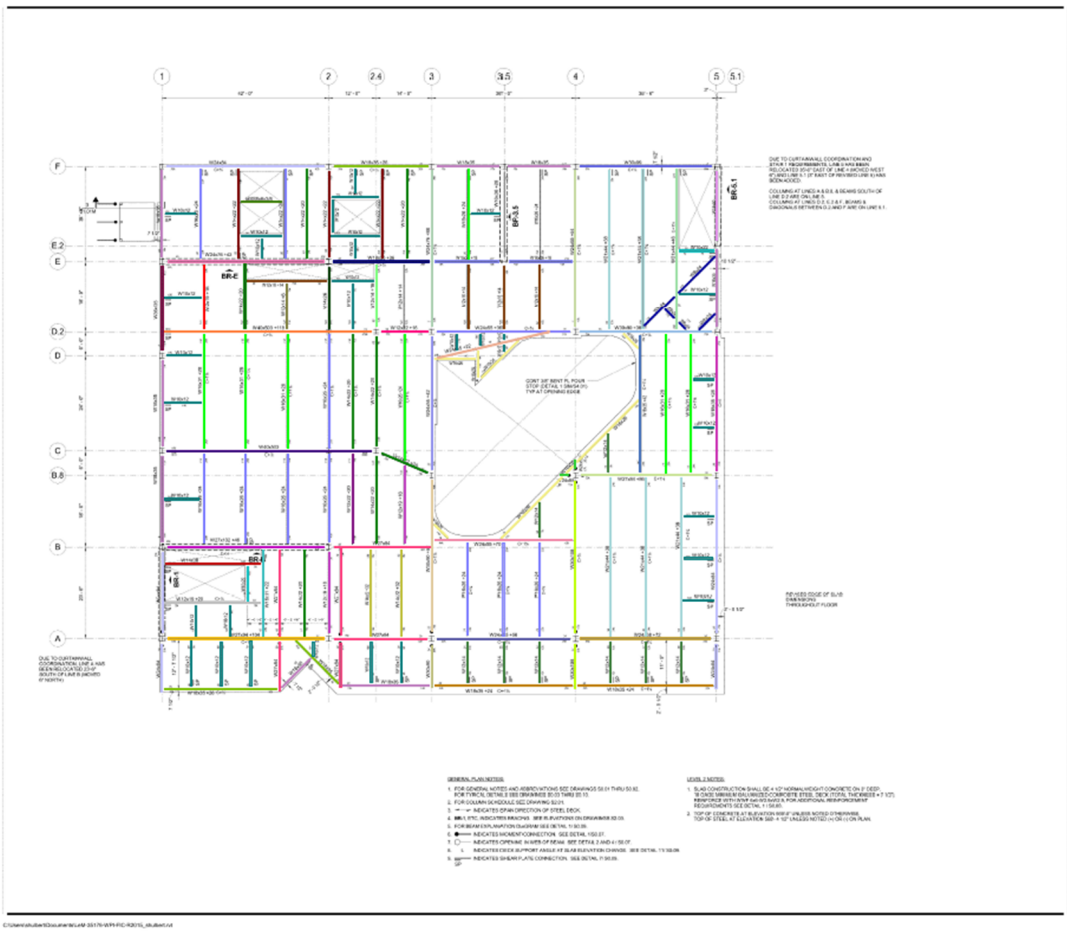
Description
PARAPET ELEVATIONS - LEVEL 7

Scale
0 2 4 8 16

A09.08


WORCESTER POLYTECHNIC INSTITUTE
FOISIE
INNOVATION
STUDIO
Gensler
FOOTING SCHEDULE
S1.00


WORCESTER POLYTECHNIC INSTITUTE
FOISIE
INNOVATION
STUDIO
Gensler
S1.01



WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 619-1700
(617) 619-1701

Date & Issue Description
1 50% CD ISSUED FOR CONSTRUCTION

Seal Signature

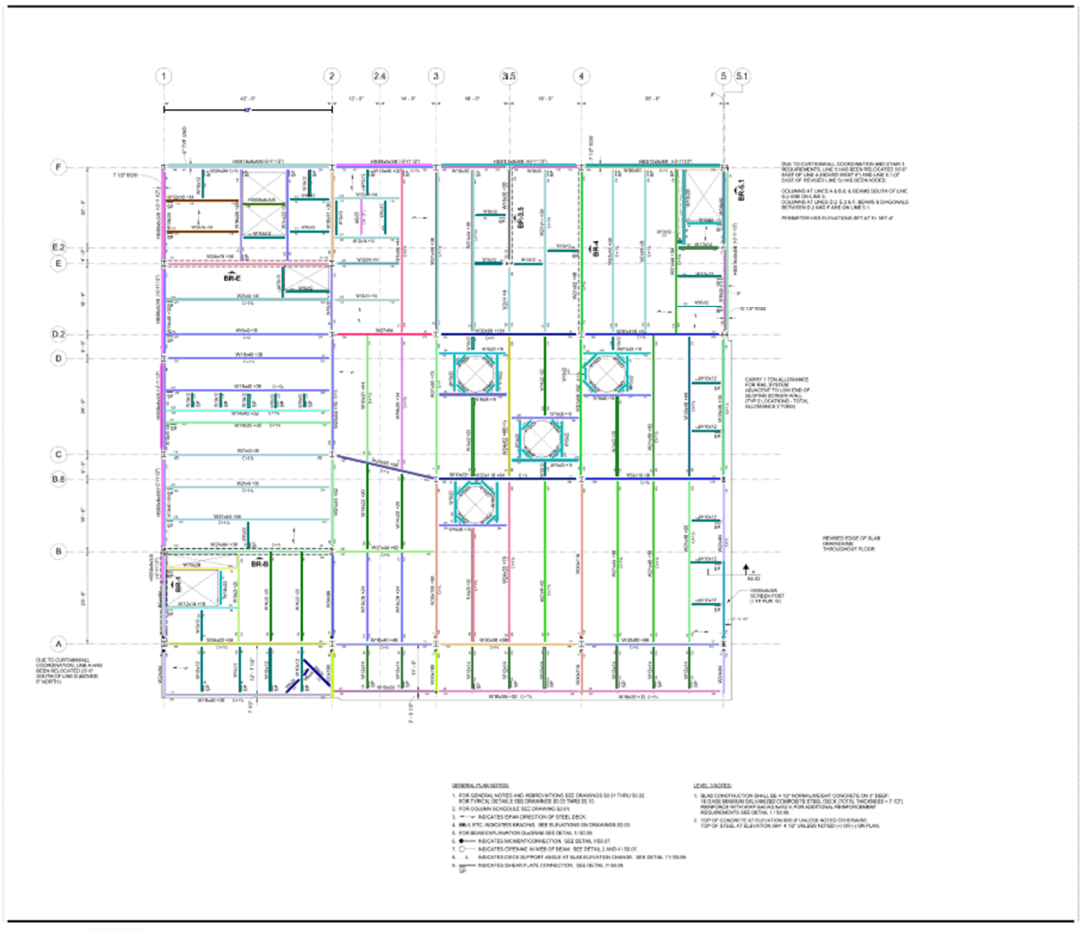
Project Name
Foisie Innovation Studio & Residence Building

Project Number
114978.002

Description
LEVEL 2 FRAMING PLAN

Scale
0 2 4 8 16

S1.02



WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston, MA 02108
(617) 423-1700
(617) 423-7301

No.	Date & Issue Description
1	10.07.16 ISSUED FOR CONSTRUCTION

Seal/Signature

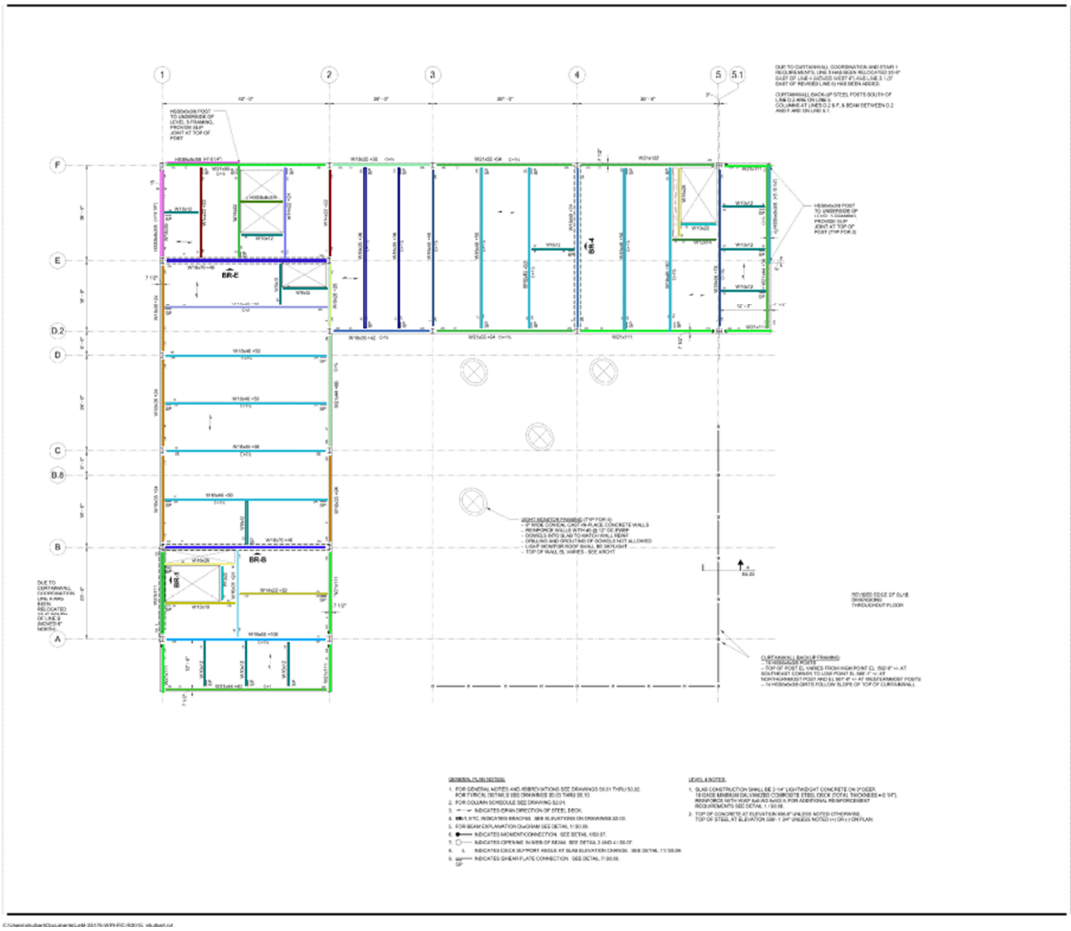
Project Name
Foisie Innovation Studio & Residence Building

Project Number
114878.000

Description
LEVEL 1 FRAMING PLAN

Scale
0 2 4 8 16

S1.03



WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

S1.04

WORCESTER POLYTECHNIC INSTITUTE
FOISIE
INNOVATION
STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston, MA 02108
(617) 619-1700
(617) 619-1701

	Date & Issue Description
1	10.09.14 ISSUED FOR CONSTRUCTION

Seal/Signature

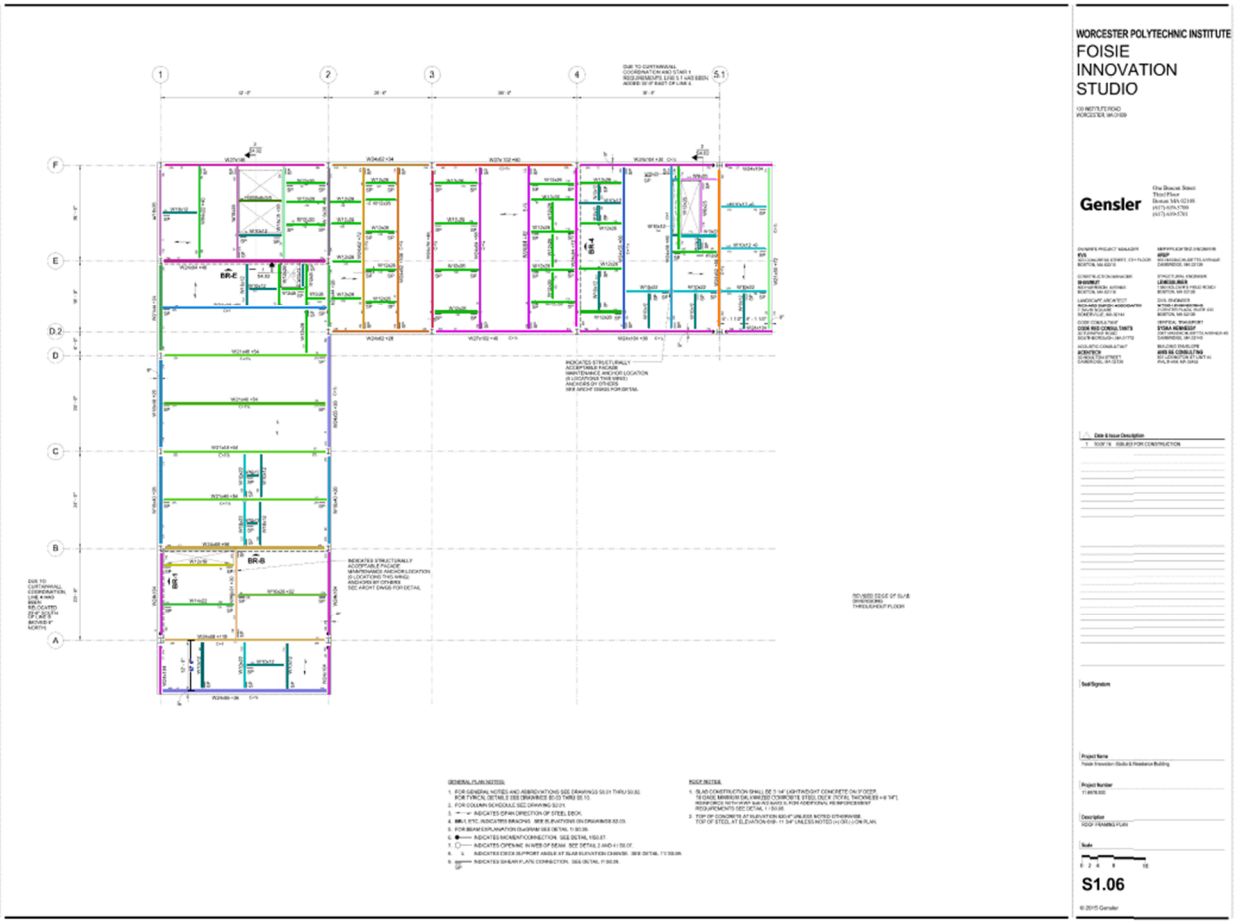
Project Name
Foisie Innovation Studio & Residence Building

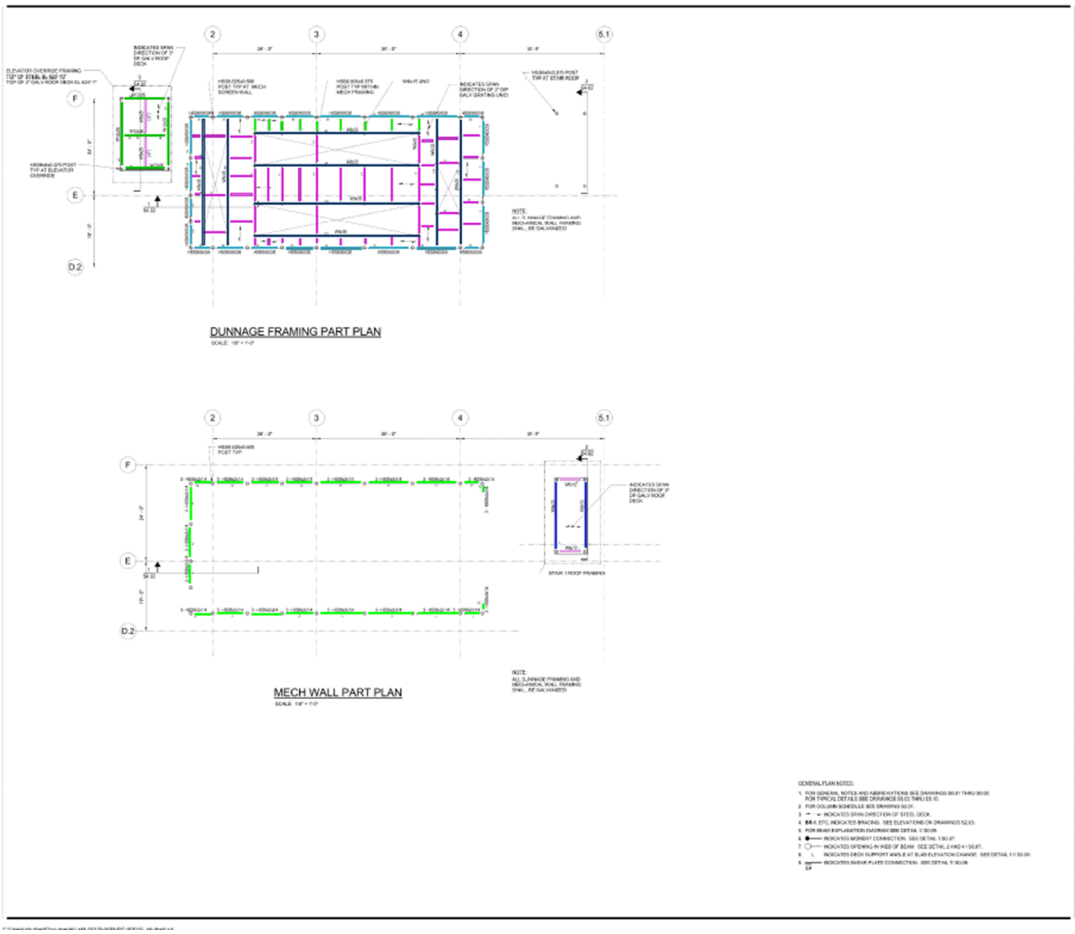
Project Number
11.8678.000

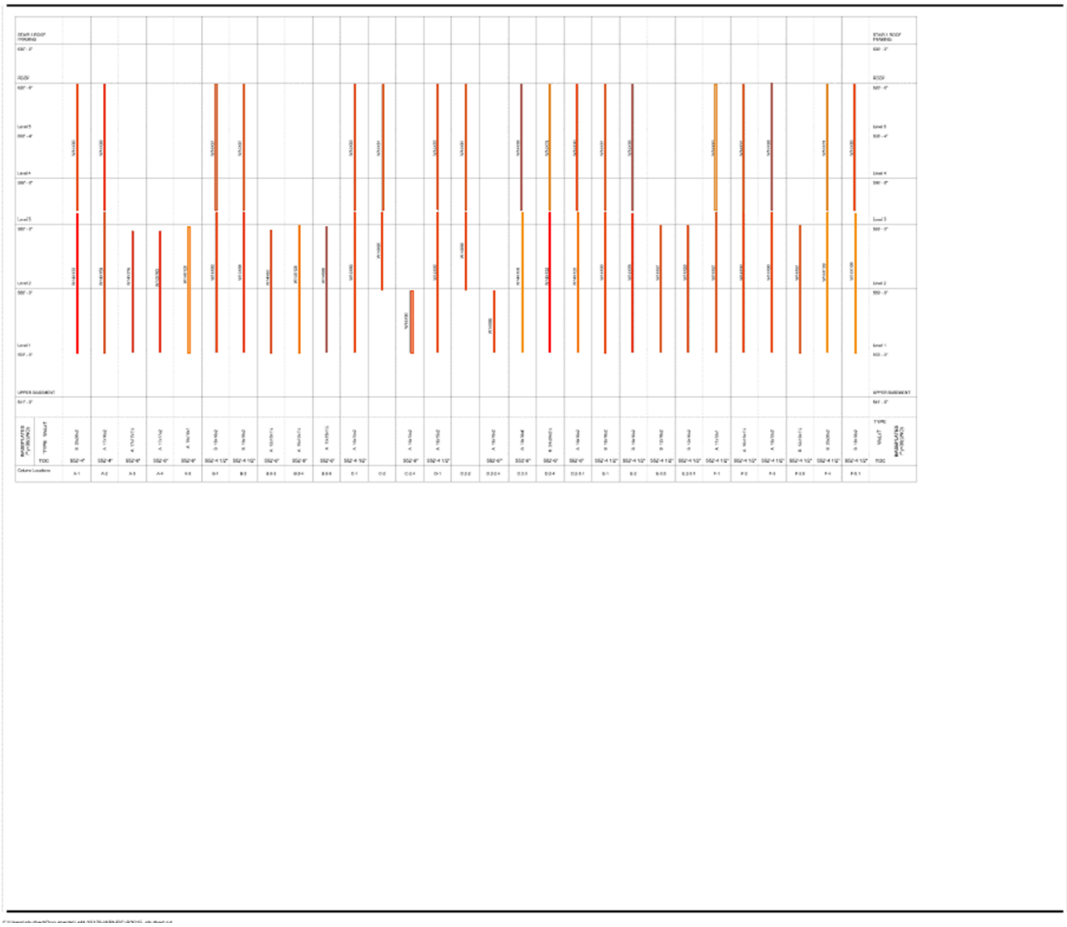
Description
LEVEL 03 FRAMING PLAN

Scale
0 2 4 8 16

S1.05


WORCESTER POLYTECHNIC INSTITUTE
FOISIE
INNOVATION
STUDIO
Gensler
S1.06


DUNNAGE FRAMING PART PLAN
MECH WALL PART PLAN
GENERAL PLAN NOTES:
WORCESTER POLYTECHNIC INSTITUTE
FOISIE
INNOVATION
STUDIO
Gensler
S1.07



WORCESTER POLYTECHNIC INSTITUTE

FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 619-7700
(617) 619-7701

Date & Issue Description
1 10.07.19 ISSUED FOR CONSTRUCTION

Seal/Signature

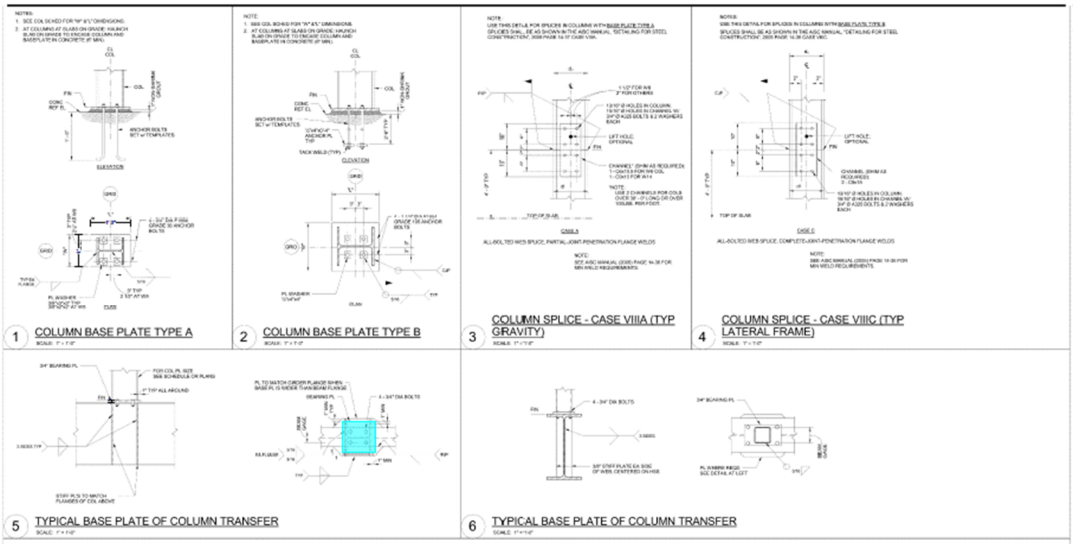
Project Name
Foisie Innovation Studio & Residence Building

Project Number
114978.000

Description
COLUMN SCHEDULE

Scale
0 2 4 8 16

S2.01



WORCESTER POLYTECHNIC INSTITUTE
FOISIE INNOVATION STUDIO

100 INSTITUTE ROAD
WORCESTER, MA 01609

Gensler

One Beacon Street
Third Floor
Boston MA 02108
(617) 574-1700
(617) 574-1701

Date & Issue Description
1 SUP 16 ISSUED FOR CONSTRUCTION

Seal/Signature

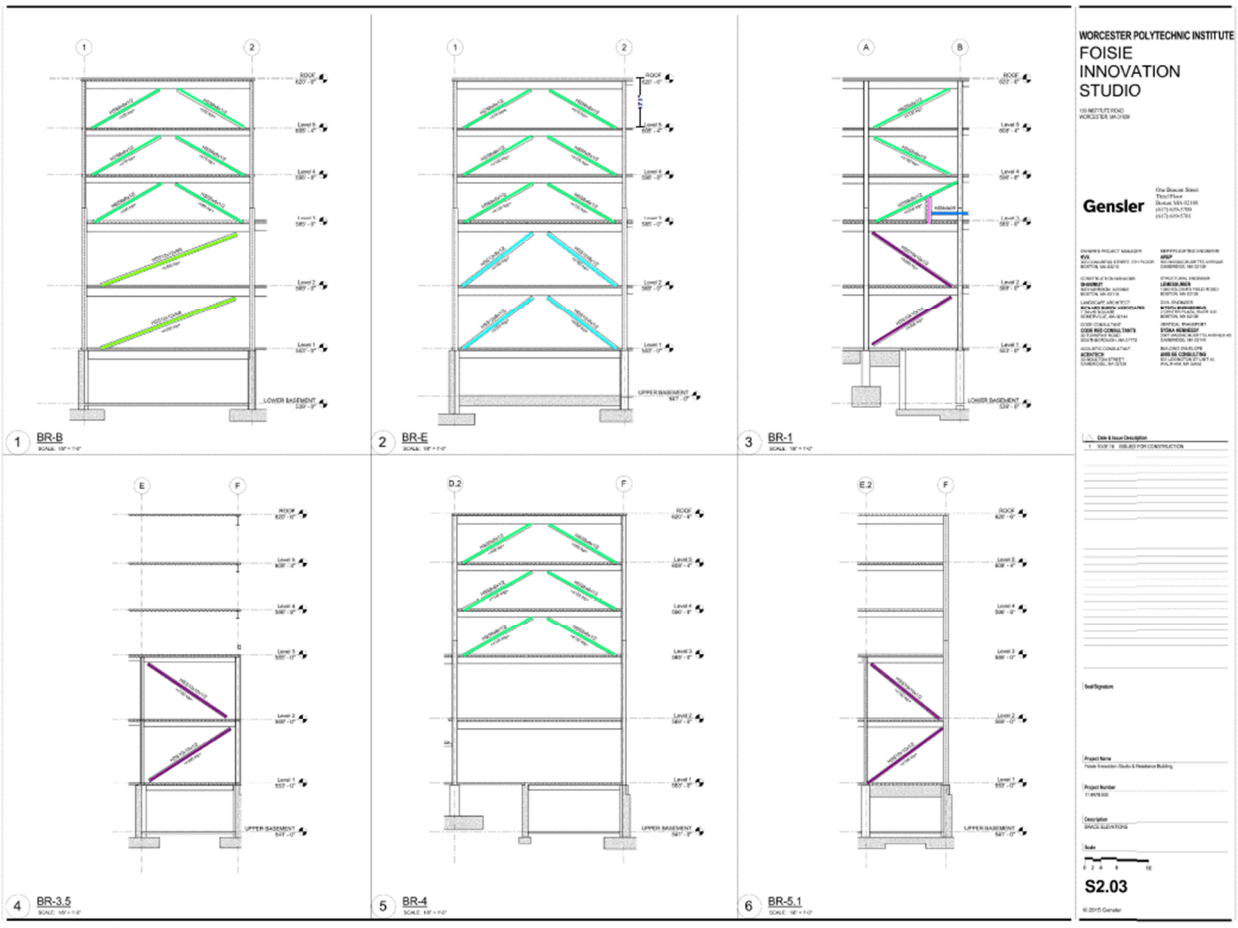
Project Name
Foisie Innovation Studio & Residence Building

Project Number

Description
COLUMN DETAILS

Scale
0 2 4 8 16

S2.02



1 BR-B

2 BR-E

3 BR-1

4 BR-3.5

5 BR-4

6 BR-5.1

9.2.2 Total QTO of FIS

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
	Architectural Building Area										
	Architectual Area										
40	Total Site Area	43,651	SF					0.00	0.00	0.00	0.0(
42	Total Building Area	18,409	SF					0.00	0.00	0.00	0.0(
43	Basement Area	6,819	SF	499	LF			0.00	0.00	0.00	0.0(
44	Level 1 Area	18,203	SF	581	LF			0.00	0.00	0.00	0.0(
45	Level 2 Area	18,929	SF	558	LF			0.00	0.00	0.00	0.0(
46	Level 3 Area	9,990	SF	549	LF			0.00	0.00	0.00	0.0(
47	Level 4 Area	10,519	SF	573	LF			0.00	0.00	0.00	0.0(
48	Level 5 Area	10,567	SF	573	LF			0.00	0.00	0.00	0.0(
	Enclosure										
	Doors										
294	Exterior Doors-Double-8'2",4'2"	2	EA	68	SF			0.00	0.00	0.00	0.0(
295	Exterior Doors-Double-8'2",6'4"	1	EA	52	SF			0.00	0.00	0.00	0.0(
296	Exterior Doors-Single-8'2",4'2"	2	EA	68	SF			0.00	0.00	0.00	0.0(
297	Exterior Doors-Double-9'3",8'	1	EA	74	SF			0.00	0.00	0.00	0.0(
299	Substation Door-Single	1	EA	14	SF			0.00	0.00	0.00	0.0(
	Enclosure										
250	WT1-Self-Adhering Sheet Waterproofing	0	SF					0.00	0.00	0.00	0.0(
	Ext CW & Windows										
238	CW2-GL1-Glass 1	9,821	SF					0.00	0.00	0.00	0.0(
244	CW2-GL2-Glass 2	4,338	SF					0.00	0.00	0.00	0.0(
246	CW1-GL4	0	SF					0.00	0.00	0.00	0.0(
247	CW1-GL3	0	SF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
248	CW3-GL6	3,262	SF					0.00	0.00	0.00	0.0(
	Ext Masonry										
235	WT3-Brick	8,451	SF					0.00	0.00	0.00	0.0(
237	WT4-Brick 2	2,991	SF					0.00	0.00	0.00	0.0(
239	WT2- PC1 TYP. Arch Precast Concrete	2,204	SF	41	CY			0.00	0.00	0.00	0.0(
240	WT2-PC2 TYP. Arch Precast Concrete	2,630	SF	49	CY			0.00	0.00	0.00	0.0(
242	WT1-Exterior Stone Cladding	612	SF	8	CY			0.00	0.00	0.00	0.0(
	Ext Mtl Pnl										
236	WT5-Aluminum Composite Metal Pannel	6,700	SF					0.00	0.00	0.00	0.0(
241	WT6-Zin Metal Wall Panel	230	SF					0.00	0.00	0.00	0.0(
243	WT8-Aluminum Louver Panel	1,566	SF					0.00	0.00	0.00	0.0(
245	WT7-Vetical Metal Louver	1,973	SF					0.00	0.00	0.00	0.0(
279	Substation-EAST-Vetical Metal Louver	1,487	SF					0.00	0.00	0.00	0.0(
281	Substation-WEST-Vetical Metal Louver	1,470	SF					0.00	0.00	0.00	0.0(
282	Substation-SOUTH-Vetical Metal Louver	2,061	SF					0.00	0.00	0.00	0.0(
283	Substation-NORTH-Vetical Metal Louver	2,068	SF					0.00	0.00	0.00	0.0(
300	WT5-GIRT	83	LF					0.00	0.00	0.00	0.0(
301	WT6-GIRT	155	LF					0.00	0.00	0.00	0.0(
	Gypsum Board										
253	WT2-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	y3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
260	WT3-1-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
261	WT3-2-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
262	WT4-1-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
263	WT4-2-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
264	WT5-1-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
265	WT5-2-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
272	WT6-2-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
273	WT6-1-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
276	WT8-Type X Glass Mat Gypsum Board 5/8"	0	SF					0.00	0.00	0.00	0.0
	Insulation										
251	WT2-Closed Cell Spray Insulation	0	SF					0.00	0.00	0.00	0.0
255	WT3-Air/Vapor Barrier	0	SF					0.00	0.00	0.00	0.0
259	WT4-Air/Vapor Barrier	0	SF					0.00	0.00	0.00	0.0
268	WT5-Air/Vapor Barrier	0	SF					0.00	0.00	0.00	0.0
269	WT5-Manufatured Recommended Girt Zone	0	SF					0.00	0.00	0.00	0.0
274	WT6-Manufatured Recommended Girt Zone	0	SF					0.00	0.00	0.00	0.0
275	WT6-Air/Vapor Barrier	0	SF					0.00	0.00	0.00	0.0
	Metal Framing										
252	WT2-Cold-formed Metal Framing	0	SF					0.00	0.00	0.00	0.0

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
256	WT3-Cold-formed Metal Framing	0	SF					0.00	0.00	0.00	0.0(
258	WT4-Cold-formed Metal Framing	0	SF					0.00	0.00	0.00	0.0(
266	WT5-Cold-formed Metal Framing	0	SF					0.00	0.00	0.00	0.0(
271	WT6-Cold-formed Metal Framing	0	SF					0.00	0.00	0.00	0.0(
277	WT8-Cold-formed Metal Framing	0	SF					0.00	0.00	0.00	0.0(
278	WT8-INSULATED METAL PANEL	0	SF					0.00	0.00	0.00	0.0(
280	WT7-V-Screen Wall Support Structure-HSS Steel	30	EA	1,890	LF			0.00	0.00	0.00	0.0(
284	WT7-H-Screen Wall Support Structure-HSS Steel	1,291	LF					0.00	0.00	0.00	0.0(
285	Substation Metal Coping	283	LF	2,263	SF			0.00	0.00	0.00	0.0(
	Mineral Wool Board Insulation										
249	WT1-Mineral Wool Semi-Rigid Board Insulation	0	SF					0.00	0.00	0.00	0.0(
254	WT3-Mineral Wool Semi-Rigid Board Insulation	0	SF					0.00	0.00	0.00	0.0(
257	WT4-Mineral Wool Semi-Rigid Board Insulation	0	SF					0.00	0.00	0.00	0.0(
267	WT5-Mineral Wool Semi-Rigid Board Insulation	0	SF					0.00	0.00	0.00	0.0(
270	WT6-Mineral Wool Semi-Rigid Board Insulation	0	SF					0.00	0.00	0.00	0.0(
	Roof										
286	Roof Area	11,115	SF	582	LF			0.00	0.00	0.00	0.0(
	Roofing										
287	Vapor Retarder	0	SF					0.00	0.00	0.00	0.0(
288	POLYISOCYANURATE	0	SF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
289	FIBERGLASS MAT Gypsum Cover Board	0	SF					0.00	0.00	0.00	0.0(
290	THERMOPLASTIC MEMBRANE Roofing TPO	0	SF					0.00	0.00	0.00	0.0(
291	6" Green Roof Trays	0	SF					0.00	0.00	0.00	0.0(
292	Parapet Wall	575	LF	2,012	SF	93	CY	0.00	0.00	0.00	0.0(
293	Parapet Coping Stone	575	LF	288	SF			0.00	0.00	0.00	0.0(
	Windows										
298	Operable Windows-Single-6'3",2'10"	59	EA	1,045	SF			0.00	0.00	0.00	0.0(
	Interior										
	Ceiling										
	Ceilings										
369	ACOUSTICAL PANEL	0	SF					0.00	0.00	0.00	0.0(
	Door Types										
	Doors										
303	Door Type A--SOLID CORE VENEER DOOR	0	EA					0.00	0.00	0.00	0.0(
304	Door Type B--DOUBLE, SOLID CORE VENEER DOOR	0	EA					0.00	0.00	0.00	0.0(
305	Door Type C--SOLID CORE DOOR, PTD	130	EA					0.00	0.00	0.00	0.0(
306	Door Type D--DOUBLE SOLID CORE DOOR, PTD	12	EA					0.00	0.00	0.00	0.0(
307	Door Type E--HOLLOW METAL DOOR, PTD	15	EA					0.00	0.00	0.00	0.0(
308	Door Type F--DOUBLE, HOLLOW METAL DOOR, PTD	6	EA					0.00	0.00	0.00	0.0(
309	Door Type G--SINGLE VENEER SOLID CORE DOOR	0	EA					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
310	Door Type H--SINGLE ALUMINUM WIDE STILE DOOR	33	EA					0.00	0.00	0.00	0.0(
311	Door Type L--COATED METAL MESH SECURITY GATE	3	EA					0.00	0.00	0.00	0.0(
312	Door Type M--NANAWALL	1	EA					0.00	0.00	0.00	0.0(
313	Door Type N--SLIDING GLASS NARROW STILE	3	EA					0.00	0.00	0.00	0.0(
314	Door Type P--SIDE FOLDING SECURITY GATE	1	EA					0.00	0.00	0.00	0.0(
315	Door Type J--DOUBLE ALUMINUM WIDE STILE DOOR	11	EA					0.00	0.00	0.00	0.0(
316	Door Type K--ALUMINUM AND GLASS SECTIONAL COILING DOOR	2	EA					0.00	0.00	0.00	0.0(
	Floor										
	Interior										
367	FINISH FLOOR AS SCHEDULED	0	SF					0.00	0.00	0.00	0.0(
368	METAL RUNNER	0	SF					0.00	0.00	0.00	0.0(
370	Waterproof Memb	0	SF					0.00	0.00	0.00	0.0(
371	Resinous Floor	0	SF					0.00	0.00	0.00	0.0(
372	Polished Concrete	0	SF					0.00	0.00	0.00	0.0(
373	LVLG and Patching Compound	0	SF					0.00	0.00	0.00	0.0(
374	Resil Tile	0	SF					0.00	0.00	0.00	0.0(
375	Carpet	0	SF					0.00	0.00	0.00	0.0(
376	Carpet Cushion	0	SF					0.00	0.00	0.00	0.0(
377	CRACK-SUPPRESSION MEMB	0	SF					0.00	0.00	0.00	0.0(
378	THINSET MORTAR BED	0	SF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS
Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
379	CARPET TILE	0	SF					0.00	0.00	0.00	0.0(
	Partition Walls										
	A2A,A3B,A3F,A6B										
	Interior										
317	CONTINUOUS ACOUS SEALANT	0	LF					0.00	0.00	0.00	0.0(
318	METAL STUD	0	LF					0.00	0.00	0.00	0.0(
319	SOUND ATTENUATION BLANKET	0	LF					0.00	0.00	0.00	0.0(
320	GYPSUM BOARD	0	LF					0.00	0.00	0.00	0.0(
321	WALL FINISH AS SCHEDULED	0	LF					0.00	0.00	0.00	0.0(
359	A-A type wall length	2,496	LF	32,452	SF			0.00	0.00	0.00	0.0(
	B2F,B3B,B3F										
	Interior										
322	CONTINUOUS ACOUS SEALANT	0	LF					0.00	0.00	0.00	0.0(
323	METAL STUD	0	LF					0.00	0.00	0.00	0.0(
324	SOUND ATTENUATION BLANKET	0	LF					0.00	0.00	0.00	0.0(
325	GYPSUM BOARD*2	0	LF					0.00	0.00	0.00	0.0(
326	WALL FINISH AS SCHEDULED	0	LF					0.00	0.00	0.00	0.0(
327	TYPE "X" GYP BD	0	LF					0.00	0.00	0.00	0.0(
360	A-B type wall length	588	LF	7,643	SF			0.00	0.00	0.00	0.0(
	C3F,C6B										
	Interior										

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
328	CONTINUOUS ACOUS SEALANT	0	LF					0.00	0.00	0.00	0.0(
329	METAL STUD	0	LF					0.00	0.00	0.00	0.0(
330	SOUND ATTENUATION BLANKET	0	LF					0.00	0.00	0.00	0.0(
331	GYPSUM BOARD*2	0	LF					0.00	0.00	0.00	0.0(
332	WALL FINISH AS SCHEDULED	0	LF					0.00	0.00	0.00	0.0(
333	TYPE "X" GYP BD	0	LF					0.00	0.00	0.00	0.0(
361	A-C type wall length	692	LF	8,993	SF			0.00	0.00	0.00	0.0(
	D1B,D2A,D2B,D3A,D3B,D3E,D6B										
	Interior										
334	CONTINUOUS ACOUS SEALANT	0	LF					0.00	0.00	0.00	0.0(
335	METAL STUD	0	LF					0.00	0.00	0.00	0.0(
336	SOUND ATTENUATION BLANKET	0	LF					0.00	0.00	0.00	0.0(
337	GYPSUM BOARD	0	LF					0.00	0.00	0.00	0.0(
338	WALL FINISH AS SCHEDULED	0	LF					0.00	0.00	0.00	0.0(
362	A-D type wall length	544	LF	7,073	SF			0.00	0.00	0.00	0.0(
	E3B										
	Interior										
339	CONTINUOUS ACOUS SEALANT	0	LF					0.00	0.00	0.00	0.0(
340	METAL STUD	0	LF					0.00	0.00	0.00	0.0(
341	SOUND ATTENUATION BLANKET	0	LF					0.00	0.00	0.00	0.0(
342	GYPSUM BOARD	0	LF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
343	WALL FINISH AS SCHEDULED	0	LF					0.00	0.00	0.00	0.0(
363	A-E type wall length	23	LF	301	SF			0.00	0.00	0.00	0.0(
	H6F										
	Interior										
344	CONTINUOUS ACOUS SEALANT	0	LF					0.00	0.00	0.00	0.0(
345	TYPE "X" GYP BD	0	LF					0.00	0.00	0.00	0.0(
346	SOUND ATTENUATION BLANKET	0	LF					0.00	0.00	0.00	0.0(
347	GYP LINER PANEL	0	LF					0.00	0.00	0.00	0.0(
348	WALL FINISH AS SCHEDULED	0	LF					0.00	0.00	0.00	0.0(
349	TYPE "X" GYP BD	0	LF					0.00	0.00	0.00	0.0(
364	A-H type wall length	165	LF	2,146	SF			0.00	0.00	0.00	0.0(
	J4F,J6F										
	Interior										
350	CONTINUOUS ACOUS SEALANT*2	0	LF					0.00	0.00	0.00	0.0(
351	TYPE "X" GYP BD	0	LF					0.00	0.00	0.00	0.0(
352	SOUND ATTENUATION BLANKET	0	LF					0.00	0.00	0.00	0.0(
353	GYP LINER PANEL	0	LF					0.00	0.00	0.00	0.0(
354	WALL FINISH AS SCHEDULED	0	LF					0.00	0.00	0.00	0.0(
365	A-J type wall length	1,145	LF	14,882	SF			0.00	0.00	0.00	0.0(
	K3B,K3F,K6B										
	Interior										

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
355	CONTINUOUS ACOUS SEALANT	0	LF					0.00	0.00	0.00	0.0(
356	METAL STUD*2	0	LF					0.00	0.00	0.00	0.0(
357	SOUND ATTENUATION BLANKET	0	LF					0.00	0.00	0.00	0.0(
358	GYPSUM BOARD	0	LF					0.00	0.00	0.00	0.0(
366	A-K type wall length	842	LF	10,940	SF			0.00	0.00	0.00	0.0(
	Structure										
	Brace										
229	HSS8*8*1/2	409	LF					0.00	0.00	0.00	0.0(
230	HSS12*12*5/8	72	LF					0.00	0.00	0.00	0.0(
231	HSS12*8*1/2	86	LF					0.00	0.00	0.00	0.0(
232	HSS6*6*3/8	7	LF					0.00	0.00	0.00	0.0(
233	HSS8*8*3/8	9	LF					0.00	0.00	0.00	0.0(
234	HSS10*10*1/2	139	LF					0.00	0.00	0.00	0.0(
	CIP Footings - Spread										
1	Spread Footings Type #6	1	EA	117	SF	12	CY	0.00	0.00	0.00	0.0(
2	Spread Footings Type #1	1	EA	149	SF	19	CY	0.00	0.00	0.00	0.0(
3	Spread Footings Type #4	2	EA	235	SF	24	CY	0.00	0.00	0.00	0.0(
4	Spread Footings Type #2	1	EA	75	SF	5	CY	0.00	0.00	0.00	0.0(
5	Spread Footings Type #5	10	EA	1,067	SF	99	CY	0.00	0.00	0.00	0.0(
6	Spread Footings Type #3	6	EA	576	SF	48	CY	0.00	0.00	0.00	0.0(
7	Spread Footings Type #7	4	EA	405	SF	33	CY	0.00	0.00	0.00	0.0(
8	Spread Footings Type #8	2	EA	331	SF	33	CY	0.00	0.00	0.00	0.0(
9	Spread Footings Type #9	1	EA	117	SF	10	CY	0.00	0.00	0.00	0.0(
	CIP Footings - Strip										

Worksheet Tab

MQP-FIS
Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
10	Strip Footings Type #1	572	LF	1,715	SF	95	CY	0.00	0.00	0.00	0.0(
11	Strip Footings Type #2	57	LF	171	SF	12	CY	0.00	0.00	0.00	0.0(
	CIP Piers Pilasters										
15	Piers Type #1	24	EA	2,016	SF	37	CY	0.00	0.00	0.00	0.0(
16	Piers Type #1A	2	EA	210	SF	5	CY	0.00	0.00	0.00	0.0(
17	Piers Type #2	1	EA	98	SF	2	CY	0.00	0.00	0.00	0.0(
18	Piers Type #3	3	EA	221	SF	4	CY	0.00	0.00	0.00	0.0(
41	fgfg	0	SF					0.00	0.00	0.00	0.0(
	Columns										
215	W14*132	71	LF					0.00	0.00	0.00	0.0(
216	W14*159	36	LF					0.00	0.00	0.00	0.0(
217	W14*90	378	LF					0.00	0.00	0.00	0.0(
218	W14*99	102	LF					0.00	0.00	0.00	0.0(
219	W14*176	31	LF					0.00	0.00	0.00	0.0(
220	W14*193	31	LF					0.00	0.00	0.00	0.0(
221	W14*120	100	LF					0.00	0.00	0.00	0.0(
222	W14*61	289	LF					0.00	0.00	0.00	0.0(
223	W14*53	95	LF					0.00	0.00	0.00	0.0(
224	W14*82	31	LF					0.00	0.00	0.00	0.0(
225	W14*68	127	LF					0.00	0.00	0.00	0.0(
226	W14*109	106	LF					0.00	0.00	0.00	0.0(
227	W14*74	63	LF					0.00	0.00	0.00	0.0(
228	W14*43	32	LF					0.00	0.00	0.00	0.0(
	Excavation of Foundation										
19	Excavation of Foundation	457	SF	7,489	CY			0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS
Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
	Foundation Wall										
12	Foundation Walls Type #1	399	LF	11,901	SF	331	CY	0.00	0.00	0.00	0.0(
13	Foundation Walls Type #2	160	LF	4,786	SF	177	CY	0.00	0.00	0.00	0.0(
14	Foundation Walls Tpye #3	9	LF	269	SF	12	CY	0.00	0.00	0.00	0.0(
97	Pit Wall Reinf. #5@12" EW, EF	150	EA	663	LF			0.00	0.00	0.00	0.0(
98	Water Stop	54	LF	40	SF			0.00	0.00	0.00	0.0(
99	Pit Mat Reinf. #5@9" T&B, EW	32	EA	493	LF			0.00	0.00	0.00	0.0(
100	Pit Wall Reinf. #5@12" EW, EF, Curve	150	EA	850	LF			0.00	0.00	0.00	0.0(
101	#5@12" of the foundation wall	0	EA					0.00	0.00	0.00	0.0(
102	Exterior Wall #5@12" V. EF	0	EA					0.00	0.00	0.00	0.0(
103	Interior Pit Wall Reinf. #5@12" EW, EF	50	EA	3,475	LF			0.00	0.00	0.00	0.0(
104	Pit Mat Reinf. #5@9" T&B, EW	18	EA	849	LF			0.00	0.00	0.00	0.0(
105	2 #5 CONT	0	LF					0.00	0.00	0.00	0.0(
106	Exterior Wall #5@8" H. EF.	0	LF					0.00	0.00	0.00	0.0(
107	4-#5 CONT	0	LF					0.00	0.00	0.00	0.0(
	Steel structure										
20	W16*26+24	378	LF					0.00	0.00	0.00	0.0(
21	W24*84+100	39	LF					0.00	0.00	0.00	0.0(
22	W24*76+110	39	LF					0.00	0.00	0.00	0.0(
23	W12*19+16	75	LF					0.00	0.00	0.00	0.0(
24	W24*55+46	41	LF					0.00	0.00	0.00	0.0(
25	W10*12	985	LF					0.00	0.00	0.00	0.0(
26	W24*76+50	39	LF					0.00	0.00	0.00	0.0(
27	W14*22+20	361	LF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
28	W12*22+20	69	LF					0.00	0.00	0.00	0.0(
29	W14*22+22	156	LF					0.00	0.00	0.00	0.0(
30	W14*22+30	23	LF					0.00	0.00	0.00	0.0(
31	W16*36+28	43	LF					0.00	0.00	0.00	0.0(
32	W14*22+28	23	LF					0.00	0.00	0.00	0.0(
33	W10*22	274	LF					0.00	0.00	0.00	0.0(
34	W12*26	384	LF					0.00	0.00	0.00	0.0(
35	W27*102+46	79	LF					0.00	0.00	0.00	0.0(
36	W14*30	47	LF					0.00	0.00	0.00	0.0(
37	W12*19	64	LF					0.00	0.00	0.00	0.0(
38	W12*14	205	LF					0.00	0.00	0.00	0.0(
39	Hss8*6*3/8	61	LF					0.00	0.00	0.00	0.0(
49	W27*84	137	LF					0.00	0.00	0.00	0.0(
50	W18*35+26	91	LF					0.00	0.00	0.00	0.0(
51	W18*35	330	LF					0.00	0.00	0.00	0.0(
52	W18*35+24	239	LF					0.00	0.00	0.00	0.0(
53	W30*90	44	LF					0.00	0.00	0.00	0.0(
54	W30*108	70	LF					0.00	0.00	0.00	0.0(
55	W24*84	223	LF					0.00	0.00	0.00	0.0(
56	W27*94+104	39	LF					0.00	0.00	0.00	0.0(
57	W12*19+20	24	LF					0.00	0.00	0.00	0.0(
58	W16*31+22	22	LF					0.00	0.00	0.00	0.0(
59	W12*19+18	40	LF					0.00	0.00	0.00	0.0(
60	W14*22+32	87	LF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
61	W16*26+24	255	LF					0.00	0.00	0.00	0.0(
62	W36*135	21	LF					0.00	0.00	0.00	0.0(
63	W40*503	52	LF					0.00	0.00	0.00	0.0(
64	W16*31+28	155	LF					0.00	0.00	0.00	0.0(
65	W40*503+118	52	LF					0.00	0.00	0.00	0.0(
66	W12*19+16	17	LF					0.00	0.00	0.00	0.0(
67	W14*22+24	111	LF					0.00	0.00	0.00	0.0(
68	W12*14+8	12	LF					0.00	0.00	0.00	0.0(
69	W12*16+14	104	LF					0.00	0.00	0.00	0.0(
70	W14*26	16	LF					0.00	0.00	0.00	0.0(
71	W24*76+42	39	LF					0.00	0.00	0.00	0.0(
72	W18*35+36	185	LF					0.00	0.00	0.00	0.0(
73	W12*14+16	16	LF					0.00	0.00	0.00	0.0(
74	W12*22+16	11	LF					0.00	0.00	0.00	0.0(
75	W24*76+88	40	LF					0.00	0.00	0.00	0.0(
76	W24*55+42	33	LF					0.00	0.00	0.00	0.0(
77	W30*90+52	39	LF					0.00	0.00	0.00	0.0(
78	W16*26+18	98	LF					0.00	0.00	0.00	0.0(
79	W24*55+36	101	LF					0.00	0.00	0.00	0.0(
80	W16*26	171	LF					0.00	0.00	0.00	0.0(
81	W24*55+22	29	LF					0.00	0.00	0.00	0.0(
82	W24*55	4	LF					0.00	0.00	0.00	0.0(
83	W24*55+70	75	LF					0.00	0.00	0.00	0.0(
84	W24*55+56	58	LF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
85	W24*68+72	33	LF					0.00	0.00	0.00	0.0(
86	W21*44+38	563	LF					0.00	0.00	0.00	0.0(
87	W27*84+86	33	LF					0.00	0.00	0.00	0.0(
88	W18*35+42	58	LF					0.00	0.00	0.00	0.0(
89	W18*35+28	34	LF					0.00	0.00	0.00	0.0(
90	W30*90+38	33	LF					0.00	0.00	0.00	0.0(
91	W30*99	54	LF					0.00	0.00	0.00	0.0(
92	W24*55+54	39	LF					0.00	0.00	0.00	0.0(
93	W18*50	17	LF					0.00	0.00	0.00	0.0(
94	W21*44+46	40	LF					0.00	0.00	0.00	0.0(
95	W8*24	50	LF					0.00	0.00	0.00	0.0(
96	HSS8*8*3/8S	154	LF					0.00	0.00	0.00	0.0(
108	HSS 16*8*5/8	79	LF					0.00	0.00	0.00	0.0(
109	W16*26+28	22	LF					0.00	0.00	0.00	0.0(
110	W16*31+30	43	LF					0.00	0.00	0.00	0.0(
111	W24*76+36	40	LF					0.00	0.00	0.00	0.0(
112	W18*40+32	45	LF					0.00	0.00	0.00	0.0(
113	W18*40+36	120	LF					0.00	0.00	0.00	0.0(
114	W18*40+56	21	LF					0.00	0.00	0.00	0.0(
115	W18*40+24	22	LF					0.00	0.00	0.00	0.0(
116	W18*40+30	41	LF					0.00	0.00	0.00	0.0(
117	W24*62+54	39	LF					0.00	0.00	0.00	0.0(
118	W12*14+18	17	LF					0.00	0.00	0.00	0.0(
119	W24*84+36	40	LF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
120	W18*35+30	121	LF					0.00	0.00	0.00	0.0(
121	W14*43+32	41	LF					0.00	0.00	0.00	0.0(
122	W16*26+26	53	LF					0.00	0.00	0.00	0.0(
123	W18*35+32	68	LF					0.00	0.00	0.00	0.0(
124	W18*40+48	23	LF					0.00	0.00	0.00	0.0(
125	W30*108+58	39	LF					0.00	0.00	0.00	0.0(
126	W21*44+62	51	LF					0.00	0.00	0.00	0.0(
127	W21*44+32	21	LF					0.00	0.00	0.00	0.0(
128	W24*55+76	27	LF					0.00	0.00	0.00	0.0(
129	W16*31+44	31	LF					0.00	0.00	0.00	0.0(
130	W18*35+34	33	LF					0.00	0.00	0.00	0.0(
131	W18*35+18	15	LF					0.00	0.00	0.00	0.0(
132	W12*14+14	79	LF					0.00	0.00	0.00	0.0(
133	W6*25	44	LF					0.00	0.00	0.00	0.0(
134	W21*50+44	41	LF					0.00	0.00	0.00	0.0(
135	W21*50+72	74	LF					0.00	0.00	0.00	0.0(
136	W30*90+58	33	LF					0.00	0.00	0.00	0.0(
137	W30*116	49	LF					0.00	0.00	0.00	0.0(
138	W14*30+32	29	LF					0.00	0.00	0.00	0.0(
139	W21*44+56	80	LF					0.00	0.00	0.00	0.0(
140	W33*118+64	34	LF					0.00	0.00	0.00	0.0(
141	W10*22+16	33	LF					0.00	0.00	0.00	0.0(
142	W24*62+66	35	LF					0.00	0.00	0.00	0.0(
143	W21*68+52	34	LF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS

Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
144	W30*99+104	34	LF					0.00	0.00	0.00	0.0(
145	W21*62+48	40	LF					0.00	0.00	0.00	0.0(
146	HSS 12*8*5/8	67	LF					0.00	0.00	0.00	0.0(
147	W30*90+68	33	LF					0.00	0.00	0.00	0.0(
148	W21*48+50	40	LF					0.00	0.00	0.00	0.0(
149	W21*48+60	40	LF					0.00	0.00	0.00	0.0(
150	HSS 6*6*3/8	202	LF					0.00	0.00	0.00	0.0(
151	W33*118+88	33	LF					0.00	0.00	0.00	0.0(
152	W21*50+82	35	LF					0.00	0.00	0.00	0.0(
153	W10*22+18	16	LF					0.00	0.00	0.00	0.0(
154	W18*40+44	35	LF					0.00	0.00	0.00	0.0(
155	W30*116+58	33	LF					0.00	0.00	0.00	0.0(
156	W21*44+34	81	LF					0.00	0.00	0.00	0.0(
157	W18*40	18	LF					0.00	0.00	0.00	0.0(
158	W10*26	19	LF					0.00	0.00	0.00	0.0(
159	W21*44+40	40	LF					0.00	0.00	0.00	0.0(
160	W21*111	240	LF					0.00	0.00	0.00	0.0(
161	W18*65+100	79	LF					0.00	0.00	0.00	0.0(
162	W16*31+24	44	LF					0.00	0.00	0.00	0.0(
163	W18*76+40	120	LF					0.00	0.00	0.00	0.0(
164	W18*46+50	646	LF					0.00	0.00	0.00	0.0(
165	W21*44+66	28	LF					0.00	0.00	0.00	0.0(
166	W18*40+60	81	LF					0.00	0.00	0.00	0.0(
167	W21*93	80	LF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS
Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
168	W14*22	63	LF					0.00	0.00	0.00	0.0(
169	W18*40+40	79	LF					0.00	0.00	0.00	0.0(
170	W21*55+54	67	LF					0.00	0.00	0.00	0.0(
171	W18*60+74	79	LF					0.00	0.00	0.00	0.0(
172	W18*46+70	39	LF					0.00	0.00	0.00	0.0(
173	W21*122	66	LF					0.00	0.00	0.00	0.0(
174	W18*40+76	41	LF					0.00	0.00	0.00	0.0(
175	W18*71+40	40	LF					0.00	0.00	0.00	0.0(
176	W18*35+38	24	LF					0.00	0.00	0.00	0.0(
177	W21*55+38	68	LF					0.00	0.00	0.00	0.0(
178	W18*46+70	40	LF					0.00	0.00	0.00	0.0(
179	W18*40+38	41	LF					0.00	0.00	0.00	0.0(
180	W24*104	87	LF					0.00	0.00	0.00	0.0(
181	W24*68+110	39	LF					0.00	0.00	0.00	0.0(
182	W16*26+32	22	LF					0.00	0.00	0.00	0.0(
183	W24*68+96	40	LF					0.00	0.00	0.00	0.0(
184	W18*40+26	64	LF					0.00	0.00	0.00	0.0(
185	W21*48+54	161	LF					0.00	0.00	0.00	0.0(
186	W21*44+24	21	LF					0.00	0.00	0.00	0.0(
187	W21*44+26	15	LF					0.00	0.00	0.00	0.0(
188	W24*55+68	41	LF					0.00	0.00	0.00	0.0(
189	W24*94+48	40	LF					0.00	0.00	0.00	0.0(
190	W14*22+40	23	LF					0.00	0.00	0.00	0.0(
191	W27*146	40	LF					0.00	0.00	0.00	0.0(

Worksheet Tab

MQP-FIS
Bid NO. 18

No.	Name	Qty1	UOM1	Qty2	UOM2	Qty3	UOM3	Mat.($)	Labor($)	Sub($)	Total($
192	W16*36+46	21	LF					0.00	0.00	0.00	0.0(
193	W24*62+34	24	LF					0.00	0.00	0.00	0.0(
194	W24*62+28	24	LF					0.00	0.00	0.00	0.0(
195	W24*62+72	41	LF					0.00	0.00	0.00	0.0(
196	W24*62+100	41	LF					0.00	0.00	0.00	0.0(
197	W24*76+46	39	LF					0.00	0.00	0.00	0.0(
198	W27*102+40	34	LF					0.00	0.00	0.00	0.0(
199	W24*84+98	41	LF					0.00	0.00	0.00	0.0(
200	W24*84+42	41	LF					0.00	0.00	0.00	0.0(
201	W24*84+72	40	LF					0.00	0.00	0.00	0.0(
202	W27*102+50	34	LF					0.00	0.00	0.00	0.0(
203	W24*104+30	33	LF					0.00	0.00	0.00	0.0(
204	W24*55+66	40	LF					0.00	0.00	0.00	0.0(
205	W24*104+30	33	LF					0.00	0.00	0.00	0.0(
206	W24*62+46	39	LF					0.00	0.00	0.00	0.0(
207	W24*55+86	40	LF					0.00	0.00	0.00	0.0(
208	W10*12+6	21	LF					0.00	0.00	0.00	0.0(
209	W6*15 UNO	22	LF					0.00	0.00	0.00	0.0(
210	W8*35	289	LF					0.00	0.00	0.00	0.0(
211	W6*15	223	LF					0.00	0.00	0.00	0.0(
212	3-HSS6*2*1/4	137	LF					0.00	0.00	0.00	0.0(
213	W6*12	10	LF					0.00	0.00	0.00	0.0(
214	W8*13	32	LF					0.00	0.00	0.00	0.0(
302	Bearing Plates	1	SF					0.00	0.00	0.00	0.0(
	Totals							**0.00**	**0.00**	**0.00**	**0.0(**

9.2.3 QTO of Structure FIS

QUANTITY SHEET		
MQP-FIS		
Location: WPI		
Date: February 22, 2019		
Classification: Enclosure		
STRUCTURE	**QTO**	**Unit**
Structural Steel		
Floor and Roof Beams	344.7	Tons
Columns	70.5	Tons
Brace	21.6	Tons
Shear Studs	367,678.0	Each
Base Plates 1" x 15" x 10" (T-L-W)		Tons/Lbs
Metal Floor Deck 2" 18 ga.	78,778.4	SF
Metal Roof Deck 2" 18 ga.	19,875.5	SF
Miscellaneaous Steel	41.5	Tons
Spread Footings		
Formwork erect and strip	2,971	SF
Reinforcing bars at 100#/CY	27,500	#
Concrete	275	CY
Perimeter Foundation Wall		
Formwork erect and strip	16,956	SF
Reinforcing bars at 100#/CY	52,000	#
Concrete	520	CY
Strip Footings		
Formwork erect and strip	1,326	SF
Reinforcing bars at 100#/CY	7,600	#
Concrete	76	CY
Piers		
Formwork erect and strip	2,545	SF
Reinforcing bars at 100#/CY	4,800	#
Concrete	48	CY
Excavation	7,351.0	CY
Backfill	6,432.0	CY
Slab on Grade		
Edge Forms	581.0	LF
Welded Wire Fabric (Wire Mesh)	19,113.2	SF
Pour/Place Concrete	337.1	CY
Finish Slab	18,203.0	SF
Slab on Deck		
Edge Forms	2,752.0	LF
Welded Wire Fabric (Wire Mesh)	59,665.2	SF
Pour/Place Concrete	1,052.3	CY
Finish Slab	28412	SF

BUILDING AREA						
Items	**Height**		**Area**	**Unit**	**Perimeter**	**Unit**
Total Site Area	0"	(unassigned)	43,651	SF		
Total Building Area	0"	(unassigned)	18,409	SF		
Basement Area	0"	(unassigned)	6,819	SF	499	LF
Level 1 Area	0"	(unassigned)	18,203	SF	581	LF
Level 2 Area	0"	(unassigned)	18,929	SF	558	LF
Level 3 Area	0"	(unassigned)	9,990	SF	549	LF
Level 4 Area	0"	(unassigned)	10,519	SF	573	LF
Level 5 Area	0"	(unassigned)	10,567	SF	573	LF
					3333	LF
Total B-F5			75,027	SF		
Roof Area			18,929	SF		

OST FOOTINGS	Name	Heights	Area	QTO1	UOM1	QTO2	UOM2	QTO3	UOM3
CIP Footings - Spread									
1	Spread Footings Type #6	2' 8"	(unassigned)	1	EA	117	SF	12	CY
2	Spread Footings Type #1	2' 8"	(unassigned)	1	EA	149	SF	19	CY
3	Spread Footings Type #4	2' 8"	(unassigned)	2	EA	235	SF	24	CY
4	Spread Footings Type #2	2' 8"	(unassigned)	1	EA	75	SF	5	CY
5	Spread Footings Type #5	2' 8"	(unassigned)	10	EA	1,067	SF	99	CY
6	Spread Footings Type #3	2' 8"	(unassigned)	6	EA	576	SF	48	CY
7	Spread Footings Type #7	2' 8"	(unassigned)	3	EA	304	SF	25	CY
8	Spread Footings Type #8	2' 8"	(unassigned)	2	EA	331	SF	33	CY
9	Spread Footings Type #9	2' 8"	(unassigned)	1	EA	117	SF	10	CY
	Subtotal					**2971**	**SF**	**275**	**CY**
CIP Footings - Strip									
10	Strip Footings Type #1	1' 6"	(unassigned)	385	LF	1,155	SF	64	CY
11	Strip Footings Type #2	1' 6"	(unassigned)	57	LF	171	SF	12	CY
	Subtotal					**1,326**	**SF**	**76**	**CY**
Foundation Wall									
12	Foundation Walls Type #1	14' 11"	(unassigned)	399	LF	11,901	SF	331	CY
13	Foundation Walls Type #2	14' 11"	(unassigned)	160	LF	4,786	SF	177	CY
14	Foundation Walls Tpye #3	14' 11"	(unassigned)	9	LF	269	SF	12	CY
	Subtotal					**16,956**	**SF**	**520**	**CY**
CIP Piers Pilasters									
15	Piers Type #1	10' 6"	(unassigned)	24	EA	2,016	SF	37	CY
16	Piers Type #1A	10' 6"	(unassigned)	2	EA	210	SF	5	CY
17	Piers Type #2	10' 6"	(unassigned)	1	EA	98	SF	2	CY
18	Piers Type #3	10' 6"	(unassigned)	3	EA	221	SF	4	CY
	Subtotal					**2,545**	**SF**	**48**	**CY**
	Total							**919**	**CY**
	Excavation							**7351**	**CY**

				OST BEAMS				
Items	**Height**	**Area**	**Length**		**Lb/ft**	**Subtotal Weight(lb)**	**Shear Studs/ft**	**Total Shear Studs(counts)**
W16*26+24	0"	(unassigned)	378	LF	26	9828	24	9072
W24*84+100	0"	(unassigned)	39	LF	84	3276	100	3900
W24*76+110	0"	(unassigned)	39	LF	76	2964	110	4290
W12*19+16	0"	(unassigned)	75	LF	19	1425	16	1200
W24*55+46	0"	(unassigned)	41	LF	55	2255	46	1886
W10*12	0"	(unassigned)	985	LF	12	11820		
W24*76+50	0"	(unassigned)	39	LF	76	2964	50	1950
W14*22+20	0"	(unassigned)	361	LF	22	7942	20	7220
W12*22+20	0"	(unassigned)	69	LF	22	1518	20	1380
W14*22+22	0"	(unassigned)	156	LF	22	3432	22	3432
W14*22+30	0"	(unassigned)	23	LF	22	506	30	690
W16*36+28	0"	(unassigned)	43	LF	36	1548	28	1204
W14*22+28	0"	(unassigned)	23	LF	22	506	28	644
W10*22	0"	(unassigned)	274	LF	22	6028		
W12*26	0"	(unassigned)	384	LF	26	9984		
W27*102+46	0"	(unassigned)	79	LF	102	8058	46	3634
W14*30	0"	(unassigned)	47	LF	30	1410		
W12*19	0"	(unassigned)	64	LF	19	1216		
W12*14	0"	(unassigned)	205	LF	14	2870		
Hss8*6*3/8	0"	(unassigned)	61	LF	32.5	1982.5		
W27*84	0"	(unassigned)	137	LF	84	11508		
W18*35+26	0"	(unassigned)	91	LF	35	3185	26	2366
W18*35	0"	(unassigned)	330	LF	35	11550		
W18*35+24	0"	(unassigned)	239	LF	35	8365	24	5736
W30*90	0"	(unassigned)	44	LF	90	3960		
W30*108	0"	(unassigned)	70	LF	108	7560		
W24*84	0"	(unassigned)	223	LF	84	18732		
W27*94+104	0"	(unassigned)	39	LF	94	3666	104	4056
W12*19+20	0"	(unassigned)	24	LF	19	456	20	480
W16*31+22	0"	(unassigned)	22	LF	31	682	22	484
W12*19+18	0"	(unassigned)	40	LF	19	760	18	720
W14*22+32	0"	(unassigned)	87	LF	22	1914	32	2784
W16*26+24	0"	(unassigned)	255	LF	26	6630	24	6120
W36*135	0"	(unassigned)	21	LF	135	2835		
W40*503	0"	(unassigned)	52	LF	503	26156		
W16*31+28	0"	(unassigned)	155	LF	31	4805	28	4340
W40*503+118	0"	(unassigned)	52	LF	503	26156	118	6136
W12*19+16	0"	(unassigned)	17	LF	19	323	16	272
W14*22+24	0"	(unassigned)	111	LF	22	2442	24	2664
W12*14+8	0"	(unassigned)	12	LF	14	168	8	96
W12*16+14	0"	(unassigned)	104	LF	16	1664	14	1456
W14*26	0"	(unassigned)	16	LF	26	416		
W24*76+42	0"	(unassigned)	39	LF	76	2964	42	1638
W18*35+36	0"	(unassigned)	185	LF	35	6475	36	6660
W12*14+16	0"	(unassigned)	16	LF	14	224	16	256
W12*22+16	0"	(unassigned)	11	LF	22	242	16	176
W24*76+88	0"	(unassigned)	40	LF	76	3040	88	3520
W24*55+42	0"	(unassigned)	33	LF	55	1815	42	1386
W30*90+52	0"	(unassigned)	39	LF	90	3510	52	2028
W16*26+18	0"	(unassigned)	98	LF	26	2548	18	1764
W24*55+36	0"	(unassigned)	101	LF	55	5555	36	3636
W16*26	0"	(unassigned)	171	LF	26	4446		
W24*55+22	0"	(unassigned)	29	LF	55	1595	22	638
W24*55	0"	(unassigned)	4	LF	55	220		
W24*55+70	0"	(unassigned)	75	LF	55	4125	70	5250
W24*55+56	0"	(unassigned)	58	LF	55	3190	56	3248

W24*68+72	0"	(unassigned)	33	LF	68	2244	72	2376
W21*44+38	0"	(unassigned)	563	LF	44	24772	38	21394
W27*84+86	0"	(unassigned)	33	LF	84	2772	86	2838
W18*35+42	0"	(unassigned)	58	LF	35	2030	42	2436
W18*35+28	0"	(unassigned)	34	LF	35	1190	28	952
W30*90+38	0"	(unassigned)	33	LF	90	2970	38	1254
W30*99	0"	(unassigned)	54	LF	99	5346		
W24*55+54	0"	(unassigned)	39	LF	55	2145	54	2106
W18*50	0"	(unassigned)	17	LF	50	850		
W21*44+46	0"	(unassigned)	40	LF	44	1760	46	1840
W8*24	0"	(unassigned)	50	LF	24	1200		
HSS8*8*3/8S	0"	(unassigned)	154	LF	37.6	5790.4		
HSS 16*8*5/8	0"	(unassigned)	79	LF	93.1	7354.9		
W16*26+28	0"	(unassigned)	22	LF	26	572	28	616
W16*31+30	0"	(unassigned)	43	LF	31	1333	30	1290
W24*76+36	0"	(unassigned)	40	LF	76	3040	36	1440
W18*40+32	0"	(unassigned)	45	LF	40	1800	32	1440
W18*40+36	0"	(unassigned)	120	LF	40	4800	36	4320
W18*40+56	0"	(unassigned)	21	LF	40	840	56	1176
W18*40+24	0"	(unassigned)	22	LF	40	880	24	528
W18*40+30	0"	(unassigned)	41	LF	40	1640	30	1230
W24*62+54	0"	(unassigned)	39	LF	62	2418	54	2106
W12*14+18	0"	(unassigned)	17	LF	14	238	18	306
W24*84+36	0"	(unassigned)	40	LF	84	3360	36	1440
W18*35+30	0"	(unassigned)	121	LF	35	4235	30	3630
W14*43+32	0"	(unassigned)	41	LF	43	1763	32	1312
W16*26+26	0"	(unassigned)	53	LF	26	1378	26	1378
W18*35+32	0"	(unassigned)	68	LF	35	2380	32	2176
W18*40+48	0"	(unassigned)	23	LF	40	920	48	1104
W30*108+58	0"	(unassigned)	39	LF	108	4212	58	2262
W21*44+62	0"	(unassigned)	51	LF	44	2244	62	3162
W21*44+32	0"	(unassigned)	21	LF	44	924	32	672
W24*55+76	0"	(unassigned)	27	LF	55	1485	76	2052
W16*31+44	0"	(unassigned)	31	LF	31	961	44	1364
W18*35+34	0"	(unassigned)	33	LF	35	1155	34	1122
W18*35+18	0"	(unassigned)	15	LF	35	525	18	270
W12*14+14	0"	(unassigned)	79	LF	14	1106	14	1106
W6*25	0"	(unassigned)	44	LF	25	1100		
W21*50+44	0"	(unassigned)	41	LF	50	2050	44	1804
W21*50+72	0"	(unassigned)	74	LF	50	3700	72	5328
W30*90+58	0"	(unassigned)	33	LF	90	2970	58	1914
W30*116	0"	(unassigned)	49	LF	116	5684		
W14*30+32	0"	(unassigned)	29	LF	30	870	32	928
W21*44+56	0"	(unassigned)	80	LF	44	3520	56	4480
W33*118+64	0"	(unassigned)	34	LF	118	4012	64	2176
W10*22+16	0"	(unassigned)	33	LF	22	726	16	528
W24*62+66	0"	(unassigned)	35	LF	62	2170	66	2310
W21*68+52	0"	(unassigned)	34	LF	68	2312	52	1768
W30*99+104	0"	(unassigned)	34	LF	99	3366	104	3536
W21*62+48	0"	(unassigned)	40	LF	62	2480	48	1920
HSS 12*8*5/8	0"	(unassigned)	67	LF	76.1	5098.7		
W30*90+68	0"	(unassigned)	33	LF	90	2970	68	2244
W21*48+50	0"	(unassigned)	40	LF	48	1920	50	2000
W21*48+60	0"	(unassigned)	40	LF	48	1920	60	2400
HSS 6*6*3/8	0"	(unassigned)	202	LF	27.48	5550.96		
W33*118+88	0"	(unassigned)	33	LF	118	3894	88	2904
W21*50+82	0"	(unassigned)	35	LF	50	1750	82	2870
W10*22+18	0"	(unassigned)	16	LF	22	352	18	288

W30*116+58	0"	(unassigned)	33	LF	116	3828	58	1914
W21*44+34	0"	(unassigned)	81	LF	44	3564	34	2754
W18*40	0"	(unassigned)	18	LF	40	720		
W10*26	0"	(unassigned)	19	LF	26	494		
W21*44+40	0"	(unassigned)	40	LF	44	1760	40	1600
W21*111	0"	(unassigned)	240	LF	111	26640		
W18*65+100	0"	(unassigned)	79	LF	65	5135	100	7900
W16*31+24	0"	(unassigned)	44	LF	31	1364	24	1056
W18*76+40	0"	(unassigned)	120	LF	76	9120	40	4800
W18*46+50	0"	(unassigned)	646	LF	46	29716	50	32300
W21*44+66	0"	(unassigned)	28	LF	44	1232	66	1848
W18*40+60	0"	(unassigned)	81	LF	40	3240	60	4860
W21*93	0"	(unassigned)	80	LF	93	7440		
W14*22	0"	(unassigned)	63	LF	22	1386		
W18*40+40	0"	(unassigned)	79	LF	40	3160	40	3160
W21*55+54	0"	(unassigned)	67	LF	55	3685	54	3618
W18*60+74	0"	(unassigned)	79	LF	60	4740	74	5846
W18*46+70	0"	(unassigned)	39	LF	46	1794	70	2730
W21*122	0"	(unassigned)	66	LF	122	8052		
W18*40+76	0"	(unassigned)	41	LF	40	1640	76	3116
W18*71+40	0"	(unassigned)	40	LF	41	1640	40	1600
W18*35+38	0"	(unassigned)	24	LF	35	840	38	912
W21*55+38	0"	(unassigned)	68	LF	55	3740	38	2584
W18*46+70	0"	(unassigned)	40	LF	46	1840	70	2800
W18*40+38	0"	(unassigned)	41	LF	40	1640	38	1558
W24*104	0"	(unassigned)	87	LF	104	9048		
W24*68+110	0"	(unassigned)	39	LF	68	2652	110	4290
W16*26+32	0"	(unassigned)	22	LF	26	572	32	704
W24*68+96	0"	(unassigned)	40	LF	68	2720	96	3840
W21*48+54	0"	(unassigned)	161	LF	48	7728	54	8694
W21*44+24	0"	(unassigned)	21	LF	44	924	24	504
W21*44+26	0"	(unassigned)	15	LF	44	660	26	390
W24*55+68	0"	(unassigned)	41	LF	55	2255	68	2788
W24*94+48	0"	(unassigned)	40	LF	94	3760	48	1920
W14*22+40	0"	(unassigned)	23	LF	22	506	40	920
W27*146	0"	(unassigned)	40	LF	146	5840		
W16*36+46	0"	(unassigned)	21	LF	36	756	46	966
W24*62+34	0"	(unassigned)	24	LF	62	1488	34	816
W24*62+28	0"	(unassigned)	24	LF	62	1488	28	672
W24*62+72	0"	(unassigned)	41	LF	62	2542	72	2952
W24*62+100	0"	(unassigned)	41	LF	62	2542	100	4100
W24*76+46	0"	(unassigned)	39	LF	76	2964	46	1794
W27*102+40	0"	(unassigned)	34	LF	104	3536	40	1360
W24*84+98	0"	(unassigned)	41	LF	84	3444	98	4018
W24*84+42	0"	(unassigned)	41	LF	84	3444	42	1722
W24*84+72	0"	(unassigned)	40	LF	84	3360	72	2880
W27*102+50	0"	(unassigned)	34	LF	102	3468	50	1700
W24*104+30	0"	(unassigned)	33	LF	104	3432	30	990
W24*55+66	0"	(unassigned)	40	LF	55	2200	66	2640
W24*104+30	0"	(unassigned)	33	LF	104	3432	30	990
W24*62+46	0"	(unassigned)	39	LF	62	2418	46	1794
W24*55+86	0"	(unassigned)	40	LF	55	2200	86	3440
W10*12+6	0"	(unassigned)	21	LF	12	252	6	126
W6*15 UNO	0"	(unassigned)	22	LF	15	330		
W8*35	0"	(unassigned)	289	LF	35	10115		
W6*15	0"	(unassigned)	223	LF	15	3345		
3-HSS6*2*1/4	0"	(unassigned)	137	LF	12.2	1671.4		
W6*12	0"	(unassigned)	10	LF	12	120		
W8*13	0"	(unassigned)	32	LF	13	416		
						656461.86	lbs	367678
TOTAL			**13773**	**LF**		**328.23093**	**ton**	

			OST COLUMNS				
Items	**Height**	**Area**	**Length**		**Lb/ft**	**Subtotal Weight(lb)**	
W14*132	0"	(unassigned)	71	LF	132	9372	
W14*159	0"	(unassigned)	36	LF	159	5724	
W14*90	0"	(unassigned)	378	LF	90	34020	
W14*99	0"	(unassigned)	102	LF	99	10098	
W14*176	0"	(unassigned)	31	LF	176	5456	
W14*193	0"	(unassigned)	31	LF	193	5983	
W14*120	0"	(unassigned)	100	LF	120	12000	
W14*61	0"	(unassigned)	289	LF	61	17629	
W14*53	0"	(unassigned)	95	LF	53	5035	
W14*82	0"	(unassigned)	31	LF	82	2542	
W14*68	0"	(unassigned)	127	LF	68	8636	
W14*109	0"	(unassigned)	106	LF	109	11554	
W14*74	0"	(unassigned)	63	LF	74	4662	
W14*43	0"	(unassigned)	32	LF	43	1376	
						134087	lbs
Total						**67.0435**	**ton**

		OST BRACE					
Items	**Height**	**Area**	**Length**	**Unit**	**LB/ft**	**Weight**	
HSS8*8*1/2	0"	(unassigned)	409	LF	48.7	19918.3	
HSS12*12*5/8	0"	(unassigned)	72	LF	93.1	6703.2	
HSS12*8*1/2	0"	(unassigned)	86	LF	62.3	5357.8	
HSS6*6*3/8	0"	(unassigned)	7	LF	27.4	191.8	
HSS8*8*3/8	0"	(unassigned)	9	LF	37.6	338.4	
HSS10*10*1/2	0"	(unassigned)	139	LF	62.3	8659.7	
Total						**41169.2**	**lbs**
						20.5846	**ton**

9.2.4 QTO of Enclosure FIS

	QTO of ENCLOSURE						
	Items	**QTO1**	**UOM1**	**QTO2**	**UOM2**	**QTO3**	**UOM3**
Enclosure							
250	WT1-Self-Adhering Sheet Waterproofing	612	SF				
Ext CW & Windows							
238	CW2-GL1-Glass 1	9,821	SF				
244	CW2-GL2-Glass 2	4,338	SF				
246	CW1-GL4	0	SF				
247	CW1-GL3	0	SF				
248	CW3-GL6	3,262	SF				
Ext Masonry							
235	WT3-Brick	8,451	SF				
237	WT4-Brick 2	2,991	SF				
239	WT2- PC1 TYP. Arch Precast Concrete	2,204	SF	41	CY		
240	WT2-PC2 TYP. Arch Precast Concrete	2,630	SF	49	CY		4,834
242	WT1-Exterior Stone Cladding	612	SF	8	CY		
Ext Mtl Pnl							
236	WT5-Aluminum Composite Metal Pannel	6,700	SF				
241	WT6-Zin Metal Wall Panel	230	SF				
243	WT8-Aluminum Louver Panel	1,566	SF				
245	WT7-Vetical Metal Louver	1,973	SF				
279	Substation-EAST-Vetical Metal Louver	1,487	SF				
281	Substation-WEST-Vetical Metal Louver	1,470	SF				
282	Substation-SOUTH-Vetical Metal Louver	2,061	SF				
283	Substation-NORTH-Vetical Metal Louver	2,068	SF				
Gypsum Board							
253	WT2-Type X Glass Mat Gypsum Board 5/8"	4834	SF				
260	WT3-1-Type X Glass Mat Gypsum Board 5/8"	8451	SF				
261	WT3-2-Type X Glass Mat Gypsum Board 5/8"	8451	SF				
262	WT4-1-Type X Glass Mat Gypsum Board 5/8"	2991	SF				
263	WT4-2-Type X Glass Mat Gypsum Board 5/8"	2991	SF				
264	WT5-1-Type X Glass Mat Gypsum Board 5/8"	6700	SF				
265	WT5-2-Type X Glass Mat Gypsum Board 5/8"	6700	SF				
272	WT6-2-Type X Glass Mat Gypsum Board 5/8"	230	SF				
273	WT6-1-Type X Glass Mat Gypsum Board 5/8"	230	SF				
276	WT8-Type X Glass Mat Gypsum Board 5/8"	1566	SF				
	Subtotal	43144	SF				
Insulation							
251	WT2-Closed Cell Spray Insulation	4834	SF				
255	WT3-Air/Vapor Barrier	8451	SF				
259	WT4-Air/Vapor Barrier	2991	SF				
268	WT5-Air/Vapor Barrier	6700	SF				
269	WT5-Manufatured Recommended Girt Zone	6700	SF				
274	WT6-Manufatured Recommended Girt Zone	230	SF				
275	WT6-Air/Vapor Barrier	230	SF				

Metal Framing							
252	WT2-Cold-formed Metal Framing	4834	SF				
256	WT3-Cold-formed Metal Framing	8451	SF				
258	WT4-Cold-formed Metal Framing	2991	SF				
266	WT5-Cold-formed Metal Framing	6700	SF				
271	WT6-Cold-formed Metal Framing	230	SF				
277	WT8-Cold-formed Metal Framing	1566	SF				
278	WT8-INSULATED METAL PANEL	1566	SF				
280	WT7-V-Screen Wall Support Structure-HSS Steel	30	EA	1,890	LF		
284	WT7-H-Screen Wall Support Structure-HSS Steel	1,291	LF				
285	Substation Metal Coping	283	LF	2,263	SF		
Mineral Wool Board Insulation							
249	WT1-Mineral Wool Semi-Rigid Board Insulation	612	SF				
254	WT3-Mineral Wool Semi-Rigid Board Insulation	8451	SF				
257	WT4-Mineral Wool Semi-Rigid Board Insulation	2991	SF				
267	WT5-Mineral Wool Semi-Rigid Board Insulation	6700	SF				
270	WT6-Mineral Wool Semi-Rigid Board Insulation	230	SF				
	Subtotal	18984					
Roof							
286	Roof Area	11,115	SF	582	LF		
Roofing							
287	Vapor Retarder	11115	SF				
288	POLYISOCYANURATE	11115	SF				
289	FIBERGLASS MAT Gypsum Cover Board	11115	SF				
290	THERMOPLASTIC MEMBRANE Roofing TPO	11115	SF				
291	6" Green Roof Trays	11115	SF				
292	Parapet Wall	575	LF	2,012	SF	93	CY
293	Parapet Coping Stone	575	LF	288	SF		
Doors							
294	Exterior Doors-Double-8'2",4'2"	2	EA	68	SF		
295	Exterior Doors-Double-8'2",6'4"	1	EA	52	SF		
296	Exterior Doors-Single-8'2",4'2"	2	EA	68	SF		
297	Exterior Doors-Double-9'3",8'	1	EA	74	SF		
299	Substation Door-Single	1	EA	14	SF		
Windows							
298	Operable Windows-Single-6'3",2'10"	59	EA	1,045	SF		

9.2.5 QTO of Interior of FIS

		QTO of INTERIOR PART					
Items	**Name**	**QTO1**	**UOM1**	**QTO2**	**UOM2**	**QTO3**	**UOM3**
Partition Walls							
A2A,A3B,A3F,A6B							
Interior							
317	CONTINUOUS ACOUS SEALANT	0	LF			32452	SF
318	METAL STUD	0	LF			32452	SF
319	SOUND ATTENUATION BLANKET	0	LF			32452	SF
320	GYPSUM BOARD	0	LF			32452	SF
321	WALL FINISH AS SCHEDULED	0	LF			32452	SF
359	A-A type wall length	2,496	LF	32,452	SF		
B2F,B3B,B3F							
Interior							
322	CONTINUOUS ACOUS SEALANT	0	LF			7643	SF
323	METAL STUD	0	LF			7643	SF
324	SOUND ATTENUATION BLANKET	0	LF			7643	SF
325	GYPSUM BOARD*2	0	LF			15286	SF
326	WALL FINISH AS SCHEDULED	0	LF			7643	SF
327	TYPE "X" GYP BD	0	LF			7643	SF
360	A-B type wall length	588	LF	7,643	SF		
C3F,C6B							
Interior							
328	CONTINUOUS ACOUS SEALANT	0	LF			8993	SF
329	METAL STUD	0	LF			8993	SF
330	SOUND ATTENUATION BLANKET	0	LF			8993	SF
331	GYPSUM BOARD*2	0	LF			17986	SF
332	WALL FINISH AS SCHEDULED	0	LF			8993	SF
333	TYPE "X" GYP BD	0	LF			8993	SF
361	A-C type wall length	692	LF	8,993	SF		
D1B,D2A,D2B,D3A,D3B,D3E,D6B							
Interior							
334	CONTINUOUS ACOUS SEALANT	0	LF			7073	SF
335	METAL STUD	0	LF			7073	SF
336	SOUND ATTENUATION BLANKET	0	LF			7073	SF
337	GYPSUM BOARD	0	LF			7073	SF
338	WALL FINISH AS SCHEDULED	0	LF			7073	SF
362	A-D type wall length	544	LF	7,073	SF		
E3B							
Interior							
339	CONTINUOUS ACOUS SEALANT	0	LF			301	SF
340	METAL STUD	0	LF			301	SF
341	SOUND ATTENUATION BLANKET	0	LF			301	SF
342	GYPSUM BOARD	0	LF			301	SF
343	WALL FINISH AS SCHEDULED	0	LF			301	SF
363	A-E type wall length	23	LF	301	SF		

H6F							
Interior							
344	CONTINUOUS ACOUS SEALANT	0	LF			2146	SF
345	TYPE "X" GYP BD	0	LF			2146	SF
346	SOUND ATTENUATION BLANKET	0	LF			2146	SF
347	GYP LINER PANEL	0	LF			2146	SF
348	WALL FINISH AS SCHEDULED	0	LF			2146	SF
349	TYPE "X" GYP BD	0	LF			2146	SF
364	A-H type wall length	165	LF	2,146	SF		
J4F,J6F							
Interior							
350	CONTINUOUS ACOUS SEALANT*2	0	LF			29764	SF
351	TYPE "X" GYP BD	0	LF			14882	SF
352	SOUND ATTENUATION BLANKET	0	LF			14882	SF
353	GYP LINER PANEL	0	LF			14882	SF
354	WALL FINISH AS SCHEDULED	0	LF			14882	SF
365	A-J type wall length	1,145	LF	14,882	SF		
K3B,K3F,K6B							
Interior							
355	CONTINUOUS ACOUS SEALANT	0	LF			10940	SF
356	METAL STUD*2	0	LF			21880	SF
357	SOUND ATTENUATION BLANKET	0	LF			10940	SF
358	GYPSUM BOARD	0	LF			10940	SF
366	A-K type wall length	842	LF	10,940	SF		
Total Patition Wall Area				**168860**	**SF**		
Height for each wall is 13 feet							

Material Subtotal			
	CONTINUOUS ACOUS SEALANT	**99312**	SF
	METAL STUD	**78342**	SF
	SOUND ATTENUATION BLANKET	**84430**	SF
	GYPSUM BOARD	**84038**	SF
	WALL FINISH AS SCHEDULED	**73490**	SF
	TYPE "X" GYP BD	**35810**	SF
	GYP LINER PANEL	**17028**	SF

QTO of Interior Part

Items	**Name**	**QTO1**	**UOM1**	**QTO2**	**UOM2**	**QTO3**	**UOM3**
Interior							
Door Types							
Doors							
303	Door Type A--SOLID CORE VENEER DOOR	0	EA				
304	Door Type B--DOUBLE, SOLID CORE VENEER DOOR	0	EA				
305	Door Type C--SOLID CORE DOOR, PTD	130	EA				
306	Door Type D--DOUBLE SOLID CORE DOOR, PTD	12	EA				
307	Door Type E--HOLLOW METAL DOOR, PTD	15	EA				
308	Door Type F--DOUBLE, HOLLOW METAL DOOR, PTD	6	EA				
309	Door Type G--SINGLE VENEER SOLID CORE DOOR	0	EA				
310	Door Type H--SINGLE ALUMINUM WIDE STILE DOOR	33	EA				
311	Door Type L--COATED METAL MESH SECURITY GATE	3	EA				
312	Door Type M--NANAWALL	1	EA				
313	Door Type N--SLIDING GLASS NARROW STILE	3	EA				
314	Door Type P--SIDE FOLDING SECURITY GATE	1	EA				
315	Door Type J--DOUBLE ALUMINUM WIDE STILE DOOR	11	EA				
316	Door Type K--ALUMINUM AND GLASS SECTIONAL COILING DOOR	2	EA				
Subtotal		**217**	**EA**				

9.3 QTO by using Revit

9.3.1 QTO of Interior Revit

Wall Material Takeoff					
Material: Name	**Family and Type**	**Material: Area (SF)**	**Material: Volume (CF)**	**Material: Unit weight**	**Base Constraint**
* Default	Basic Wall: Generic 18" Wall	845.88	1,268.81	0.49 lb/ft³	LEVEL 01
LEVEL 01: 1					
* Default	Basic Wall: Generic 18" Wall	774.19	1,161.29	0.49 lb/ft³	LEVEL 02
LEVEL 02: 1					
Basic Wall: Generic 18" Wall: 2					
Yellow Feature Wall	Basic Wall: Generic 18" Yellow Feature Wall	247.84	371.76	0.00 lb/ft³	LEVEL 01
Yellow Feature Wall	Basic Wall: Generic 18" Yellow Feature Wall	648.99	941.78	0.00 lb/ft³	LEVEL 01
LEVEL 01: 2					
Yellow Feature Wall	Basic Wall: Generic 18" Yellow Feature Wall	645.01	967.52	0.00 lb/ft³	LEVEL 02
LEVEL 02: 1					
Basic Wall: Generic 18" Yellow Feature Wall: 3					
Yellow Feature Wall	Basic Wall: Generic 22" Yellow Feature Wall	166.01	304.36	0.00 lb/ft³	LEVEL 01
Yellow Feature Wall	Basic Wall: Generic 22" Yellow Feature Wall	214.93	372.19	0.00 lb/ft³	LEVEL 01
LEVEL 01: 2					
Basic Wall: Generic 22" Yellow Feature Wall: 2					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	111.55	5.78	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	56.97	16.77	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	340.52	17.71	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	171.53	51.35	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	82.83	4.29	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	42.42	12.45	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	198.81	10.33	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	100.4	29.97	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	640.45	33.36	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	320.22	96.73	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	385.14	20.06	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	192.57	58.17	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	460.92	24.01	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	230.46	69.62	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	839.5	43.72	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	419.75	126.8	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	388	20.21	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	194	58.6	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	851.17	44.33	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	425.58	128.56	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	412.78	21.5	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	206.39	62.35	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	459.78	23.95	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	229.89	69.45	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	314.44	16.38	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	157.22	47.49	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	448.94	23.38	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	224.47	67.81	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	562.78	29.31	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	281.39	85	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	90.92	4.74	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	45.46	13.73	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	1,179.61	61.44	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	589.81	178.17	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	118.99	6.19	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	59.69	17.96	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	251.72	13.1	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	126.27	37.99	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	688.26	35.82	0.49 lb/ft³	LEVEL 01

* Material - Stud - Metal	Basic Wall: Partition A3_	345.4	103.88	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	88.48	4.61	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	44.24	13.36	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	175.73	9.15	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	87.86	26.54	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	500.34	26.06	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	250.17	75.57	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	622.75	32.43	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	311.46	94.06	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	620.4	32.31	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	310.26	93.7	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	83.33	4.31	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	42.87	12.51	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	81.45	4.22	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	41.91	12.23	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	95.57	4.92	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_	50.24	14.28	0.49 lb/ft³	LEVEL 01
LEVEL 01: 56					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	93.33	4.86	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	46.67	14.1	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	1,627.69	84.78	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	813.85	245.85	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	379.28	19.75	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	189.64	57.29	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	1,318.33	68.66	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	659.17	199.12	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	307.39	16.01	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	153.7	46.43	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	162.68	8.47	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	81.34	24.57	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	385.67	20.09	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	192.83	58.25	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	97.48	5.08	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	48.74	14.72	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	352.39	18.35	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	176.19	53.23	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	259.51	13.52	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	129.76	39.2	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	93.98	4.9	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	46.99	14.2	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	175	9.11	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	87.5	26.43	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	117.65	6.13	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	58.82	17.77	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	259.75	13.53	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	129.88	39.23	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	397	20.68	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	198.5	59.96	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	541.17	28.19	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	270.58	81.74	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	384	20	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	192	58	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	224	11.67	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	112	33.83	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	211.14	11	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	105.57	31.89	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	398	20.73	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	199	60.11	0.49 lb/ft³	LEVEL 02

* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	552.33	28.77	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	276.17	83.43	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	156.5	8.15	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	78.25	23.64	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	97.33	5.07	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	48.67	14.7	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	398	20.73	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	199	60.11	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	398	20.73	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	199	60.11	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	398	20.73	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	199	60.11	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	398	20.73	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	199	60.11	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	398	20.73	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	199	60.11	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	1,593.44	82.7	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	802.59	239.84	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	398	20.73	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	199	60.11	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	75.89	3.89	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	39.12	11.27	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	399.15	20.79	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	199.57	60.29	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	110.47	5.72	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	56.89	16.58	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	208.49	10.86	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	104.31	31.48	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	309.4	15.98	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	159.21	46.36	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	646.42	33.67	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	323.21	97.64	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	206.25	10.67	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	106.27	30.95	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	304.49	15.86	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	152.24	45.99	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	69.61	3.62	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_	34.81	10.51	0.49 lb/ft³	LEVEL 02
LEVEL 02: 78					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	270.28	14.08	0.49 lb/ft³	LEVEL 03
* Material - Stud - Metal	Basic Wall: Partition A3_	135.14	40.82	0.49 lb/ft³	LEVEL 03
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	270.28	14.08	0.49 lb/ft³	LEVEL 03
* Material - Stud - Metal	Basic Wall: Partition A3_	135.14	40.82	0.49 lb/ft³	LEVEL 03
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	82.5	4.3	0.49 lb/ft³	LEVEL 03
* Material - Stud - Metal	Basic Wall: Partition A3_	41.25	12.46	0.49 lb/ft³	LEVEL 03
LEVEL 03: 6					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	270.28	14.08	0.49 lb/ft³	LEVEL 04
* Material - Stud - Metal	Basic Wall: Partition A3_	135.14	40.82	0.49 lb/ft³	LEVEL 04
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	270.28	14.08	0.49 lb/ft³	LEVEL 04
* Material - Stud - Metal	Basic Wall: Partition A3_	135.14	40.82	0.49 lb/ft³	LEVEL 04
LEVEL 04: 4					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	144.23	7.51	0.49 lb/ft³	LEVEL 05
* Material - Stud - Metal	Basic Wall: Partition A3_	72.11	21.78	0.49 lb/ft³	LEVEL 05
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	281.86	14.68	0.49 lb/ft³	LEVEL 05
* Material - Stud - Metal	Basic Wall: Partition A3_	140.93	42.57	0.49 lb/ft³	LEVEL 05
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_	281.86	14.68	0.49 lb/ft³	LEVEL 05
* Material - Stud - Metal	Basic Wall: Partition A3_	140.93	42.57	0.49 lb/ft³	LEVEL 05
LEVEL 05: 6					
Basic Wall: Partition A3_: 150					

* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_ fascia	85.09	4.42	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_ fascia	43.05	12.82	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_ fascia	115.77	6.02	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_ fascia	58.39	17.45	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_ fascia	30.34	1.57	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_ fascia	15.67	4.55	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_ fascia	98.71	5.13	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_ fascia	49.85	14.88	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_ fascia	236.5	12.32	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition A3_ fascia	118.25	35.72	0.49 lb/ft³	LEVEL 01
LEVEL 01: 10					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_ fascia	167.42	8.72	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_ fascia	83.71	25.29	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition A3_ fascia	205.55	10.71	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition A3_ fascia	102.78	31.05	0.49 lb/ft³	LEVEL 02
LEVEL 02: 4					
Basic Wall: Partition A3_ fascia: 14					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D2_	229.83	11.97	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition D2_	229.83	47.88	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D2_	17.17	0.89	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition D2_	17.17	3.58	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D2_	36.17	1.88	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition D2_	36.17	7.54	0.49 lb/ft³	LEVEL 01
LEVEL 01: 6					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D2_	442.91	23.07	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition D2_	442.91	92.27	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D2_	229	11.93	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition D2_	229	47.71	0.49 lb/ft³	LEVEL 02
LEVEL 02: 4					
Basic Wall: Partition D2_ : 10					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D3_	112.07	5.83	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition D3_	113.98	34.17	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D3_	114.99	5.98	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition D3_	116.82	35.04	0.49 lb/ft³	LEVEL 01
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D3_	11.03	0.57	0.49 lb/ft³	LEVEL 01
* Material - Stud - Metal	Basic Wall: Partition D3_	10.9	3.18	0.49 lb/ft³	LEVEL 01
LEVEL 01: 6					
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D3_	117.87	6.14	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition D3_	117.88	35.61	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D3_	121.42	6.32	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition D3_	121.4	36.66	0.49 lb/ft³	LEVEL 02
* Material - Sheathing - Gypsum Wall Board	Basic Wall: Partition D3_	11.17	0.58	0.49 lb/ft³	LEVEL 02
* Material - Stud - Metal	Basic Wall: Partition D3_	11	3.17	0.49 lb/ft³	LEVEL 02
LEVEL 02: 6					
Basic Wall: Partition D3_: 12					
* Default	Basic Wall: Stadium Seating	26.33	1.1	0.49 lb/ft³	LEVEL 01
* Default	Basic Wall: Stadium Seating	191.37	7.97	0.49 lb/ft³	LEVEL 01
* Default	Basic Wall: Stadium Seating	280.68	11.69	0.49 lb/ft³	LEVEL 01
* Default	Basic Wall: Stadium Seating	319.82	13.32	0.49 lb/ft³	LEVEL 01
LEVEL 01: 4					
Basic Wall: Stadium Seating: 4					
Total Wall Area (SF)		50495.48			

	Door Material Takeoff			
Material: Name	**Family and Type**	**Material: Unit weight**	**Count**	**Level**
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 01
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 01
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 01
Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior: 6				
Glass	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 01
aluminum-dbmatte	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 01
aluminum	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 01
Glass	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 01
aluminum-dbmatte	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 01
aluminum	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 01
Door Type H4 - Sectional: 10'0"X8'0": 6				
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior: 16				
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 01
Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior: 6				
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 01
Single - Plain Panel - Hollow Metal Frame: 3'-0" x 8'-0" - Interior: 2				
LEVEL 01: 36				
* Default - Metal - Stainless Steel	Door CW - Double - Offset Pivot Hinge - Single Swing - w Rails: Default - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Double - Offset Pivot Hinge - Single Swing - w Rails: Default - Exterior	0.00 lb/ft³	1	LEVEL 02
Door CW - Double - Offset Pivot Hinge - Single Swing - w Rails: Default - Exterior: 2				
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02

* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
* Default - Metal - Stainless Steel	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Glass - Transparent	Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 02
Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles: Default - Interior: 20				
Glass	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 02
aluminum-dbmatte	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 02
aluminum	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 02
Glass	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 02
aluminum-dbmatte	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 02
aluminum	Door Type H4 - Sectional: 10'0"X8'0"	0.49 lb/ft³	1	LEVEL 02
Door Type H4 - Sectional: 10'0"X8'0": 6				
Glass - NanaWall - Generic	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Rubber - NanaWall - Black	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Metal - NanaWall - Aluminum	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Glass - NanaWall - Generic	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Rubber - NanaWall - Black	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Metal - NanaWall - Aluminum	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Glass - NanaWall - Generic	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Rubber - NanaWall - Black	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Metal - NanaWall - Aluminum	Door-NanaWall-WD66: Standard	0.00 lb/ft³	1	LEVEL 02
Door-NanaWall-WD66: Standard: 9				
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
Double - Plain Panel - Hollow Metal Frame: 6'-0" x 7'-0" - Exterior: 8				
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
Double - Plain Panel - Hollow Metal Frame: 6'-0" x 8'-0" - Interior: 10				
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 02
Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior: 8				

* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 8'-0" - Interior	0.49 lb/ft³	1	LEVEL 02
Single - Plain Panel - Hollow Metal Frame: 3'-0" x 8'-0" - Interior: 2				
LEVEL 02: 65				
* Default - Metal - Stainless Steel	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 03
* Default - Glass - Transparent	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 03
* Default - Metal - Stainless Steel	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 03
* Default - Glass - Transparent	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 03
Door CW - Single - Sliding - w Rails & Stiles: Default - Interior: 4				
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 03
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 03
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 03
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 03
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 03
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 03
Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior: 6				
LEVEL 03: 10				
* Default - Metal - Stainless Steel	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 04
* Default - Glass - Transparent	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 04
* Default - Metal - Stainless Steel	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 04
* Default - Glass - Transparent	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 04
Door CW - Single - Sliding - w Rails & Stiles: Default - Interior: 4				
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 04
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 04
Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior: 2				
LEVEL 04: 6				
* Default - Metal - Stainless Steel	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 05
* Default - Glass - Transparent	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 05
* Default - Metal - Stainless Steel	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.49 lb/ft³	1	LEVEL 05
* Default - Glass - Transparent	Door CW - Single - Sliding - w Rails & Stiles: Default - Interior	0.00 lb/ft³	1	LEVEL 05
Door CW - Single - Sliding - w Rails & Stiles: Default - Interior: 4				
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 05
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 05
* Default - Door - Frame	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 05
* Default - Door - Panel	Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior	0.49 lb/ft³	1	LEVEL 05
Single - Plain Panel - Hollow Metal Frame: 3'-0" x 7'-0" - Exterior: 4				
LEVEL 05: 8				
Subtotal			**125**	

Ceiling Material Takeoff

Material: Name	Family and Type	Material: Area (SF)	Material: Volume (CF)	Count	Level
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	182.46	9.5	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	161.89	8.43	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	129.81	6.76	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	133.12	6.93	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	376.59	19.61	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	187.75	9.78	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	68.24	3.55	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	96.57	5.03	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	121.38	6.32	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	81.28	4.23	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	54.09	2.82	1	LEVEL 01
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	54.12	2.82	1	LEVEL 01
* Material - Ceiling - ACT 24" x 48"	Compound Ceiling: 24" x 72" Plank Ceiling System 2	1,286.45	67	1	LEVEL 01
* Material - Ceiling - ACT 24" x 48"	Compound Ceiling: 24" x 72" Plank Ceiling System 2	1,466.09	76.36	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	100.7	4.2	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	194.5	8.1	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	118.33	4.93	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	71.1	2.96	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	71.29	2.97	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	519.18	21.63	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	68.28	2.85	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	331.93	13.83	1	LEVEL 01
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	326.09	13.59	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	364.44	75.92	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	100.7	20.98	1	LEVEL 01

* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	194.5	40.52	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	118.33	24.65	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	71.1	14.81	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	71.29	14.85	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	519.18	108.16	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	68.28	14.23	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	331.93	69.15	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	326.09	67.94	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	329.3	68.6	1	LEVEL 01
* Material - Stud - Metal	Compound Ceiling: CLOUD	427.46	89.05	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	364.44	15.18	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	329.3	13.72	1	LEVEL 01
aluminum	Compound Ceiling: CLOUD	427.46	17.81	1	LEVEL 01
		11109.04			
LEVEL 01: 50					
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	119.85	6.24	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	117.53	6.12	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	215.46	11.22	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	112.63	5.87	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	112.4	5.85	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	1,039.65	54.15	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	110.85	5.77	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	111.51	5.81	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	227.25	11.84	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	115.26	6	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	48.17	2.51	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	191.49	9.97	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	138.43	7.21	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	101.02	5.26	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	101.16	5.27	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	106.09	5.53	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	180.02	9.38	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	161.8	8.43	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	379.46	19.76	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	158.24	8.24	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	116.68	6.08	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	116.68	6.08	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	111.83	5.82	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	111.95	5.83	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	111.95	5.83	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	685.49	35.7	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	114.71	5.97	1	LEVEL 02
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	54.09	2.82	1	LEVEL 02
* Material - Ceiling - ACT 24" x 48"	Compound Ceiling: 24" x 72" Plank Ceiling System 2	995.54	51.85	1	LEVEL 02

* Material - Ceiling - ACT 24" x 48"	Compound Ceiling: 24" x 72" Plank Ceiling System 2	1,099.98	57.29	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	211.03	8.79	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	59.2	2.47	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	77.95	3.25	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	217.18	9.05	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	345.62	14.4	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	507.96	21.16	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	179.53	7.48	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	64.09	2.67	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	45.18	1.88	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	269.06	11.21	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	269.21	11.22	1	LEVEL 02
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	607.2	25.3	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	211.03	43.97	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	59.2	12.33	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	77.95	16.24	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	217.18	45.25	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	345.62	72	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	507.96	105.82	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	179.53	37.4	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	64.09	13.35	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: CLOUD	364.44	75.92	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	45.18	9.41	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	269.06	56.06	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	269.21	56.09	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	607.2	126.5	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 02
* Material - Stud - Metal	Compound Ceiling: CLOUD	72	15	1	LEVEL 02
aluminum	Compound Ceiling: CLOUD	364.44	15.18	1	LEVEL 02
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 02
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 02
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 02
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 02
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 02
aluminum	Compound Ceiling: CLOUD	72	3	1	LEVEL 02
		14666.47			
LEVEL 02: 68					
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	1,328.39	69.19	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	84.15	4.38	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	77.94	4.06	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	88.04	4.59	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	86.77	4.52	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	92.61	4.82	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	238.98	12.45	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	236.06	12.29	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	407.82	21.24	1	LEVEL 03
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	444.02	23.13	1	LEVEL 03
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	3,877.01	161.54	1	LEVEL 03
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	101.91	4.25	1	LEVEL 03
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	87.54	3.65	1	LEVEL 03
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	89.85	3.74	1	LEVEL 03
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	85.27	3.55	1	LEVEL 03
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	677.02	28.21	1	LEVEL 03
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	119.36	4.97	1	LEVEL 03

* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	3,877.01	807.71	1	LEVEL 03
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	101.91	21.23	1	LEVEL 03
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	87.54	18.24	1	LEVEL 03
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	89.85	18.72	1	LEVEL 03
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	85.27	17.76	1	LEVEL 03
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	677.02	141.05	1	LEVEL 03
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	119.36	24.87	1	LEVEL 03
		13,160.70			
LEVEL 03: 24					
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	1,384.14	72.09	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	84.15	4.38	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	77.94	4.06	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	88.04	4.59	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	86.77	4.52	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	92.61	4.82	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	231.45	12.05	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	227.5	11.85	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	407.82	21.24	1	LEVEL 04
* Material - Ceiling - ACT 24" x 24"	Compound Ceiling: 24" x 24" ACT System	444.02	23.13	1	LEVEL 04
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	4,218.40	175.77	1	LEVEL 04
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	87.54	3.65	1	LEVEL 04
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	89.85	3.74	1	LEVEL 04
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	85.27	3.55	1	LEVEL 04
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	751.99	31.33	1	LEVEL 04
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	104.6	4.36	1	LEVEL 04
* Material - Ceiling - Gypsum Board	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	122.09	5.09	1	LEVEL 04
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	4,218.40	878.83	1	LEVEL 04
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	87.54	18.24	1	LEVEL 04
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	89.85	18.72	1	LEVEL 04
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	85.27	17.76	1	LEVEL 04
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	751.99	156.67	1	LEVEL 04
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	104.6	21.79	1	LEVEL 04
* Material - Stud - Metal	Compound Ceiling: 1/2" GWB on 2 1/2" Metal Stud	122.09	25.44	1	LEVEL 04
		14,043.92			
LEVEL 04: 24					
Total Ceiling Area (SF)		**52,980.13**			

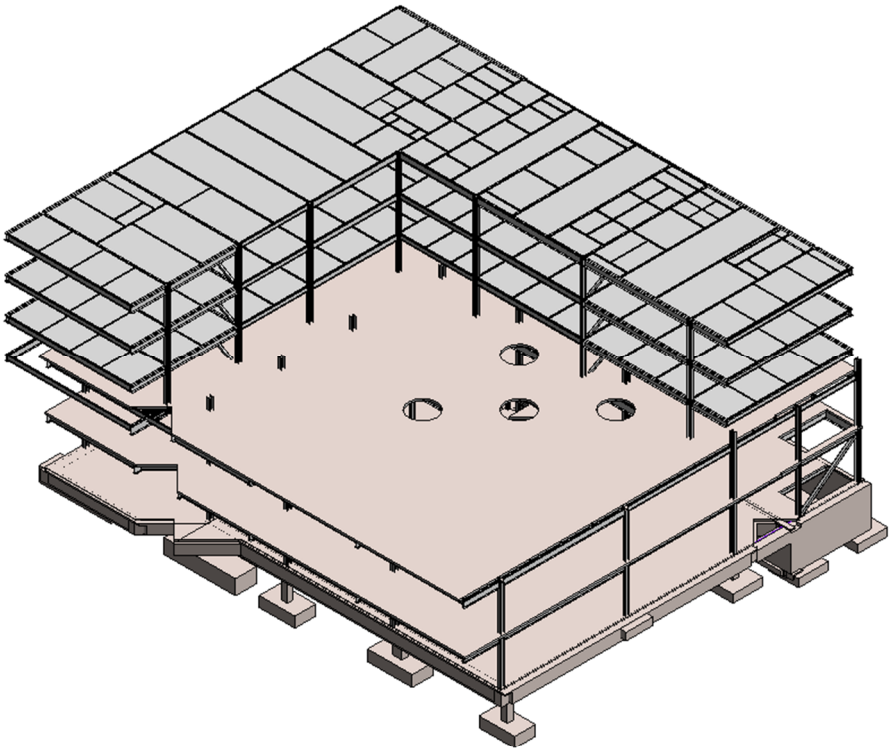
Window Material Takeoff

Material: Name	Family and Type	Material: Area	Count	Level
Curtain Wall Sliding Panel - Frame	Panel_Sliding DoorFrame: Default	17.56	1	LEVEL 01
Curtain Wall Sliding Panel - Panel	Panel_Sliding DoorFrame: Default	49.04	1	LEVEL 01
Panel_Sliding DoorFrame: Default: 2				
LEVEL 01: 2				
Total Window Material Area (SF)		**66.6**		

9.3.2 Structure QTO Comparison of Two Revit Model and OST

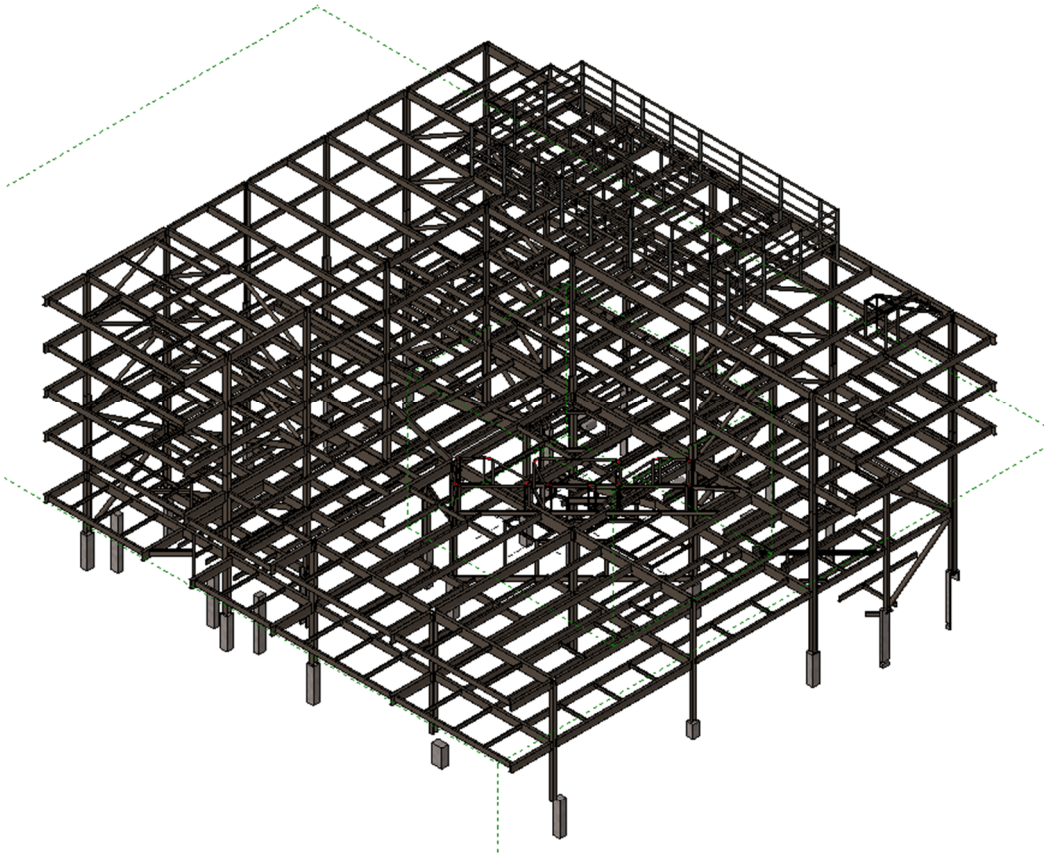
	Gensler		Student		OST	
Iteams	**QTO**	**Unit**	**QTO**	**Unit**	**QTO**	**Unit**
Beams	298.24	Ton	316.06	Ton	344.7	Ton
Columns	72.41	Ton	64.06	Ton	70.5	Ton
Brace	25.00	Ton	15.59	Ton	21.6	Ton
Base Plates	27.00	Ea	-	Ea	47	Ea
Slab on Deck	73,092.00	SF	73,210.39	SF	98653.8	SF
Shear Studs	-	Ea	-	Ea	367678	Ea
Mis Steel	-	Ton	-	Ton	41.5	Ton
Concrete	3,294.04	CY	2,916.31	CY	2308	CY
Formwork	-	SF	-	SF	23798	SF
Rebar	-	Ton	-	Ton	45.95	Ton
Weld Wire Fabric	-	SF	-	SF	78778.4	SF
Finish Slab	-	SF	-	SF	75027	SF

9.3.3 Student Model



	Student Model	
Iteams	**QTO**	**Unit**
Beams	316.06	Ton
Columns	64.06	Ton
Brace	15.59	Ton
Base Plates	-	Ea
Slab on Deck	73,210.39	SF
Shear Studs	-	
Mis Steel	-	
Concrete	2,916.31	CY
Formwork	-	
Rebar	-	
Weld Wire Fabric	-	
Finish Slab	-	

9.3.4 Gensler Model



	Gensler	
Iteams	**QTO**	**Unit**
Beams	298.24	Ton
Columns	72.41	Ton
Brace	25.00	Ton
Base Plates	27.00	Ea
Slab on Deck	73,092.00	SF
Shear Studs	-	
Mis Steel	-	
Concrete	3,294.04	CY
Formwork	-	
Rebar	-	
Weld Wire Fabric	-	
Finish Slab	-	

9.4 QTO of Interior Navisworks

9.4.1 Interior QTO Comparison of Revit, Navisworks, and OST

	Gensler					OST					Navisworks				
Items	QTO	Unit	Price	SUBTOTAL	COMMENTS	QTO	Unit	Price	SUBTOTAL	COMMENTS	QTO	Unit	Price	SUBTOTAL	COMMENTS
Partition Walls Area	50495.48	SF	$5.34	$269,645.86	092116330500	47,495	SF	$5.34	$253,626	092116330500	42241.79	SF	$5.34	$225,571.16	092116330500
Doors	125.00	EA	$1,388.00	$173,500.00	081413103020	217	EA	$1,388.00	$301,196	081413103020	137	EA	$1,388.00	$190,156.00	081413103020
Floor	-										82512.7	SF	$6.49	$535,874.15	096813106100
Ceilings	-					-					59688.5	SF	$16.64	$993,216.64	095133100140
Windows	49.04	SF	$67.80	$3,324.91	085250102060	-					-				
Stairs						156.00	Riser	$700.59	$109,292.04	055113500200					
						1.00	EA	$45,000.00	$45,000.00	n/a	-				
PARTION WALLS															
Basic Wall: Generic 18" Wall	1620.07	SF	$6.23	$10,093.04	092116339200	-					1620.07	SF	$6.23	$10,093.04	092116339200
Basic Wall: Generic 18" Yellow Feature Wall	1541.84	SF	$6.23	$9,605.66	092116339200						1541.84	SF	$6.23	$9,605.66	092116339200
Basic Wall: Generic 22" Yellow Feature Wall	380.94	SF	$6.23	$2,373.26	092116339200						380.94	SF	$6.23	$2,373.26	092116339200
Material - Sheathing - Gypsum Wall Board	302252.95	SF	$6.23	$1,883,035.88	092116339200	79,038	SF	$6.23	$492,407	092116339200	-	SF			
Material - Stud - Metal	15881.48	SF	$3.41	$54,155.85	050523871200	72,342	SF	$3.41	$246,686	050523871200	-	SF			
Basic Wall: Stadium Seating	818.20	SF	$6.23	$5,097.39	092116339200	818	SF	$6.23	$5,097		818.20	SF	$6.23	$5,097.39	092116339200
Continous Acoustical Sealant	-					98,312	SF	$1.29	$126,822	092910305500	-				
Sound Attenuation Blanket	-					84,430	SF	$4.25	$358,828	098116103400	-				
Wall Finish as Scheduled	-					73,490	SF	$0.55	$40,420	099123740340	-				
Type "X" Gypsum Board	-					35,810	SF	$0.71	$25,425	071213201000	-				
Gypsum Liner Panel	-					17,028	SF	$8.85	$150,698	092116230060	-				
CEILINGS															
Ceiling - ACT 24"x24"	11480.87	SF	$3.80	$43,627.31	095123101175	11,281	SF	$3.80	$42,867	095123101175	-				
Ceiling - ACT 24"x48"	2095.52	SF	$3.80	$7,962.98	095123101175	1,999	SF	$3.80	$7,594	095123101175	-				
Ceiling - Gypsum Board	13350.91	SF	$8.12	$108,409.39	092910307085	11,351	SF	$8.12	$92,169	092910307085	-				
Stud - Metal	14147.35	SF	$3.41	$48,242.46	050523871200	13,747	SF	$3.41	$46,878	050523871200	-				
Aluminum	796.44	SF	$16.64	$13,252.76	095133100140	796	SF	$16.64	$13,253	095133100140	-				
Total:				$2,632,326.74					$2,358,258.93					$1,971,987.29	

9.4.2 QTO of Interior: Navisworks

Row Labels	ModelLength	ModelWidth	ModelThickness	ModelPerimeter	ModelArea	ModelVolume	Count	Sum of Height
⊟ Ceiling Finishes								
⊞ Basic Ceiling				3229.500832	24199.43188		14	0
⊞ Compound Ceiling			24.75	12414.31888	35489.07371	7748.569419	115	0
⊟ Floor Finishes								
⊞ Floor			9	3728.10603	82512.7028	123769.0542	6	0
⊟ Interior Doors								
⊟ Door - Single Plain Panel - Hollow Metal Frame-U								
⊞ 3'-0" x 7'-0" - Exterior		12	0.583333333		182.3064236	19.2536169	4	28
⊞ 3'-0" x 8'-0" - Interior		3	0.145833333		40.08398438	4.48969184	1	7.833333333
⊞ 36" Wide x 96" Tall		228	11.08333333		3046.382813	341.2165799	76	595.3333333
⊞ Door CW - Double - Offset Pivot Hinge - Single Swing - w Rails		6.25	0		50	3.164577693	1	8
⊞ Door CW - Single - Butt Hinge - Single Swing - w Rails & Stiles		41.171875	0.541666667		314.6117622	29.55119466	13	98.95833333
⊞ Door CW - Single - Sliding - w Rails & Stiles		17.6215072	0		152.9463731	13.95634826	6	52.16666667
⊞ Door Type H4 - Sectional		40	0.666666667		553.0546875	28.4068287	4	32
⊞ Door-NanaWall-WD66		24	0.65625		1330.084804	102.1890222	3	29.5
⊟ Double - Plain Panel - Hollow Metal Frame (1)								
⊞ 6'-0" x 8'-0" - Interior		48	1.166666667		643.5017361	73.25491898	8	62.66666667
⊟ Double - Plain Panel - Hollow Metal Frame (2)								
⊞ 6'-0" x 7'-0" - Exterior		24	0.583333333		288.2022569	32.72757523	4	28
⊞ 6'-0" x 8'-0" - Interior		30	0.729166667		337.6942274	40.43023003	5	39.16666667
⊞ Hafele Barn Door		24	0		197.8333333	28	2	16
⊟ Single - Plain Panel - Hollow Metal Frame								
⊞ 3'-0" x 7'-0" - Exterior		27	1.3125		325.2871094	36.2796224	9	63
⊞ 3'-0" x 8'-0" - Interior		3	0.145833333		40.08398438	4.48969184	1	7.833333333
⊟ Partitions								
⊟ (blank)								
⊞ Generic 18" Wall	139.7916667	3			1620.069444	2430.104167	2	32
⊞ Generic 18" Yellow Feature Wall	94.68932436	4.5			1541.840239	2281.0613	3	48
⊞ Generic 22" Yellow Feature Wall	28.00604293	3.666666667			380.9414379	676.545414	2	29
⊞ Partition A3_	4189.564758	127.96875			40321.88706	16361.51161	315	3216.089286
⊞ Partition A3_ fascia	106.3070927	2.84375			472.5252458	190.6430686	7	31
⊞ Partition D2_	59.89565854	1.302083333			955.0805366	248.7188897	5	80
⊞ Partition D3_	82.09115882	2.125			492.3014897	173.2571427	6	36
⊞ Stadium Seating	132.0964838	0.166666667			818.1950005	34.07392673	4	21.91071429

9.5 Cost Estimation of All Methods

9.5.1 Cost Estimation of OST

OST Cost Estimate: Foisie Innovation Studio						
Project: MQP						
Location WPI						Estimator: Jacob
Architect/Engineer						4/11/2019
		QTO	Unit	Price	Subtotal	Total
Foundations						
	Foundation Excavation					
	Excavation	7,351	CY	$7.53	$55,353	
	Backfill	6,432	CY	$2.99	$19,232	
	Structural Fill	674	CY	$35.00	$23,596	
	Spread Footings					
	Formwork erect and strip	2,971	SF	$6.48	$19,252	
	Reinforcing Bars at 100#/CY	27,500	#	$1.31	$36,025	
	Concrete	275	CY	$314.53	$86,496	
	Perimeter Foundation Wall					
	Formwork erect and strip	16,956	SF	$11.00	$186,516	
	Reinforcing bars at 100#/CY	26	Tons	$2,167.20	$56,347	
	Concrete	520	CY	$350.21	$182,109	
	Waterproofing	8,478	SF	$10.00	$84,780	
	Stirp Footings					
	Formwork erect and strip	1,326	SF	$7.60	$10,078	
	Reinforcing bars at 100#/CY	7,600	#	$1.31	$9,956	
	Concrete	76	CY	$383.50	$29,146	
	Piers					
	Formwork erect and strip	2,545	SF	$7.29	$18,553	
	Reinforcing bars at 100#/CY	4,800	#	$1.64	$7,872	
	Concrete	48	CY	$288.85	$13,865	
	Slab on Grade					
	Edge Forms	581	LF	$2.23	$1,296	
	Welded Wire Fabric (Wire Mesh)	19,113	SF	$0.84	$16,055	
	Pour/Place Concrete	18,203	SF	$15.00	$273,045	
	Finish Slab	18,203	SF	$1.11	$20,205	
						$1,149,777

Structure						
	Structure Steel					
	Floor and Roof Beams	345	Tons	$3,694.94	$1,273,646	
	Columns	71	Tons	$3,694.94	$260,493	
	Brace	22	Tons	$3,694.94	$79,811	
	Shear Studs	13,130	Each	$12.00	$157,557	
	Base Plates 2"x18"x18"	47	SF	$43.00	$2,021	
	Metal Floor Deck 2" 18 ga.	78,778	SF	$4.42	$348,201	
	Metal Roof Deck 2" 18 ga.	19,876	SF	$3.57	$70,956	
	Spray-On Fireproofing	118,385	SF	$3.75	$443,943	
	Miscellaneous Steel	42	Tons	$3,649.94	$151,473	
	Slab on Deck					
	Edge Forms	2,750	LF	$2.23	$6,133	
	Welded Wire Fabric (Wire Mesh)	59,665	SF	$0.84	$50,119	
	Pour/Place Concrete	28,412	CY	$3.97	$112,796	
	Finish Slab	56,824	SF	$1.11	$63,075	
						$3,020,220
Enclosure						
Exterior Wall						
	Ext CW & Windows					
	GL1-Glass Type: Plain	9,821	SF	$39.28	$385,769	
	GL2-Glass Type: Dot	4,338	SF	$39.28	$170,397	
	GL6-Glass Type: Strip	3,262	SF	$39.28	$128,131	
	Exterior Caulking	1,800	LF	$5.00	$9,000	
	Interior Caulking	1,800	LF	$2.50	$4,500	
	Ext Masonry					
	WT3-Brick	8,451	SF	$29.44	$248,797	
	WT4-Brick 2	2,991	SF	$29.44	$88,055	
	WT2-PC1 TYP. Arch Precast Concrete	2,204	SF	$45.79	$100,921	
	WT2-PC2 TYP. Arch Precast Concrete	2,630	SF	$45.79	$120,428	
	WT1-Exterior Stone Cladding	612	SF	$58.95	$36,077	
	Ext Metal Panel					
	WT5-Alluminum Composite Metal Panel	6,700	SF	$5.18	$34,706	
	WT6-Zin Metal Panel	2,330	SF	$6.11	$14,236	
	WT8-Aluminum Louver Panel	2,256	Counts	$115.76	$261,211	

	Vertical Metal Louver	9,059	SF	$10.16	$92,039	
	Gypsum Board					
	Type X Glass Mat Gypsum Board 5/8"	43,144	SF	$15.15	$653,632	
	Roof Blocking	1,131	LF	$25.00	$28,275	
	Window Blocking	1,800	LF	$15.00	$27,000	
	Insulation					
	Closed Cell Spray Insulation	4,834	SF	$0.93	$4,496	
	Air/Vapor Barrier	18,372	SF	$0.92	$16,902	
	Manufactured Recommended Girt Zone	6,930	SF	$4.40	$30,492	
	WT1-Self-Adhering sheet Waterproofing	612	SF	$32.31	$19,774	
	Metal Framing					
	Cold-Formed Metal Framing	1,239	SF	$3.68	$4,558	
	Screen Wall Support Structure-HSS Steel	265	Each	$275.30	$72,977	
	Substation Metal Coping	283	LF	$25.72	$7,279	
	Mineral Wool Board Insulation					
	Mineral Wool Semi-Rigid Board Insulation	18,984	SF	$1.27	$24,110	
	Doors					
	Exterior Doors-Double-8'2",4'2"	2	Each	$470.90	$942	
	Exterior Doors-Double-8'2",6'4"	1	Each	$941.80	$942	
	Exterior Doors-Single-8'2",4'2"	2	Each	$470.90	$942	
	Exterior Doors-Double-9'3",8'	1	Each	$470.90	$471	
	Substation Door-Single	1	Each	$446.29	$446	
	Windows					
	Operable Windows-Single-6'3",2'10"	59	Each	$861.16	$50,808	
						$2,638,313
Roofing						
	Roofing					
	Vapor Retarder	18,929	SF	$2.59	$49,026	

	Polyisocyanurate	18,929	SF	$0.82	$15,522	
	Fiberglass Mat Gypsum Cover Board	18,929	SF	$1.92	$36,344	
	Thermoplastic Membrane Roofing TPO	18,929	SF	$20.00	$378,580	
	6" Green Roof Trays	18,929	SF	$1.47	$27,826	
	Parapet Wall	575	LF	$340.00	$195,500	
	Parapet Coping Stone	288	SF	$35.29	$10,164	
						$712,961
Interior Construction						
	Stairs					
	Stairs	156	Riser	$700.59	$109,292	
	Stadium Stairs	1	Each	$45,000.00	$45,000	
	Partition Walls					
	Doors	217	Each	$1,388.00	$301,196	
	Partition Walls Area	47,495	SF	$5.34	$253,626	
	Material - Sheathing - Gypsum Wall Board	79,038	SF	$6.23	$492,407	
	Material - Stud - Metal	72,342	SF	$3.41	$246,686	
	Basic Wall: Stadium Seating	818	SF	$6.23	$5,097	
	Continuous Acoustical Sealant	98,312	SF	$1.29	$126,822	
	Sound Attenuation Blanket	84,430	SF	$4.25	$358,828	
	Wall Finish as Scheduled	73,490	SF	$0.55	$40,420	
	Type "X" Gypsum Board	35,810	SF	$0.71	$25,425	
	Gypsum Liner Panel	17,028	SF	$8.85	$150,698	
	Ceilings					
	Ceiling - ACT 24"x24"	11,281	SF	$3.80	$42,867	
	Ceiling - ACT 24"x48"	1,999	SF	$3.80	$7,594	
	Ceiling - Gypsum Board	11,351	SF	$8.12	$92,169	
	Stud - Metal	13,747	SF	$3.41	$46,878	
	Aluminum	796	SF	$16.64	$13,253	
	Floorings					
	Floor	82,513	SF	$6.49	$535,874	
	Painting					
	Paint Gypsum Walls	174,029	SF	$1.50	$261,043	
	Paint Door Frames	217	Each	$100.00	$21,700	
	Paint Gypsum Ceilings	11,351	SF	$3.00	$34,053	

	Millwork					
	Allowance	78,000	SF	4	$312,000	
						$3,522,929
						$11,044,200

FIGURE 12: THE TOTAL COST OF OST

9.5.2 Cost Estimation In BIM

9.5.2.1 Structural Cost Estimate

	Gensler					Student				
Iteams	**QTO**	**Unit**	**Price**	**Unit**	**Total**	**QTO**	**Unit**	**Price**	**Unit**	**Total**
Beams	298.24	Ton	$ 3,694.94	Ton	$ 1,101,961.52	316.06	Ton	$ 3,694.94	Ton	$ 1,167,818.39
Columns	72.41	Ton	$ 3,694.94	Ton	$ 267,557.13	64.06	Ton	$ 3,694.94	Ton	$ 236,693.51
Brace	25.00	Ton	$ 3,694.94	Ton	$ 92,373.50	15.59	Ton	$ 3,694.94	Ton	$ 57,597.59
Base Plates	27.00	Ea	$ 43.00	Ea	$ 1,161.00	-	Ea	$ 43.00	Ea	$ -
Slab on Deck	73,092.00	SF	$ 4.42	SF	$ 323,066.64	73,210.39	SF	$ 4.42	SF	$ 323,589.92
Shear Studs			$ 3.03	Ea	$ -			$ 3.03	Ea	$ -
Mis Steel			$ 3,694.94	Ton	$ -			$ 3,694.94	Ton	$ -
					$ -					$ -
Concrete	3,294.04	CY	$ 350.21	CY	$ 1,153,605.75	2,916.31	CY	$ 350.21	CY	$ 1,021,320.93
					$ -					$ -
					$ -					$ -
Formwork	-		$ 7.60	SF	$ -	-		$ 7.60	SF	$ -
Rebar	-		$ 1.31	Ton	$ -	-		$ 1.31	Ton	$ -
Weld Wire Fabric	-		$ 0.84	CSF	$ -	-		$ 0.84	CSF	$ -
Finish Slab	-		$ 1.11	SF	$ -	-		$ 1.11	SF	$ -
Subtotal					**$ 2,939,725.53**					**$ 2,807,020.34**

9.5.2.2 Interior Cost Estimate

	Gensler					Navisworks				
Items	**QTO**	**Unit**	**Price**	**SUBTOTAL**	**COMMENTS**	**QTO**	**Unit**	**Price**	**SUBTOTAL**	**COMMENTS**
Partition Walls Area	50495.48	SF	$5.34	$269,645.86	092116330500	42241.79	SF	$5.34	$225,571.16	092116330500
Doors	125.00	EA	$1,388.00	$173,500.00	081413103020	137	EA	$1,388.00	$190,156.00	081413103020
Floor	-					82512.7	SF	$6.49	$535,874.15	096813106100
Ceilings	-					59688.5	SF	$16.64	$993,216.64	095133100140
Windows	49.04	SF	$67.80	$3,324.91	085250102060	-				
Stairs						-				
PARTION WALLS										
Basic Wall: Generic 18" Wall	1620.07	SF	$6.23	$10,093.04	092116339200	1620.07	SF	$6.23	$10,093.04	092116339200
Basic Wall: Generic 18" Yellow Feature Wall	1541.84	SF	$6.23	$9,605.66	092116339200	1541.84	SF	$6.23	$9,605.66	092116339200
Basic Wall: Generic 22" Yellow Feature Wall	380.94	SF	$6.23	$2,373.26	092116339200	380.94	SF	$6.23	$2,373.26	092116339200
Material - Sheathing - Gypsum Wall Board	302252.95	SF	$6.23	$1,883,035.88	092116339200	-	SF			
Material - Stud - Metal	15881.48	SF	$3.41	$54,155.85	050523871200	-	SF			
Basic Wall: Stadium Seating	818.20	SF	$6.23	$5,097.39	092116339200	818.20	SF	$6.23	$5,097.39	092116339200
Continous Acoustical Sealant	-					-				
Sound Attenuation Blanket	-					-				
Wall Finish as Scheduled	-					-				
Type "X" Gypsum Board	-					-				
Gypsum Liner Panel	-					-				
CEILINGS										
Ceiling - ACT 24"x24"	11480.87	SF	$3.80	$43,627.31	095123101175	-				
Ceiling - ACT 24"x48"	2095.52	SF	$3.80	$7,962.98	095123101175	-				
Ceiling - Gypsum Board	13350.91	SF	$8.12	$108,409.39	092910307085	-				
Stud - Metal	14147.35	SF	$3.41	$48,242.46	050523871200	-				
Aluminum	796.44	SF	$16.64	$13,252.76	095133100140	-				
Total:				**$2,632,326.74**					**$1,971,987.29**	

9.5.3 Cost Estimation of SDC Design & Construction

SDC				
BUILDING SYSTEM DESCRIPTION	**AREA (SF)**	**$/SF**	**COST**	**% Total**
SHELL COST				
A10 FOUNDATIONS	75500	15	$1,132,500	5.5%
B10 SUPERSTRUCTURE	75500	30	$2,265,000	11.0%
B20 EXTERIOR WALLS	75500	32.5	$2,453,750	11.9%
B30 ROOFING	75500	16	$1,208,000	5.8%
SHELL COST TOTAL		**$93.50/sf**	**$7,059,250**	**34.1%**
INTERIORS COST				
C10 INTERIOR CONSTRUCTION	75000	$ 25.70	$ 1,927,375.00	9.3%
C20 STAIRCASES		$ 3.02	$ 226,500.00	1.1%
C10 INTERIOR FINISHES		$ 18.67	$ 1,400,000.00	6.8%
INTERIOR COST TOTAL		**$47.07/sf**	**$3,553,875**	**17.2%**
SYSTEMS COSTS				
D10 CONVEYING SYSTEMS		3	$ 226,500.00	1.1%
D20 PLUMBING		10.69	$ 806,750.00	3.9%
D30 HVAC		54.65	$ 4,126,075.00	19.9%
D40 FIRE PROTECTION		4.5	$ 339,750.00	1.6%
D50 ELECTRICAL		34.67	$ 2,617,750.00	12.7%
SYSTEMS COST TOTAL		**$107.51/s**	**$ 8,116,825.00**	**39.2%**
EQUIPMENT & FURNISHINGS				
E10 EQUIPMENT		1.09	$82,000	0.4%
E20 FURNISHINGS		1.77	$133,750	0.6%
EQUIPMENT & FURNISHINGS TOTAL		**2.86**	**$215,750**	**1.0%**
SPECIAL CONSTRUCT & DEMOLITION				
F10 SPECIAL CONSTRUCTION		0	0	0
F20 SELECTIVE BUILDING DEMOLITION		0	0	0
SPECIAL CONSTRUCT & DEMOLITION TOTAL				
SITE COST				
G SITE PREP/DEVELOPMENT		23	$ 1,736,500.00	8.4%
SITE COST TOTAL		23	**$ 1,736,500.00**	**8.4%**
TOTAL DIRECT COST (Trade Costs)		**273.94**	**$20,682,200.00**	**100.0%**
ALLOCATIONS		**143.07**	**$10,801,982.00**	
TOTAL CONSTRUCTION COST		**417.01**	**$31,484,182.00**	

9.5.4 RSMeans Cost Per SF

9.5.4.1 College Dormitory RSMeans SF Estimate

RSMeans data from GORDIAN **Square Foot Cost Estimate Report**

Date: **4/9/2019**

Estimate Name:	**Foisie Innovation Studio - Dorm Space** Worcester , MA , 01609
Building Type:	**College, Dormitory, 2-3 Story with Brick Veneer / Rigid Steel**
Location:	**WORCESTER, MA**
Story Count:	**3**
Story Height (L.F.):	**11.66**
Floor Area (S.F.):	**45000**
Labor Type:	**STD**
Basement Included:	**Yes**
Data Release:	**Year 2018 Quarter 4**
Cost Per Square Foot:	**$400.27**
Building Cost:	**$16,506,653.52**

Costs are derived from a building model with basic components.
Scope differences and market conditions can cause costs to vary significantly.

		% of Total	Cost Per S.F.	Cost
A Substructure		**9.88%**	**20.71**	**683,301.85**
A1010	**Standard Foundations**		**5.89**	**194,298.50**
	Spread footings, 3000 PSI concrete, load 75K, soil bearing capacity 6 KSF, 4' - 0" square x 12" deep		5.89	194,298.50
A1030	**Slab on Grade**		**5.99**	**197,560.00**
	Slab on grade, 8" thick, heavy industrial, reinforced		5.99	197,560.00
A2010	**Basement Excavation**		**3.43**	**113,190.00**
	Excavate and fill, 100,000 SF, 16' deep, clay excavation, bank run gravel borrow for backfill		3.43	113,190.00
A2020	**Basement Walls**		**5.4**	**178,253.35**
	Foundation wall, CIP, 12' wall height, pumped, .444 CY/LF, 21.59 PLF, 12" thick		5.4	178,253.35
B Shell		**31.28%**	**65.53**	**2,162,550.58**
B1010	**Floor Construction**		**25.61**	**845,007.07**
	Steel column, TS14, 500 KIPS, 16' unsupported height, 109 PLF		7.04	232,158.59
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 PSF total load		5.88	194,101.05
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and wall, 25'x25' bay, 23" deep, 40 PSF superimposed load, 84 PSF total load		9.92	327,460.10
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and wall, 25'x25' bay, 23" deep, 40 PSF superimposed load, 84 PSF total load, for columns add		0.4	13,047.98
	Fireproofing, gypsum board, fire rated, 3 layer, 1.5" thick, 8" steel column, 3 hour rating, 23 PLF		2.37	78,239.35
B1020	**Roof Construction**		**9.89**	**326,520.04**
	Roof, steel joists, beams, 1.5" 22 ga metal deck, on columns, 25'x25' bay, 20" deep, 40 PSF superimposed load, 60 PSF total load		3.26	107,510.04

	Steel deck, cellular, single span, 20' span, 3" deep, 6 PSF, 30 PSF TL		6.64	219,010.00
B2010	**Exterior Walls**		**20.3**	**669,873.60**
	Brick veneer wall, engineer face, 16 ga x 3-5/8" LB @ 16" metal stud back-up, english bond		20.3	669,873.60
B2020	**Exterior Windows**		**4.32**	**142,591.85**
	Windows, aluminum, awning, insulated glass, 4'-5" x 5'-3"		4.32	142,591.85
B2030	**Exterior Doors**		**2.07**	**68,290.99**
	Door, aluminum & glass, without transom, full vision, double door, hardware, 6'-0" x 7'-0" opening		2.07	68,290.99
B3010	**Roof Coverings**		**3**	**99,119.78**
	Roofing, single ply membrane, EPDM, 60 mils, loosely laid, stone ballast		0.62	20,531.94
	Insulation, rigid, roof deck, extruded polystyrene, 40 PSI compressive strength, 4" thick, R20		1.51	49,943.08
	Roof edges, aluminum, duranodic, .050" thick, 6" face		0.53	17,431.43
	Flashing, aluminum, no backing sides, .019"		0.11	3,642.19
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick		0.23	7,571.14
B3020	**Roof Openings**		**0.34**	**11,147.25**
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs		0.15	5,033.23
	Smoke hatch, unlabeled, galvanized, 2'-6" x 3', not incl hand winch operator		0.19	6,114.02
C Interiors		**23.22%**	**48.64**	**1,605,154.70**
C1010	**Partitions**		**14.63**	**482,813.48**
	Wood partition, 5/8"fire rated gypsum board face, 5/8"fire rated gypsum board base, 2 rows-2x4 framing, same opposite face, 2" fiberglas insulation		13.62	449,533.33
	Gypsum board, 1 face only, exterior sheathing, fire resistant, 5/8"		0.59	19,362.18
	Add for the following: taping and finishing		0.42	13,917.97
C1020	**Interior Doors**		**14.29**	**471,590.54**
	Door, single leaf, kd steel frame, hollow metal, commercial quality, flush, 3'-0" x 7'-0" x 1-3/8"		14.29	471,590.54
C1030	**Fittings**		**2.86**	**94,477.94**
	Toilet partitions, cubicles, ceiling hung, painted metal		2.03	66,910.80
	Bathroom accessories, stainless steel, mirror, framed, with shelf, 72" x 24"		0.84	27,567.14
C2010	**Stair Construction**		**5.73**	**188,963.28**
	Stairs, steel, pan tread for conc in-fill, picket rail,12 risers w/ landing		5.73	188,963.28
C3010	**Wall Finishes**		**4.95**	**163,227.83**
	Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats		2.22	73,425.00
	Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats		0.53	17,622.00
	Ceramic tile, thin set, 4-1/4" x 4-1/4"		2.19	72,180.83
C3020	**Floor Finishes**		**5.5**	**181,445.48**
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 24 oz		3.79	124,935.36
	Vinyl, composition tile, maximum		0.34	11,220.26
	Tile, ceramic natural clay		1.37	45,289.86
C3030	**Ceiling Finishes**		**0.69**	**22,636.15**
	Acoustic ceilings, 3/4" fiberglass board, 24" x 48" tile, tee grid, suspended support		0.69	22,636.15

D Services		32.60%	150.95	6,278,964.15
D1010	**Elevators and Lifts**		**5.28**	**174,289.90**
	Hydraulic passenger elevator, 4000 lb., 3 floor, 12' story height, 125 FPM		5.28	174,289.90
D2010	**Plumbing Fixtures**		**17.3**	**570,817.75**
	Water closet, vitreous china, bowl only with flush valve, wall hung		7.75	255,697.20
	Lavatory w/trim, wall hung, vitreous china, 19" x 17"		3.47	114,664.44
	Laundry sink w/trim, plastic, on wall or legs, 36" x 23" double compartment		0.39	12,980.17
	Service sink w/trim, PE on CI,wall hung w/rim guard, 22" x 18"		0.51	16,950.58
	Shower, stall, fiberglass 1 piece, three walls, 36" square		4.71	155,551.61
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH		0.45	14,973.75
D2020	**Domestic Water Distribution**		**5.66**	**186,719.19**
	Electric water heater, commercial, 100< F rise, 500 gal, 240 KW 984 GPH		5.66	186,719.19
D2040	**Rain Water Drainage**		**1.78**	**58,886.88**
	Roof drain, CI, soil,single hub, 5" diam, 10' high		0.51	16,849.00
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add		1.27	42,037.88
D3050	**Terminal & Package Units**		**86.5**	**4,152,000.00**
	Rooftop, multizone, air conditioner, 1,500 SF, 16.62 ton		75.2	3,609,600.00
	Computer room unit, air cooled, includes remote condenser, 23 ton		11.3	542,400.00
D4010	**Sprinklers**		**6.16**	**203,388.95**
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 10,000 SF		2.07	68,461.85
	Wet pipe sprinkler systems, copper tubing, type M, extra hazard, 1 floor, 2000 SF		4.09	134,927.10
D4020	**Standpipes**		**1.12**	**37,058.95**
	Dry standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor		0.67	22,130.86
	Dry standpipe risers, class III, steel, black, sch 40, 6" diam pipe, additional floors		0.45	14,928.09
D5010	**Electrical Service/Distribution**		**1.9**	**62,808.25**
	Underground service installation, includes excavation, backfill, and compaction, 100' length, 4' depth, 3 phase, 4 wire, 277/480 volts, 600 A		0.63	20,903.90
	Feeder installation 600 V, including RGS conduit and XHHW wire, 600 A		0.51	16,856.30
	Switchgear installation, incl switchboard, panels & circuit breaker, 277/480 V, 600 A		0.76	25,048.05
D5020	**Lighting and Branch Wiring**		**17.12**	**564,831.19**
	Receptacles incl plate, box, conduit, wire, 20 per 1000 SF,2.4 watts per SF		4.6	151,928.70
	Wall switches, 2.5 per 1000 SF		0.94	30,953.21
	Central air conditioning power, 4 watts		0.69	22,758.45
	Motor installation, three phase, 200 V, 15 HP motor size		0.12	3,848.90
	Motor feeder systems, three phase, feed to 200 V 15 HP, 230 V 15 HP, 460 V 40 HP, 575 V 50 HP		0.05	1,618.89
	Fluorescent fixtures recess mounted in ceiling, 0.8 watt per SF, 20 FC, 5 fixtures @32 watt per 1000 SF		4.63	152,753.04
	Fluorescent fixtures recess mounted in ceiling, 1.6 watt per SF, 40 FC, 10 fixtures @32watt per 1000 SF		6.09	200,970.00
D5030	**Communications and Security**		**8.13**	**268,163.09**
	Telephone wiring for offices & laboratories, 8 jacks/MSF		1.88	62,132.90
	Communication and alarm systems, fire detection, addressable, 25 detectors, includes outlets, boxes, conduit and wire		1.12	36,925.42
	Fire alarm command center, addressable with voice, excl. wire & conduit		0.54	17,789.08

	Communication and alarm systems, includes outlets, boxes, conduit and wire, intercom systems, 25 stations		1.9	62,662.09
	Communication and alarm systems, includes outlets, boxes, conduit and wire, master TV antenna systems, 12 outlets		0.68	22,480.64
	Internet wiring, 8 data/voice outlets per 1000 S.F.		2.01	66,172.96
E Equipment & Furnishings		**3.03%**	**6.34**	**209,286.54**
E1090	**Other Equipment**		**4.52**	**149,240.00**
	2.00-Hydraulic, passenger elevator, 2000 lb, 2 floors, 100 FPM		4.52	149,240.00
E2020	**Moveable Furnishings**		**1.82**	**60,046.54**
	Furnishings, dormitory furniture, dressing unit, built-in, deluxe		1.82	60,046.54
F Special Construction		**0%**	**0**	**0**
G Building Sitework		**0%**	**0**	**0**

SubTotal	**100%**	**$292.17**	**$10,939,257.82**
Contractor Fees (General Conditions,Overhead,Profit)	**30.00%**	**$87.65**	**$4,892,483.00**
Architectural Fees	**7.00%**	**$20.45**	**$674,912.70**
User Fees	**0.00%**	**$0.00**	**$0.00**
Total Building Cost		**$400.27**	**$16,506,653.52**

9.5.4.2 Laboratory/Classroom RSMeans SF Estimate

RSMeans data from GORDIAN

Square Foot Cost Estimate Report

Date: **4/9/2019**

Estimate Name:	**Foisie Innovation Studio - Lab Space** Worcester , MA , 01609
Building Type:	**School, Vocational with Face Brick & Concrete Block / Bearing Walls**
Location:	**WORCESTER, MA**
Story Count:	**2**
Story Height (L.F.):	**16**
Floor Area (S.F.):	**45000**
Labor Type:	**OPN**
Basement Included:	**No**
Data Release:	**Year 2018 Quarter 4**
Cost Per Square Foot:	**$400.27**
Building Cost:	**$14,977,528.48**

Costs are derived from a building model with basic components.

Scope differences and market conditions can cause costs to vary significantly.

		% of Total	Cost Per S.F.	Cost
A Substructure		**9.88%**	**20.71**	**683,301.85**
A1010	**Standard Foundations**		**5.89**	**194,298.50**
	Spread footings, 3000 PSI concrete, load 75K, soil bearing capacity 6 KSF, 4' - 0" square x 12" deep		5.89	194,298.50
A1030	**Slab on Grade**		**5.99**	**197,560.00**
	Slab on grade, 8" thick, heavy industrial, reinforced		5.99	197,560.00
A2010	**Basement Excavation**		**3.43**	**113,190.00**
	Excavate and fill, 100,000 SF, 16' deep, clay excavation, bank run gravel borrow for backfill		3.43	113,190.00
A2020	**Basement Walls**		**5.4**	**178,253.35**
	Foundation wall, CIP, 12' wall height, pumped, .444 CY/LF, 21.59 PLF, 12" thick		5.4	178,253.35
B Shell		**31.28%**	**65.53**	**2,162,550.58**
B1010	**Floor Construction**		**25.61**	**845,007.07**
	Steel column, TS14, 500 KIPS, 16' unsupported height, 109 PLF		7.04	232,158.59
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 PSF total load		5.88	194,101.05
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and wall, 25'x25' bay, 23" deep, 40 PSF superimposed load, 84 PSF total load		9.92	327,460.10

	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and wall, 25'x25' bay, 23" deep, 40 PSF superimposed load, 84 PSF total load, for columns add		0.4	13,047.98
	Fireproofing, gypsum board, fire rated, 3 layer, 1.5" thick, 8" steel column, 3 hour rating, 23 PLF		2.37	78,239.35
B1020	**Roof Construction**		**9.89**	**326,520.04**
	Roof, steel joists, beams, 1.5" 22 ga metal deck, on columns, 25'x25' bay, 20" deep, 40 PSF superimposed load, 60 PSF total load		3.26	107,510.04
	Steel deck, cellular, single span, 20' span, 3" deep, 6 PSF, 30 PSF TL		6.64	219,010.00
B2010	**Exterior Walls**		**20.3**	**669,873.60**
	Brick veneer wall, engineer face, 16 ga x 3-5/8" LB @ 16" metal stud back-up, english bond		20.3	669,873.60
B2020	**Exterior Windows**		**4.32**	**142,591.85**
	Windows, aluminum, awning, insulated glass, 4'-5" x 5'-3"		4.32	142,591.85
B2030	**Exterior Doors**		**2.07**	**68,290.99**
	Door, aluminum & glass, without transom, full vision, double door, hardware, 6'-0" x 7'-0" opening		2.07	68,290.99
B3010	**Roof Coverings**		**3**	**99,119.78**
	Roofing, single ply membrane, EPDM, 60 mils, loosely laid, stone ballast		0.62	20,531.94
	Insulation, rigid, roof deck, extruded polystyrene, 40 PSI compressive strength, 4" thick, R20		1.51	49,943.08
	Roof edges, aluminum, duranodic, .050" thick, 6" face		0.53	17,431.43
	Flashing, aluminum, no backing sides, .019"		0.11	3,642.19
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick		0.23	7,571.14
B3020	**Roof Openings**		**0.34**	**11,147.25**
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs		0.15	5,033.23
	Smoke hatch, unlabeled, galvanized, 2'-6" x 3', not incl hand winch operator		0.19	6,114.02
C Interiors		**23.22%**	**48.64**	**1,605,154.70**
C1010	**Partitions**		**14.63**	**482,813.48**
	Wood partition, 5/8"fire rated gypsum board face, 5/8"fire rated gypsum board base, 2 rows-2x4 framing, same opposite face, 2" fiberglas insulation		13.62	449,533.33
	Gypsum board, 1 face only, exterior sheathing, fire resistant, 5/8"		0.59	19,362.18
	Add for the following: taping and finishing		0.42	13,917.97
C1020	**Interior Doors**		**14.29**	**471,590.54**
	Door, single leaf, kd steel frame, hollow metal, commercial quality, flush, 3'-0" x 7'-0" x 1-3/8"		14.29	471,590.54
C1030	**Fittings**		**2.86**	**94,477.94**
	Toilet partitions, cubicles, ceiling hung, painted metal		2.03	66,910.80

	Bathroom accessories, stainless steel, mirror, framed, with shelf, 72" x 24"	0.84	27,567.14
C2010	**Stair Construction**	**5.73**	**188,963.28**
	Stairs, steel, pan tread for conc in-fill, picket rail,12 risers w/ landing	5.73	188,963.28
C3010	**Wall Finishes**	**4.95**	**163,227.83**
	Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats	2.22	73,425.00
	Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats	0.53	17,622.00
	Ceramic tile, thin set, 4-1/4" x 4-1/4"	2.19	72,180.83
C3020	**Floor Finishes**	**5.5**	**181,445.48**
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 24 oz	3.79	124,935.36
	Vinyl, composition tile, maximum	0.34	11,220.26
	Tile, ceramic natural clay	1.37	45,289.86
C3030	**Ceiling Finishes**	**0.69**	**22,636.15**
	Acoustic ceilings, 3/4" fiberglass board, 24" x 48" tile, tee grid, suspended support	0.69	22,636.15
D Services	**32.60%**	**150.95**	**6,112,449.16**
D1010	**Elevators and Lifts**	**5.28**	**174,289.90**
	Hydraulic passenger elevator, 4000 lb., 3 floor, 12' story height, 125 FPM	5.28	174,289.90
D2010	**Plumbing Fixtures**	**17.3**	**570,817.75**
	Water closet, vitreous china, bowl only with flush valve, wall hung	7.75	255,697.20
	Lavatory w/trim, wall hung, vitreous china, 19" x 17"	3.47	114,664.44
	Laundry sink w/trim, plastic, on wall or legs, 36" x 23" double compartment	0.39	12,980.17
	Service sink w/trim, PE on CI,wall hung w/rim guard, 22" x 18"	0.51	16,950.58
	Shower, stall, fiberglass 1 piece, three walls, 36" square	4.71	155,551.61
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH	0.45	14,973.75
D2020	**Domestic Water Distribution**	**5.66**	**186,719.19**
	Electric water heater, commercial, 100< F rise, 500 gal, 240 KW 984 GPH	5.66	186,719.19
D2040	**Rain Water Drainage**	**1.78**	**58,886.88**
	Roof drain, CI, soil,single hub, 5" diam, 10' high	0.51	16,849.00
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add	1.27	42,037.88
D3050	**Terminal & Package Units**	**86.5**	**3,985,485.01**
	Rooftop, multizone, air conditioner, 1,500 SF, 16.62 ton	75.2	3,609,600.00
	Computer room unit, air cooled, includes remote condenser, 23 ton	11.3	375,885.01
D4010	**Sprinklers**	**6.16**	**203,388.95**

	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 10,000 SF	2.07	68,461.85
	Wet pipe sprinkler systems, copper tubing, type M, extra hazard, 1 floor, 2000 SF	4.09	134,927.10
D4020	**Standpipes**	**1.12**	**37,058.95**
	Dry standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor	0.67	22,130.86
	Dry standpipe risers, class III, steel, black, sch 40, 6" diam pipe, additional floors	0.45	14,928.09
D5010	**Electrical Service/Distribution**	**1.9**	**62,808.25**
	Underground service installation, includes excavation, backfill, and compaction, 100' length, 4' depth, 3 phase, 4 wire, 277/480 volts, 600 A	0.63	20,903.90
	Feeder installation 600 V, including RGS conduit and XHHW wire, 600 A	0.51	16,856.30
	Switchgear installation, incl switchboard, panels & circuit breaker, 277/480 V, 600 A	0.76	25,048.05
D5020	**Lighting and Branch Wiring**	**17.12**	**564,831.19**
	Receptacles incl plate, box, conduit, wire, 20 per 1000 SF,2.4 watts per SF	4.6	151,928.70
	Wall switches, 2.5 per 1000 SF	0.94	30,953.21
	Central air conditioning power, 4 watts	0.69	22,758.45
	Motor installation, three phase, 200 V, 15 HP motor size	0.12	3,848.90
	Motor feeder systems, three phase, feed to 200 V 15 HP, 230 V 15 HP, 460 V 40 HP, 575 V 50 HP	0.05	1,618.89
	Fluorescent fixtures recess mounted in ceiling, 0.8 watt per SF, 20 FC, 5 fixtures @32 watt per 1000 SF	4.63	152,753.04
	Fluorescent fixtures recess mounted in ceiling, 1.6 watt per SF, 40 FC, 10 fixtures @32watt per 1000 SF	6.09	200,970.00
D5030	**Communications and Security**	**8.13**	**268,163.09**
	Telephone wiring for offices & laboratories, 8 jacks/MSF	1.88	62,132.90
	Communication and alarm systems, fire detection, addressable, 25 detectors, includes outlets, boxes, conduit and wire	1.12	36,925.42
	Fire alarm command center, addressable with voice, excl. wire & conduit	0.54	17,789.08
	Communication and alarm systems, includes outlets, boxes, conduit and wire, intercom systems, 25 stations	1.9	62,662.09
	Communication and alarm systems, includes outlets, boxes, conduit and wire, master TV antenna systems, 12 outlets	0.68	22,480.64
	Internet wiring, 8 data/voice outlets per 1000 S.F.	2.01	66,172.96
E Equipment & Furnishings		**3.03%**	**6.34**	**209,286.54**
E1090	**Other Equipment**	**4.52**	**149,240.00**
	2.00-Hydraulic, passenger elevator, 2000 lb, 2 floors, 100 FPM	4.52	149,240.00
E2020	**Moveable Furnishings**	**1.82**	**60,046.54**
	Furnishings, dormitory furniture, dressing unit, built-in, deluxe	1.82	60,046.54

F Special Construction	0%	0	0
G Building Sitework	0%	0	0

Subtotal	100%	$344.79	$11,378,143.67
Contractor Fees (General Conditions, Overhead, Profit)	30.00%	$87.65	$2,892,483.00
Architectural Fees	7.00%	$20.45	$674,912.70
User Fees	0.00%	$0.00	$0.00
Total Building Cost		$452.89	$14,945,539.37

		RSMeans
Items		Cost
STRUCTURE		$1,366,603.70
ENCLOSURE		$4,325,101.16
INTERIOR		$3,210,309.40
SYSTEMS COST		$11,260,314.15
EQUIPMENT & FURNISHINGS		$418,573.08
SITE COST	Assumed from SDC Estimate	**$1,736,500.00**
TOTAL TRADE COST		$22,317,401.49
ALLOCATIONS		$9,134,791.40
TOTAL CONSTRUCTION COST		$31,452,192.89

* Values represented are the sum of the two RSMeans estimates