REPUBLIC OF TÜRKİYE

ALTINBAŞ UNIVERSITY

Institute of Graduate Studies

Civil Engineering

PROJECT CONTROL SYSTEM FOR BUILDING CONSTRUCTION PROJECTS IN IRAQ USING SUPPORT VECTOR MACHINE

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Master's Thesis

Supervisor

Assoc.Prof. Dr. Sepanta NAİMİ

Istanbul, 2023

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The thesis titled PROJECT CONTROL SYSTEM FOR BUILDING CONSTRUCTION PROJECTS IN IRAQ USING SUPPORT VECTOR MACHINE prepared by MUAYAD ALSUDANI and submitted on 12/04/2023 has been **accepted unanimously** for the degree of Master of Science in Civil Engineering

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I hereby declare that all information/data presented in this graduation project has been obtained in full accordance with academic rules and ethical conduct. I also declare all unoriginal materials and conclusions have been cited in the text and all references mentioned in the Reference List have been cited in the text, and vice versa as required by the abovementioned rules and conduct.

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ABSTRACT

PROJECT CONTROL SYSTEM FOR BUILDING CONSTRUCTION PROJECTS IN IRAQ USING SUPPORT VECTOR MACHINE

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Date: April / 2023

Pages: 101

Managers monitor and regulate the various expenses related with project duties. The traditional variances are computed by comparing the actual performance measures gathered during the execution phase to the baseline metrics chosen during the planning phase. These variances are taken into account throughout the control procedures in order to establish their relevance. In real-world projects, the question is whether traditional methodologies can provide a meaningful indicator for project control. The present paper used the exponentially weighted moving average (EWMA) control chart in conjunction with the support vector machine (SVM) to propose an excellent tool for construction project monitoring. The EWMA advances SPC schemes are used to study the chart's upper and lower control limits and to use cost performance index (CPI) data to determine out of control spots. The SVM findings then demonstrated a good indicator for predicting the overall egression of the project based on different time periods. The numerical results show that using the control chart method in conjunction with SVM to analyze the actual values of CPI indices improves project management teams' capacity to recognize cost problems on time.

Keywords: Statistical Control Charts, Project Performance Evaluation, Cost Performance Index ,Earned Value Management, Support Vector Machine.

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ABBREVIATIONS

EVM	:	Earned Value Management
PMI	:	Project Management Institute
PF	:	Performance Factor
PVM	:	Planned Value Method
EDM	:	Earned Duration Method
ESM	:	Earned Schedule Method
ANNs	:	Artificial Neural Networks
RBFNN	:	Radial Basis Function Neural Network
CBR	:	Case-Based Reasoning
RA	:	Regression Analysis
PSO	:	Particle Swarm Optimization
DT	:	Decision Tree
SVM	:	Support Vector Machine

1. INTRODUCTION

1.1 OVERVIEW

A construction building is a structure that contains self-contained facilities or a single housing unit. It can have multiple residential units, such as in an apartment complex. Individual houses or individual dwellings, lodging or rooming houses, dormitories, apartments, and hotels are the five types of construction buildings. The main difficulty in this decade has been the market's competitiveness. Due to the recession in the housing industry, builders are competing to lower unit prices. A project's success is determined by the following criteria: cost within budget, schedule on time, and quality[1]. Predicting the building process is a significant issue for successful project management and ensuring a profit[2]. As a result, efforts have been focused on the concept of developing a forecast method to describe the costly problems in order to ensure successful construction projects. Many studies have attempted to optimize the investment revenue of building projects by maximizing practical project values and minimizing total project costs[3]. The project manager will be forced to make a decision based on the inaccurate strategy, budget, or schedule, and the balance between quality and cost will be disrupted. Due to poor project preparation and activity control, overbudgeting, poor materials, labor shortages, increased material costs, delays in deliveries, material waste, unexpected weather changes, material loss, insecurity, and poor communication, most project managers have difficulty controlling costs during project implementation. As a result, there are cost overruns, disagreements, and even project abandonment [4].

1.2 PROJECT MANAGEMENT TECHNIQUES

Many project management tools have been developed to assist managers in keeping projects on track and aligned with their anticipated timeframes, scopes, and budgets [5]. Earned Value Management (EVM) is an important project management tool that analyzes the performance and progress of a project objectively by integrating scope, schedule, and cost aspects [6]. EVM is primarily concerned with accurately measuring work in progress against a comprehensive project plan by establishing cost, time, and project completion performance indices. Managers can keep the project on track and figure out how the project will perform in the future by comparing the planned values of these performance indices (calculated according to the baseline plan) with their actual records [7].

EVM, according to Hall (2012), is a management system that offers a variety of research options. EVM incorporates the three important project management components of cost, time, and scope from a conceptual standpoint. More specifically, the project manager can use EVM to monitor the project's performance during execution and get warning signals so that remedial steps can be taken to get the project back on track. PMI (2008) provides a summary of EVM's major measurements and calculations [8].

The EVM technique may also be utilized to generate project projections, which is the subject of this research. Vanhoucke identified the most popular EVM time and cost forecasting methodologies (2012b). The performance factor (PF) here denotes the assumption that was made in order to generate a certain projection. The first row of Table 2 illustrates the many alternative assumptions regarding the projected performance of future work, while the second row shows the related performance factors. We can identify nine time forecasting strategies, which can be grouped into three broad methodologies: Anbari's (2003) planned value method (PVM), Jacob and Kane's (2004) earned duration method (EDM), and Lipke's earned schedule method (ESM) (2003). In addition, eight distinct EVM-based methodologies for project cost forecasting are explored [9]

In cost estimation scope, many methods and techniques are used, out of which Artificial Neural Networks (ANNs), hybrid models of ANN with secondary artificial intelligence or meta-heuristic methods, Radial Basis Function Neural Network (RBFNN); Case-Based Reasoning (CBR), Regression Analysis (RA), Particle Swarm Optimization (PSO), Decision Tree (DT), and Expert Systems are investigated here. Artificial neural networks are one of the many algorithms, which are modelling biological learning processes by computers. They are classified under a major classification named machine learning. In fact, machine learning is the process of programming the computers to optimize a performance based on a past available data or experience[10]. Wang et al in 2012 developed ANN and Support Vector Machine (SVM) for predicting the cost of building projects and schedule. SVM has shown superior performance. The paper also recommends using an ensemble of ANN and SVM, while it should be taken into account that early planning is considered a key factor in project success [11] Other researchers have conducted a survey and implemented data analysis in order to extract the main influencing input parameters of their fuzzy model. Peško et al. in 2017 have considered comparing ANN and SVM capabilities in cost estimation for construction of urban roads out of which, SVM has shown superior result compared to ANN. They claim for more expanded data-base in the future researches. Also, they raise the need for a cost model that is capable of estimating at very early stage of the project for management purposes [12].

1.3 PROBLEM STATEMENT

Decisions made early in the construction process have a considerable impact on the final cost of a structure. As the construction project progresses, its influence diminishes. Estimators are frequently asked how much it costs to build a house, especially since no two projects are identical. Understanding the cost structure of construction works based on previously completed construction buildings is critical for estimating and controlling costs on future projects. The identifiable structure makes construction cost planning and monitoring easier, but less precise. Due to the importance of cost estimates in the early stages of a project and the restricted availability of information during this time, construction managers often estimate project costs using their expertise, experience, and standard estimators. For that, we need a model that can be utilized in practice by the parties involved, such as the estimator or even the owner, to anticipate the expenses required to finance the construction of dwellings, with the cost estimate's results predicted to be close to the real cost. Many academics are still looking for and creating a new method that can deal with limited data and provide more accurate cost estimates. However, until today, the number of studies on construction projects at various stages has been quite restricted.

1.4 RESEARCH OBJECTIVES

The main objectives of this study are:

a. To identify the independent parameters for construction building process.

b. To develop a machine learning-based regression model, using the support vector machine (SVM) method, to support early estimates of total construction costs of construction building.

1.5 THESIS ORGANIZATION

This thesis has five chapters. Chapter one includes an introduction to the cost estimation in construction building project management.

Chapter two presents a general view of the criteria for the selection of cost methods and parameters in different studies collected from vary researches.

The computational program, including the studied parameters, the work methodology, are presented in Chapter three.

Chapter four discusses the result and the calculation of the work. Chapter five is the conclusion.

2. LITERATURE REVIEW

2.1 SCHEME CONTROLS IN BUILDING

Project controls also include procedures, knowledge, professional skills, as well as tools which used plan, handle, monitor, and ameliorate minor risks or events that may affect a project's price and timeline. These solar cells are the disciplinary and methodical procedures used to endorse project management practices which focus on regulating the project's routine and value. By reducing the kingdom of construction projects to a cellular scale, they may appear as follows [13]:

a. Preparation and Scheduling

b. Risk Assessment (Valuation, Identity, and Mitigation)

c. Cost Estimation

d. Cost Control & Assurance

e. Scheduling and Control

f. Change Order Management

g. Document Management

h. Scheduling and Control

i. Change Order Management

2.2 PROJECT SCHEME MANAGEMENT

An arrangement control system specialist obviously takes the firm's profitability then orientation from an initiative, cost, and hazard perspective when dealing with large magnitude or multi - faceted initiatives. By investigating the trends and residuals on all parts of a project, any nearing risks that may affect the project's agenda or spending plan are identified and discussed initially for team discussion and mitigation. These panels not only clarify the significance of trends, but they also meticulously document all aspects of the project's trip for reference purposes. Scheme control systems are critical to project and comprehensive prevention, regardless of cost as well as possibility [14].

2.2.1 Project Control Strategy

Create a journalism framework and customizable intelligences to close the information gap among investors. Collate and admit the projects' actual development (schedule as well as price) on regular intervals to leverage trends, then forecast a sensible conclusion. Clearly identify how approaching risks affect the project's agenda as well as budget, and bring them to the forefront for discussion and mitigation if needed. Allow for complete openness and accountability of all strategies [6].

2.2.2 Project Control Document

A project governance text is an official acct that has been reviewed by the entire team in charge of the project as well as clearly expresses the program's status and guidance after considering schedule, cost, and risk. These crucial documents encompass data that backs up predictions as well as highlight decision viewpoints to guarantee that the endeavor stays on track for finalization. In the case of a disturbed project, the above data does have the tenor for getting the task back on track for an acceptable show concluding [15].

2.2.3 Risk Management

Suitable mitigation proposals can be put in place to control and handle danger proactively by assessing hazards at the earliest possible stage. We assume a consistent price then schedule risk assessment in our structured approach to Danger Planning, allowing us to track multiple options on the budget as well as program. Everything begins with the construction manager making himself easily accessible to construction companies in order to solicit bids. Previously, the construction managers who are involved in the project's execution will make an offer to the owner[16]. This same bid will include information about the amount of money which the construction manager must offer in order for the system to just be completed. There really are two types of bid risk[17]:

a. Revealed bid: Exposure bids are irrevocably associated with public projects. it sale where a mildly construction company can make an offer. Ordinarily, an open bid has been openly elevated

b. Shut put in an offer: Shut bids are used in private strategies. The system owner has sent out an accurate amount of offer invitations to construction companies.

After receiving all bidders for the specific project, this same owner selects the consultant using one of the three methods listed below [18]:

a. Reduced assortment: In this case, the price is the most important consideration. Constructing property managers present this same lowest bids for which they are willing to finish the work. The construction manager chooses the lowest bid and profits from it.

b. Best value selection: This operation considers both credentials and price. The owner chooses the most enticing offer in both terms of craftsmanship and price.

c. Credentials selection: When expertise is used as the sole factor in choosing a construction property manager, the recent market is used. A proposal for skills is used by the owner to obtain additional information about the company's experience and project management capabilities.

2.3 CONTRACT TYPES

When the selection process is completed, the type of contract has also to be decided upon. Normally, there are four agreement types [19]:

a. Solid mass: The most common form of contract. This same owner, followed by the contractor, established a guaranteed amount for the entire project. If the total cost of the system is proven to fall below the agreed amount, this same prices stay the same.

b. Constituent price: This technique is chosen when there are objective problems in determining the final significance in advance. In order to cut costs, the project owner proposes components with a fixed unit price.

2.4 CONSTRUCTION COST MANAGEMENT

a. Charge fee: The best negotiated agreement for construction firms is a cost-plus fee contract. Any extra unforeseeable expenses must be protected by the owner just after project's overall cost and the agreed-upon standard rate again for contracting company[20].

b. Unit rate value: This kind of agreement is similar to the previous one. The key distinction is the complete making objective, which cannot be surpassed in this case.

2.5 PROJECT ORGANIZATION PROCESSES

After the demand process is completed, it is now up to all of the project's stakeholders to put it into effect. In general, regardless of its unique physiognomies, each proposal has a normal life cycle. This formation might be divided into four basic phases [21]:

2.5.1 Project Initiation

During the first phase, the program's objective and viability are ascertained. This is a very important phase of the procedure because it can imply that the system is viable. If there is any doubt, a viability investigation is carried out and a suggested remedy has been issued based on the results. When everything is made the decision, a project introduction document (Proportional - derivative) is created. The most important relics in managing projects is the actual start document, which serves as the foundation for the order to make the best[22].

2.5.2 Planning Phase

The project scheduling phase is when the team documents all of the work that needs to be done. It is a continuous action that will almost certainly lead to the completion of the project. Even during planning phase, the main priority would be to strategize moment, costs, as well as resources for the scheme. This same group is creating the strategy that must be shadowed based on system prerequisites. It is additionally known as scope organization. A task breakdown structure (Break down structure), a checklist that separates all essential tasks into smaller extra functional categories, is another important text that must be ready . As pretty shortly as the budget, schedule, and work have indeed been established, the project is well almost ready for start. The following step in this extremely important process is risk assessment. At the this point, this same team could perhaps inspect all potential project impediments and come up with hard solutions. Lastly, a planning process is still necessary because it will ensure efficient flow of information among strategic support [23].

2.5.3 Implementation Phase

The project administration strategy is put through its paces during the execution phase. As a rule, this step is broken down into two primary processes: performing and monitoring and controlling. The scheme team ensures that all required tasks are completed. At the exact same moment, advancement is tracked, and changes are implemented as needed. In fact, a scheme coach gets to spend the majority of his time oversight, then sending tasks and maintaining project authority based on the information he receives [24].

2.5.4 Closing Stage (Closure)

The program's final phase symbolizes his formal finalization. The project leader evaluates what ended up going well and then makes reference to every potential failures. Finally, the side performs a project accounting, determines the final budget, and gives details on any pending tasks [25].

2.6 PROJECT SCHEDULING

Numerous risks that may arise throughout a building project can be avoided with reliable planning. The primary goal of planning would be to enhance the distribution of materials and resources within a scheme. Any prospective suspensions could be avoided using this method, and improved communication among all parties can indeed be ensured. Here are some various scheduling methodologies that a project manager could use [26]:

2.7 GANTT DIAGRAMS

It is, without hesitation, one of the most applications efficiently that a development team may have at the disposal. A Gantt Chart may offer a contractor with an assumption of a building project and allow the contractor to distinguish between tasks that have been left behind and those that have been finished in a timely manner. Gantt are simply indispensable [27].

2.7.1 Streak of Balance Preparation

The run of success of stability method is incredibly helpful for repetitive tasks. It can be of tremendous assistance in meeting the deadlines and allocating resources effectively [28].

2.7.2 Dangerous Path Method

It is among the most general tools, and it contributes significantly to the methodical allocation of assets and centralized controller of timelines. A cutting-edge husk, a critical trail method, can make a contribution to the earlier or at least on-time conclusion to the building project [29].

2.7.3 Q-Scheduling

This building planning method has become increasingly popular in recent years because it allows project leaders to prioritize multiple, sometimes created many problems [30].

2.8 BUDGET IN CONSTRUCTION PROJECT MANAGEMENT

Trying to define the finances is by far among the most important constraints that ought to be taken into account when the project manager begins putting together such a building project. Estimating the price may seem a difficult task, however if done correctly, it may be one of the most important aspects of achievement. As a general rule, a strategy manager ought to keep four basic variables in mind [31]:

a. Scheme Analysis: The first step must be the clarity of the disparate objectives and constraints for the forthcoming feature. Once the construction company has done that, the contractor will have a proper insight of the goals the construction company wants to achieve as well as who the construction company will need to do so.

b. Guesstimation of a cheap: After ingesting all of the program's urgencies, it's time to organize the cheap in tandem with such a solid timeline. Today is also a good day to solicit bids from taking an interest service providers.

c. Price monitoring: As soon as the building scheme is put into action, it is critical to begin keeping an eye on project costs. The quicker the construction company twitch does this, the better, because it will allow the construction company to detect a little expected capital misuse and abuse before they become late-night.

Accounting: That had a capable finance department is energizing. They would be made responsible for maintaining all financial contracts on track, in conjunction with the project's team.

2.9 THE LEGAL FEATURE OF A CONSTRUCTION SCHEME

A building scheme is made up of many different details. One of the most important aspects which no project manager should overlook is the legal constraints. A very well project manager for construction ought to constantly be able to propose solutions to potential legal disputes or hazards that might come up. Cutting-edge that method, the entire scheme is managed to secure and built on solid foundations. Through general, there are five big components that should be taken into account [32]:

2.9.1 The Gatherings

This group refers to anyone who is involved in the construction project (servicers , consultants, deputize -contractors, buyer.

2.9.2 Contracts

Although there are definite contract processes for building projects, there are frequently fickle whims in the contracts that necessitate additional professional counsel.

2.9.3 Legislation and Regulation

A solid lawful team can make unquestionable that all the dissimilar legislations and regulations are followed properly.

2.9.4 Procurement

The bidding process involves the purchase of every one of the various items and services required for a construction project. It is therefore critical that the entire system is thoroughly controlled from a legal standpoint.

2.9.5 Insurance

It's no mystery there are numerous physical hazards on a worksite. This is why a project manager ought to have been skilled about health coverage pacts and taken good care of every last detail.

2.10 CONSTRUCTION RISK

The final system cost more than the scheme budget. This might not only render it unviable in the big scheme of things, but it could also lead to the client going bankrupt. The following are some of the reasons why projects cost more than they should[30]:

a. The spending plan was incorrect.

b. The system underwent numerous changes and variations.

c. The program's chances improved.

d. The patient's team delayed the servicer.

e. The contract documents failed to clearly assign obligations, or the scope of work was inadequately defined.

f. Unforeseen location conditions occur, increasing costs. Changes in founding circumstances can significantly increase prices.

2.11 THE PROJECT IS COMPLETED LATE-NIGHT

The customer not just to delays their proposal, resulting in a loss of revenue, but they additionally pay extra to use other infrastructure in the intervening period. Late projects invariably incur extra supervisory and institution costs. Late schemes may also cause reputational harm. Among the reasons for the late concluding are [33]:

a. The scope of the project changes during implementation , creating delays then variation claims.

b. The contractor receives admission and information late.

c. Poor public insight of the project.

It can result in negative publicity and seamless mass demonstrations, legal actions, and boycotts. Poorly executed and overseen projects even have brought down presidencies. Neighbors may feud for years as a result of a one-of-a-kind project. Irate citizens can cause projects to be postponed or completely halted. A significant construction company or supplier going bankrupt could cause work delays and additional costs whereas another collection agency is found. Modern addition warranties for craftmanship and equipment may be worthless [28].

2.12 MITIGATE CONSTRUCTION RISK

2.12.1 Minimize Projects That Exceed Budget

Assuring that the low cost is correct. Finances must be evaluated and updated on a regular basis throughout the scheme's lifespan to account for all known information and changes. Verify that the cost includes all price increases and that those prices are a precise valuation. Include appropriate contingencies and payouts for unidentified expenses as needed.

To have a precise job description leads to price for construction companies. Minimizing changes and differences throughout the stages of design and building Before construction begins, conduct a thorough inquiry of the project site circumstances, such as culpability ground inquests [34].

2.12.2 Minimize Projects Agenda Errors

a. The building schedule isn’t realistic. Ensure that the agenda is realistic by paying experienced project managers [35].

b. The construction agenda fails to account for the patient's processes, project constraints, and normally expected weather events

c. Throughout the scheme, there are changes and variations. Reduce or prevent changes by guaranteeing that the project's scope is adequately equipped and complete, and that the lender has all of the necessary information when pricing the proposal

d. Advancement is not supervised all through the project's duration. Slippage must be identified and corrected

e. Consultants are chosen solely on the basis of their price, rather than their expertise and available resources for the system.

f. The scheme is poorly managed, resulting in delays in granting access and issuing information to the contractor.

2.12.3 Minimize Adverse Weather

Trying to design the proposal so that any work that could be harmed by inclement weather has been assembled and then built clandestinely before being moved off-site. Even redoing this same scheme to remove actions which might be affected by weather, such as using varying skill methodologies, could remove the need to excavate during the rainy season. As a result of planning the program's twitch, it does not begin during the most adverse weather. Allowing enough time in the construction programme for normal dependable climate [36].

2.12.4 Minimize The Shortage of Resources

Initiatives can be postponed indefinitely to twitch whenever the level of building projects falls, potentially saving resources and making the project cheaper. The proposal could be intended to make use of modules, which could even be built in areas where assets are much more abundant. Other materials, that are more easily obtainable or are far less employment to install, might be scrounge. To acct again for lack of resources, the building exertion could be enlarged. [37].

2.13 COST

Consumers normally base their decision on a company's value alone. Even so, the least expensive contractor may not deliver the least expensive project. It is critical to select a contractor who has the necessary experience and skills to finish the work safely, to a desired quality, and on time. Clients should take a glance into the servicer's past projects but also clients. They must review this same company's construction preparation and ensure that one‘s scheme assets are adequate. [38].

The poor presentation of the completed scheme can be avoided through [39]:

a. Choosing a design team with the necessary expertise, experience, and assets to create and carry out the correct project to life.

b. Clients who are not only concerned with the project's value but also with ensuring that the system will produce what is required.

c. Clients who are not persuaded by their hidden interests, but rather by what is best for the project.

d. Customers with reasonable expectations for what they're able to afford.

e. Choosing experienced project managers to oversee the task and building process..

Poor community perception of a scheme is often caused through [40]:

a. Insufficient interaction about the venture by all stake - holders.

b. Ignoring better environmental and design precepts

c. Favoring certain project shareholders while disregarding the concerns of others.

d. Failure to properly manage the construction process, resulting in excessive noise (especially after hours), dust, injury to the neighboring land, litter, environmental harm, traffic backlogs, and car park glitches.

e. From the beginning of the endeavor, good care procedures must be mandatory. Contracting companies' security records must be reviewed before they are assigned.

2.13.1 Cost Controlling

Avoid overly expensive schemes. Extensively applying the law contractor values to make sure they have valued all possible work. By assigning contractors who sign legally binding contracts with no conflicting provisions or exemptions. By carefully reviewing all different claims and bank statements, ensuring that drugs haven't really been heretofore paid a salary as well as that the collection agency is qualified for payment again for item. Consider possible approaches, methods, as well as systems that could accomplish the desired final result at a lower cost or in a better way. This entails conducting extensive research and evaluating the proposal. Making sure that construction strategies are rigorous enough to prevent construction company collusion, examining whether one consultant is unfairly favour over another during the request or sales prices process, and ensuring the existence of perpetual good financial safeguards in place throughout the 6 year period [41].

2.14 CURRENT WORK

The study used the technique of Support Vector Machine (SVM) to improve the construction project management during various phases. The study used the technique based on regression model to identify the better way for cost conservation in the project pathway. The study showed and evaluated the related parameters that can impact negatively the project performance and leading to spent excessive cost. The study outline was to enhance the controlling of the project for the managing team to execute the project according the standards and the required scope.

2.15 LITERATURE SURVEY

According to the study, the assessed for build time, using support curriculum robot (SVM) recently among the most precise analyse the potential. Each construction contract includes a project limit as an integral part.. Within a week of applying a vector support process model to similar information, a significant improvement in prediction performance has been obtained. The main, conventional regression reintroduction model was applied to the data using the healthy known "duration price " model, after which the modelling approach with SVM was built and tried to apply to the identical data. The results demonstrate that SVM prediction was considerably more precise The key standards that a significant current issue is quasi with the contracted and actual construction time. It is prevalent for construction time to be ascertained at irregular intervals. The generated lively proposals are merely of a formal nature and do not represent the company's actual capabilities. First, duration cost" model, a linear regression perfect was performed on the information for approximately 80 artifacts.

A support-vector machine is a relatively new trying to demonstrate method that has shown great promise in producing accurate estimates for a variety of issues[42].

According to the study, Gradient Boosting Machinery and equipment are methods derived from Ai Technology that attempt to understand the relationship between data donations and one or multiple corresponding outputs. According to the findings, the Gradient Boosting Process Stagnation outdoes the presently offered forecasting techniques. Furthermore, a mass. testing has been used in the past to assess the efficacy of the future mechanism as the disparity between schooling and evaluation sets grows larger However, the use of these techniques in a project governance context has received little attention. This paper also presents a predicting future analysis that relates the pro - posed Back Propagation Conversion model to the highest performing Earned Value and Earned Timetable techniques. The SVM parameters are fine-tuned using an annoyed -validation as well as network search procedure, followed by a large supercomputing test. [43].

According to the study, cost estimation represents one of the most key steps in road managing projects. This same 12 variables were determined to be the most significant factors influencing perfect cost estimation. Following past data, a maximum of 80 research papers were distanced at irregular intervals into three windings: labeled training (60 instances), annoyed validation set (3 cases), as well as test sets (eight cases). The model might have been successful in forecasting project costs to the There are numerous factors that influence the final project cost. Numerous strategies were employed in order to estimate system cost, which ignored likely scheme achievement and risks. The objective is to enhance construction managerial' capacity for estimating a cost estimation estimation for highway projects using The work is based on the collection of chronological street execution cases.[44]

According to the study, , the building project's process flow cost prediction following database is recognized, the indicator is lowered using the principal axis method, and the radial basis method is managed to improve using the atom swarm optimization technique to recognize the agency's entire process cost forecasting the latest project pricing system necessitates a massive data magnitude, a small amount of data, and a large prediction deviation. This authors propose a whole system framework cost predictive model using a new support course machine throughout order to enhance the prognostication rightness of the entire procedure for building scheme.. Inside the software section[45].

According to the findings of the study, The building sector has an elevated debt ratio, higher working risk, and high economic leverage ratio. To forecast a financial crisis, this research used the price perfect, accounting-founded model, and hybrid imitations. These multiple copies then were compared to see which could best predict a firm's failure. Making a choice variables for the Fusion and Bookkeeping models in this news publication can also enhance their efficacy. Finally, the best can be chosen for predicting stability. Financial unpredictable nature causes a chain reaction among money acts between businesses, limiting production competitiveness. The company's allure and firm-year accounting principles differ compared to other industries. As a result, creating a hypothesized model of an economic meltdown within the building sector is necessary. Requesting this prototype for real-world situations involving relevant parties can aid in forecasting a financial catastrophe in the future.. [46].

According to the results of the research, the estimation of conceptual price levels in building projects could be considered to be a significant problem in viability studies... In order to generate accurate approximations, the suggested neural net model is taught using a cross mutual authentication. Two prominent intelligent methods, nonlinear generalized linear models and , are used to prove the achievement of the future model. Their findings are contrasted using available datasets from of the building company's relevant literature. The supercomputing results show that the displayed smart model outperforms the other two effective methods. This estimate has a major effect on the outcome of building projects. Assuredly, this guesstimate gathers the required info that can be used in cost management as well as project planning. The objective of this article is to present a smart model for improving conceptual perceived value is defined during the early stages of a program's lifetime cycle in the construction industry. To guesstimate the theoretical expenditures of global construct, a robust and efficient design, namely the back propagation device prototype, is urbanized [47].

This same study found that cost forecasting in the initial phases of building endeavors is one of the most critical flaws in monitoring and evaluation. As a result, the study has been redirected forward into hybrid trying to demonstrate, i.e. combining dissimilar techniques.

In this study, the following variables were used to predict the target mutable - actual building price of roadways: lower housing costs Prior studies has remained focused on process-based and info ideal advancement through the use of various techniques such as regression analysis, support vector method , and neural networks. According to the research findings, neither method is suitable as the best for all situations [48].

The study found that, despite becoming precise, support curriculum machines are not favored in requests require fast categorization due to the large number of endorse courses. To address this issue, we devised a primitive technique that possesses the following characteristics: it separates the perception of basic functions from the idea of provision matrices; it greedily discovers a set of seed kernel function of such a specified limit size to approximate the instinctual cost function well [49].

According to the findings of the study, In this article,. Even though the scientific method is novel and creative, we only go back to the basics of level features to create a "multiverse" of proposals based on the expected variations of project outcomes. After which we create and collect information in order to brand the data sensical . it explain how to tool the research methods and show three case studies. we offer an innovative research methods for project switching in the face of uncertainty. In particular, we combine Earned Value Research methods with construction risk assessment. The process assists project managers to identify as to if project deviance from predicted costs fall within the deviations originating from activity planned variability [7]. When it comes to construction initiatives, labor expenses can account for up to sixty percent of the total budget. One of the primary factors that determines direct and indirect labor expenses is the degree to which a worker is actively involved in the completion of the project [43]. The cost of labor in a variety of metropolitan areas is contrasted and compared. It is necessary to assemble a list of pricing trends in different regions of the country in order to lay the groundwork for the development of communities with a stronger economic state than the capital region [44]. There are issues with both the designs and the actual construction. The use of untrained personnel and lackadaisical quality control throughout the entire construction process exacerbates the difficulties. Depending on the location, the reinforcing rods corrode and fracture, and the concrete hardens at varying rates. Similarly, rebuilding and restoring the structure's components would incur greater costs [45]. An analysis of the relevant research literature has determined which factors influence early-stage cost projections for buildings [46]. A significant project's budget, which could be in the hundreds of crores or millions of dollars, would typically require cutting-edge technology and a flexible approach to resource management [47]. A significant barrier to effective resource management is the fact that construction management requires a substantial quantity of resources. Price, availability, quality, and quantity of imported materials are all crucial considerations [48]. Gradation-related particle shape and size are poorly understood, and there is a dearth of data linking these characteristics to the mechanical performance of materials [49]. Gradation refers to the size and geometry relationship between individual particles. All of these factors have substantial effects on the economy, and some are even catastrophic [50].

According to the findings of the study,. Based on these interview sessions and literature reviews, a list of 65 good practice suggestions for the critical project control systems of planning, tracking, reporting, and analyzing was established. The Quantitative methodology also was used, with the involvement of an advisory group of eight doctors, to assess such suggestions for improvement and determine their level of relevance. Following two RDS of Delphi, such suggestions are put forward as "crucial," "substantial," or "HUMOURING" measures for improving construction management practice. The goal of this higher ed is to fix the key flaws in the current project time and expense management procedures for building tasks throughout the United Kingdom. A questionnaire was administered with 250300 top business owners, preceded by the in discussions with 18experienced practitioners out of these organizations to obtain further insights into the potential issues, as well as their experience of best practices on how these flaws can be addressed.

The study found that the limits of system controls on building projects change all through the scheme's life span. As a result, this paper proposes the development of a clever project switches framework model that'd facilitate effective authority of the tasks identified all through the project life-cycle, ensuring that the role of project control system is well defined in each phase of the endeavor in order to make sure more sustainable project outcomes[50]. Then there is no efficient attempt to tackle project panels, only individual investor after issues appear in a project. With no clearly delineated building projects to adopt developer switch processes throughout the framework life-cycle, there is a significant gap in research to improve the performance of construction projects that satisfies the project's key stakeholders[51]. The applying evidence - based the factors that contribute to the success and malfunction of schemes, as well as identifies project regulatory systems that are presently being used in the building sector to regulate initiatives throughout the project life-cycle. The study's findings show that, while efforts have continued to be created to control strategies in numerous parts of a building project's lifelong -cycle, these control systems appear to be discombobulated and scattered among construction practitioners. Due to the need for precision, it may be difficult to accurately estimate costs when creating a budget. During the planning phase, a project manager must consider inflation, interest rates, fixed and variable expenses, and administrative costs, among other factors[52]. Quantitative methodologies such as parametric modeling and program evaluation and review are two examples of quantitative approaches that businesses may choose to pursue, whereas others may favor a qualitative approach[53]. One could also approach the problem from the top down or the bottom up. Top-down analysis may be utilized if historical pricing information is readily available[54]. Due to their wealth of experience working on comparable initiatives, project managers make the best decisions[55]. When a company lacks sufficient knowledge about previously completed projects, it may benefit from bottom-up strategies that employ task-specific cost estimates and then aggregate them at the project level[56]. Earned Value Management (EVM) is a technique used in project management to control costs. It provides a neutral evaluation of the project's progress and development by considering its cost, duration, and scope [57].

3. METHODOLOGY OF RESEARCH

Activity-based, comprehensive, and unit-based cost estimates are typically the most accurate because they utilize the most accurate data. There are numerous methods to calculate the price of an item. Because they are simple, the majority of people will be able to understand and use these evaluation methods. Methods for estimating costs based on activities, whether in detail or as a collection of units, are only as precise as the data and instruments they employ. Typically, a work statement is used in conjunction with a series of diagrams or specifications to describe the scope of a project. You can determine what tasks are involved, how hard the team is working, and what the job is when making non-standard estimates. After the analyst has broken down each process into its component duties, the costs for personnel, materials, equipment, and vendors will be itemized and totaled. In cost estimates, the first word of a summary of an action is typically a verb. This is done so that the assessment can proceed more efficiently. Action words such as "must" and "shall" make it plain and simple to comprehend what is required. Direct costs can be broken down into their component elements and then re-totaled to gain a clear understanding of their true cost. The next stage is to consider the situation's specifics, such as secondary costs, administrative costs, potential outcomes, and escalation. As new information becomes available, the forecast may be modified accordingly. This is done so that the project's actual work progress and budget can be brought into alignment as soon as possible, thereby reducing the project's total cost. This section should include information about the most effective methods for monitoring and inspecting, as well as determining the cost of a product. Additionally, the methodologies employed should be described. His plan for his investigation included three steps: formulating a hypothesis, conducting preliminary research, and conducting the primary investigation. After determining how much everything in the project actually cost, the next stage was to assign a monetary value to each component based on its effectiveness. The first stage was to determine how much everything would actually cost, and the second step was to assign a relative value to each component of the endeavor based on its effectiveness. During the third phase of the research, the researcher utilized the SVM correlated with SPC control chart, which was constructed using data from the project, to determine which option for completing the project is optimal in terms of cost and any other relevant factors.

3.1 IMPLEMENTING DATA PROCESS

At the process of the current procedure, it is necessary to compile all pertinent data in preparation for the thesis. This information will be utilized in a succession of rigorous experiments to evaluate and validate the effectiveness of the SVM system. Interviews and a survey conducted in Iraq yielded the most crucial information regarding the Iraqi economy. Compared to less intimate surveys, this type of research provides the most precise and comprehensive information about the research topic. However, unlike other research methods, interviews do not provide as much insight into the interviewee's unique preferences and motivations. Depending on the size and complexity of the region being surveyed, various forms of surveys will be scheduled, and the surveying process may consist of one or two phases. The available budget is one of the most important factors to consider when choosing a survey design. Local government responsibility for this is a significant factor to consider. A multi-level survey [31] has been devised in order to establish a balance between the statistically required population size and the accuracy of the data collected. This strategy, which was developed with the aid of a multi-stage survey, is currently being implemented. Analyzing the results of complex survey designs, such as those with multiple phases of sampling, multiple sample options at each stage, and stratification, necessitates the use of multilevel modeling. It allows you to examine a wider range of examples with less specificity, but this does not change the fact that you can still identify the classification's defining characteristics. This allows for the study of a larger population. This means that the first phase focuses on collecting the absolute minimum of information required, while the second phase, with its smaller sample size, collects specific, material, technical, or other characteristics. This indicates that the primary objective of this initial phase is data collection. The sample size is determined primarily on the basis of an expert's estimation of the variety of structures to be constructed. This is accomplished without substantially altering the fundamental concepts underlying classification. Conversations that cover a great deal of territory "are an excellent method to encourage people to discuss their own ideas and experiences in greater detail. They enable individuals to compare their own perspectives with those of others." In addition, the interview queries were formulated with Iraqi initiatives and the pertinent historical context of the topic at hand in mind. This was done to guarantee sufficient responses to the queries. This was done to ensure that only genuine answers were submitted. The researcher must direct the interview in a way that yields useful data, and the subject must participate in the study openly and truthfully [17].

3.2 EFFECTIVE PROJECT CONTROL DATA

Building projects still have trouble with process planning because they don't have enough information about the status quo and the changes that need to be made to the flow of the process during project implementation. Even when the project is being carried out, planners still have to collect data by hand for many field processes. Because of this, we don't know enough about the building process and often can't get the information we need when we need it. As many as 27% of failed building projects can be traced back to poor planning because of a lack of knowledge [32, 33]. Also, it takes more time and work to plan the process because the data can't be used to make a flexible process model. to make sure that everyone working on the project stays up-to-date and works well with each other. When there are big differences between what actually happened and what was planned, "project control," which is a part of project management, means taking corrective action (or telling others to do so) to get the result you want. "Project control" is a part of project management that involves comparing actual performance to what was planned and making the necessary changes. Simply put, project controls are a group of tools that are used to keep the project on track. Along with interpersonal and project management skills, the information they share is invaluable for helping people make the best decisions. A key part of any project management process is comparing what was planned with what actually happened. Evaluation of the project's status on a regular basis to figure out if any changes need to be made, Documenting and storing data in a way that is both complete and up-to-date, taking into account the final status of the project. The sharing of information that lets progress reports, projections, and analyses be made, as well as figuring out how recently approved changes to the project's budget and schedule will affect the project's budget and schedule, and keeping an eye on how those changes are put into place. Sae-Hyun Ji and his coworkers explain in [33] the most important parts of a project's execution life cycle. They changed the way that parameters are made, which combines many important variables into a manageable set of parameters. They came up with this new way of doing things. The model suggests that a rough estimate of the total price can be made by adding up the prices of the quantity-based adjustments to the parameters. A case study of a 24-home building project was used in the research to compare how well the suggested method and a CBR model estimated costs. The method that was suggested improved the accuracy of the cost estimates. A standard cost forecasting model has a lot of important parts that can be broken down into simpler models. This lets the model's limitations be worked around. This might be a way to get around the model's limits. This research comes up with a new way to choose parameters. The main goal of the study is to improve cost estimates by using this method. Also, the cost model shown is a proactive answer to the need to recalculate prices over and over again. In the last sentence, this topic was talked about in more detail. Variables that affect the cost of a structure are things that describe the structure and have an effect on the cost of the structure. A project's essential components can serve as a description. In general, a project can be summed up in more detail as its number of important parts grows. On the other hand, if there are a lot of important variables, there will be a lot of situations where estimates are needed. Choosing the right number of parts is important if you want your calculation to be as accurate as possible. Table 3 is a summary of the different things that can affect building a house.

Table 3.1: The Independent Data Group 1.

F1	Type of structure
F2	Type of loading pattern
F3	Location of the building (region of buildi
F4	Lifespan of structure
F5	Water table level
F6	Types of material that will used in constr
F7	Soil Settlement
F8	Soil Erosion
F9	Foundations in Sand and Silt
F10	Collapsible Soils

Table 3.2: The Independent Data Group 2.

F11	purpose of building
F12	friendly neighborhood
F13	available facilities
F14	government laws
F15	shape & size
F16	terrain condition
F17	type of ground soil
F18	natural light & air
F19	environmental condition
F20	site requirements

Table 3.3: The Independent Data Group 3.

F21	Material processing time
F22	Work scheduling method
F23	number of supervisors
F24	workers experience
F25	Change job tasks
F26	equipment availability
F27	equipment scheduling efficiency
F28	maintenance quality
F29	Suitability of equipment
F30	Availability of transportation

Table 3.4: The Independent Data Group 4.

F31	Political factor
F32	Economic factor
F33	Technology factor
F34	construction materials.
F35	Management factors
F36	materials in the market factor
F37	Finance factors
F38	equipment productivity facto
F39	Provides space to store mater
F40	Method of transferring mater

3.3 PROJECT PERFORMANCE FUNCTIONS

The project surveillance time should be determined after the project schedule has been finalized, with both the overall duration of the project and the significance of the schedule taken into account. The frequency may be weekly, biweekly, monthly, or bimonthly. The duration of the monitoring time is determined by the project's metric, which is why it is so extensive. Total Planned Duration, or TPD for short, is the sum of the durations of all planned activities up to the present time. In this instance, "Actual Duration of an Action" refers to the actual amount of time required to execute a given task (abbreviated as ADi). TAD, which stands for "total actual duration," is the sum of the times required to complete each individual assignment. Earned Duration of an Activity (or EDi for short) is a measurement of how long an activity is anticipated to take to complete. EDi can determine how much progress has been made and how much remains. Additionally, it can conduct physical evaluations and utilize a weighted milestone system. Total earned duration, or TED, is the total amount of time expended on duties. Earned Period (ED) is the amount of time corresponding to the present TED S-Curve point. Progress is expressed as a percentage of the total duration of the undertaking. Time to Plan, Time to Execute, and Time to Execute, respectively, can be used to calculate Duration Variance, Duration Performance Index, Earned Duration Index, Expected Duration at Completion, and Estimated Duration to Completion. Here are the answers to EDM's TPD, TAD, and TED-related TPD, TAD, and TED questions:

$$TPDt = \sum t\ j{=}1\ \sum n\ i{=}1\ CPij \tag{3.1}$$

$$TADt = \sum t\ j{=}1\ \sum n\ i{=}1\ CAij \tag{3.2}$$

$$TEDt = \sum n\ i{=}1\ Edit \tag{3.3}$$

$$DPIi = EDi + ADi, \tag{3.4}$$

where EDi represents the Earned Duration of action I at the time DPIi is being calculated. If it is greater than 1, the actual development of action I is behind the projected schedule. If there are multiple, the unexpected event occurred after the anticipated one. If everything goes according to plan, we will have accomplished our objective when we reach the number one. It indicates the extent to which the undertaking is being effectively completed. The Period Performance Index (DPI) is a macro-level indicator of how near a project is to attaining its most important success factor timely completion. Cost performance index CPI is:

$$\text{CPI} = \frac{\textbf{earned value (EV)}}{\textbf{actual cost (AC)}} \tag{3.5}$$

If the CPI is greater than one, the financial success of the project was outstanding, assuming it was completed on time and within budget. If the CPI exceeds 1, all allocated funds have been expended. The financial viability of the endeavor can be determined by comparing the prices of electric vehicle and air conditioning systems. By comparing EV and Solar, we can determine how well the project adheres to its schedule. Adaptations to the graph SV compares the actual progress made to the anticipated progress made to determine if they are consistent. SV Obtainable by deducting EV from PV. A significant defect in conventional EVMs is that schedule changes are typically quantified in terms of monetary value rather than time. In fact, this is a significant disadvantage. The first method is based on mathematics: averaging the predicted totals (the planned value rate being the average PV per time period). To determine the PV rate, divide the BAC by the BAC schedule (SAC). There is no difference between the BAC/SAC, BAC/SAC, BAC/SAC, and PV rates. TV = SV / PV is a crucial value because it is the formula for converting SV to time units. Another technique involves drawing a horizontal line from the intersection of the EV and status curves to the commencement of the PV curve. Next, you determine the difference in time between the two locations. The difference in duration between the two designs can be expressed in either of the two methods discussed. This is the more concrete consequence of the project slipping behind schedule. However, there are significant issues with each of these options. Both of these models assume that there is no time-dependent correlation between the variables. For example, to calculate the PV Rate, one would divide the total project cost by the anticipated completion time. It is anticipated that this ratio will remain constant for the duration of the undertaking. When calculating the difference between the SV and PV at time t, it is assumed that the average PV Rate is valid forever. The assumption that factors do not change over time is demonstrably false. The program is coming to a close, and SV's actions reflect this fact. After each action, the difference between actual and predicted outcomes diminishes.

3.3.1 Applying Revit Drawing

Architects, landscape architects, structural engineers, MEP engineers, designers, and builders use Autodesk Revit for building information modeling. The construction industry significantly relies on this program. The Charles River Initiative developed the original software. The company changed its name to Revit Technology Corporation in 2000, and Autodesk acquired it in 2002. Users can create a 3D model of a building and all of its components, annotate it with 2D sketching tools, and then access information about the building from a database linked to the model. Revit, a 4D building information modeling program, is unrivaled when it comes to planning and keeping track of a building's entire lifecycle, from conception to eventual demolition. Revit, short for "Revit Building Information Modeling," is a program used in the construction industry to generate fully-customizable, three-dimensional models of buildings that include information on both geometric and non-geometric aspects of the design and construction of the building. A number of competing applications, including ArchiCAD and Reflex, provided comparable three-dimensional models of simulated structures with parameter-based control over each construction element (parametric components). The ability to create parametric components without learning a new programming language is a significant departure from the majority of CAD applications. Due to the model's consideration of their interdependencies, the model automatically updates itself whenever there is a change to the components, views, or remarks. The term "parametric building model" was devised to describe how variable parameters affected the building model and its associated documentation. Several distinct phases comprise the sketching procedure for this case study:

Revit will be used to design the 20 by 20-foot chosen structure.

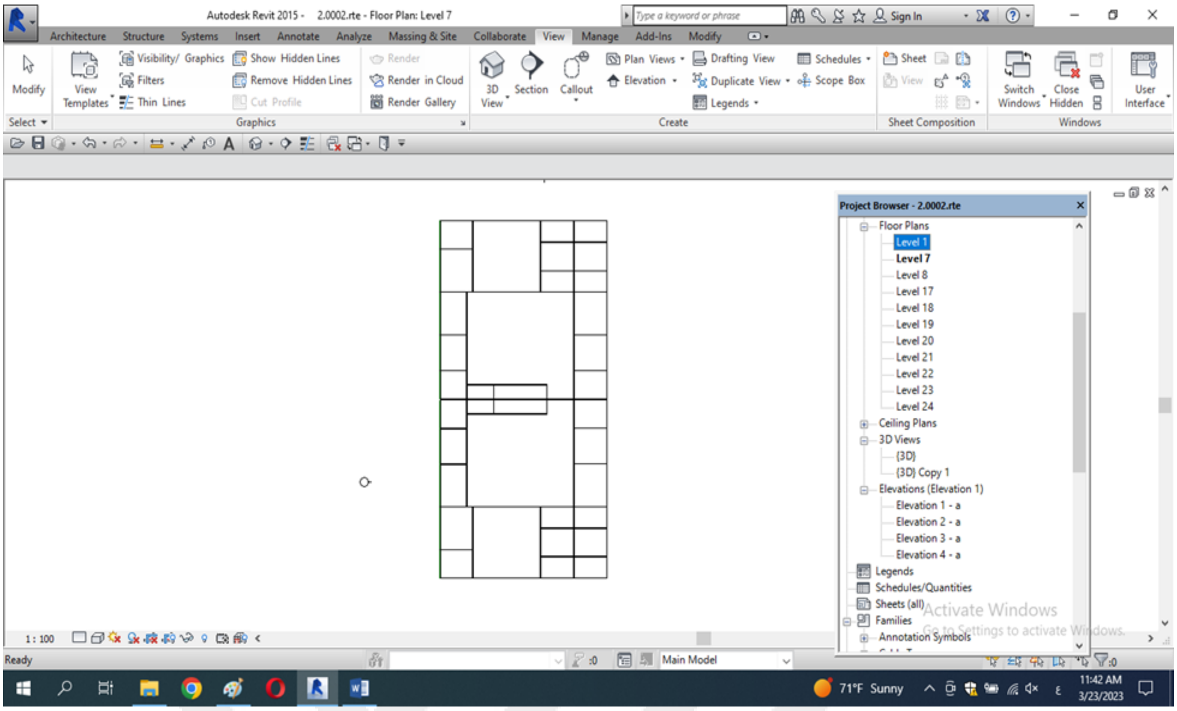

Figure 3.1: The Building Dimensions.

The door and window groups will be used to implement walls from the building component of the program in the rendering. Figure 3.2 illustrates how the (Project Browser) can be utilized to clarify and monitor the various construction phases.

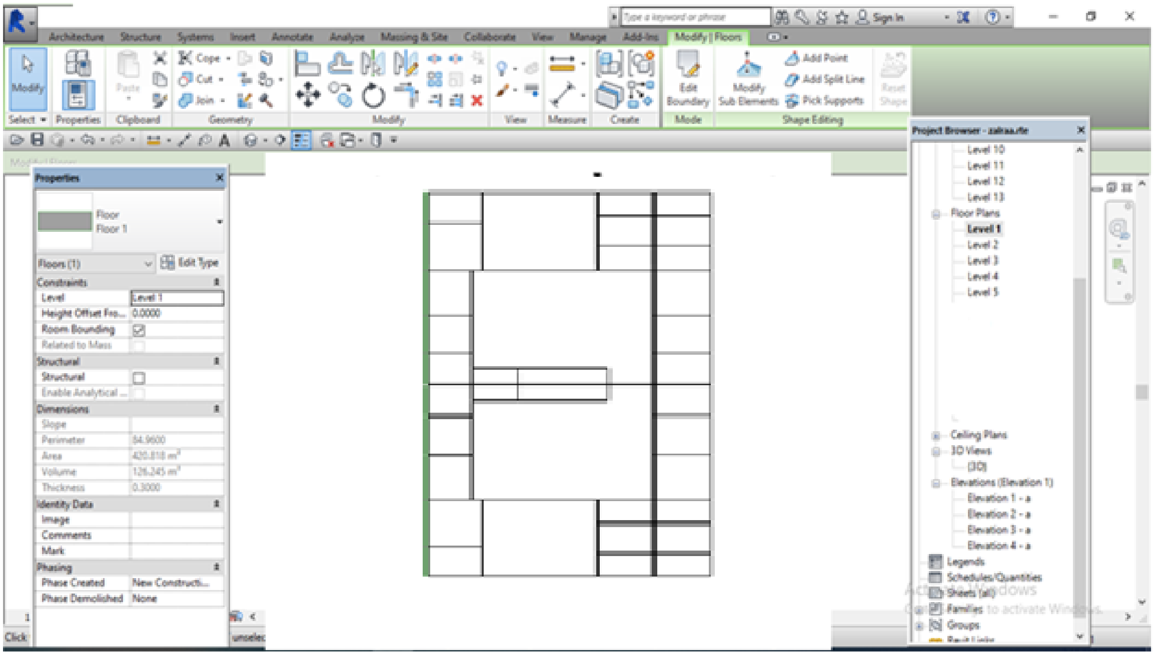

Figure 3.2: Doors and Windows Families.

When structural modifications were made, such as the relocation of a wall, it was necessary to renovate the adjacent walls, floors, and ceilings. In addition to modifying the locations and values of measurements and notes, it was necessary to modify the floor areas listed on the plans, the redrawn section views, and other such elements. Throughout its development, bidirectional associativity between components, views, and remarks has been one of Revit's distinguishing characteristics. The name "Revise Immediately," which is an acronym for the program's complete name, was chosen in large part due to its user-friendliness. Revit's primary characteristic is a parametric change dissemination engine that uses context-driven parametric, an innovative technology that is more extensible than the variation-driven and history-driven parametric typically found in mechanical CAD applications. Autodesk developed the Revit program for building information modeling. There is no doubt that the doors and windows in the can be tailored to your exact specifications due to their unique characteristics (Properties Viewer Message). The results of this stage can be viewed in 3D using a viewer similar to those depicted in figures 3.3 and 3.4. This phase entails the installation of all required components, including stairwells.

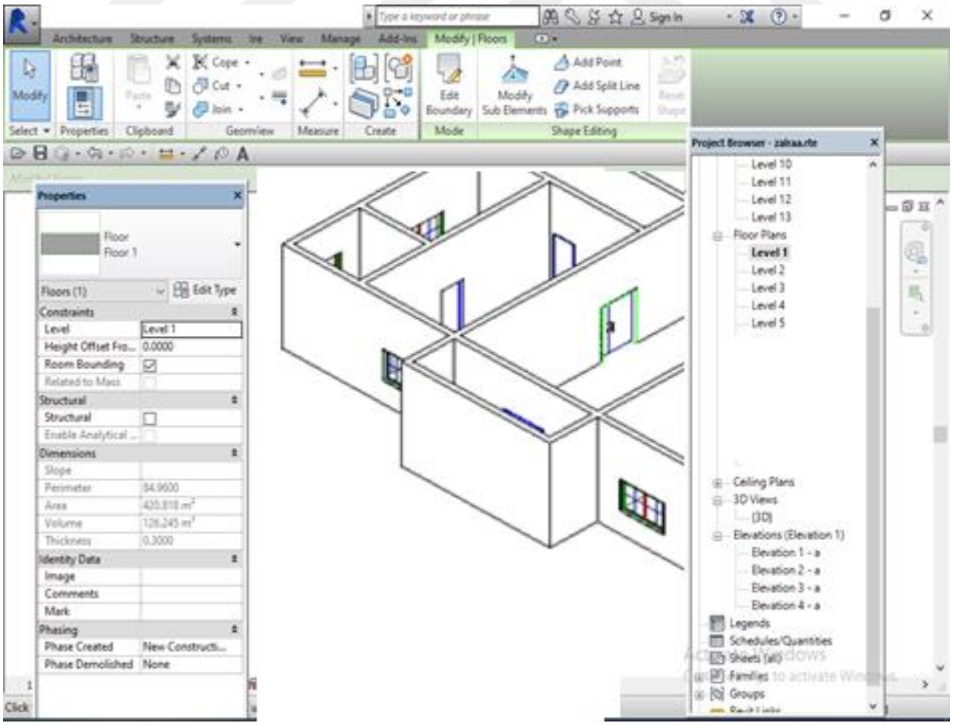

Figure 3.3: Specify The Levels.

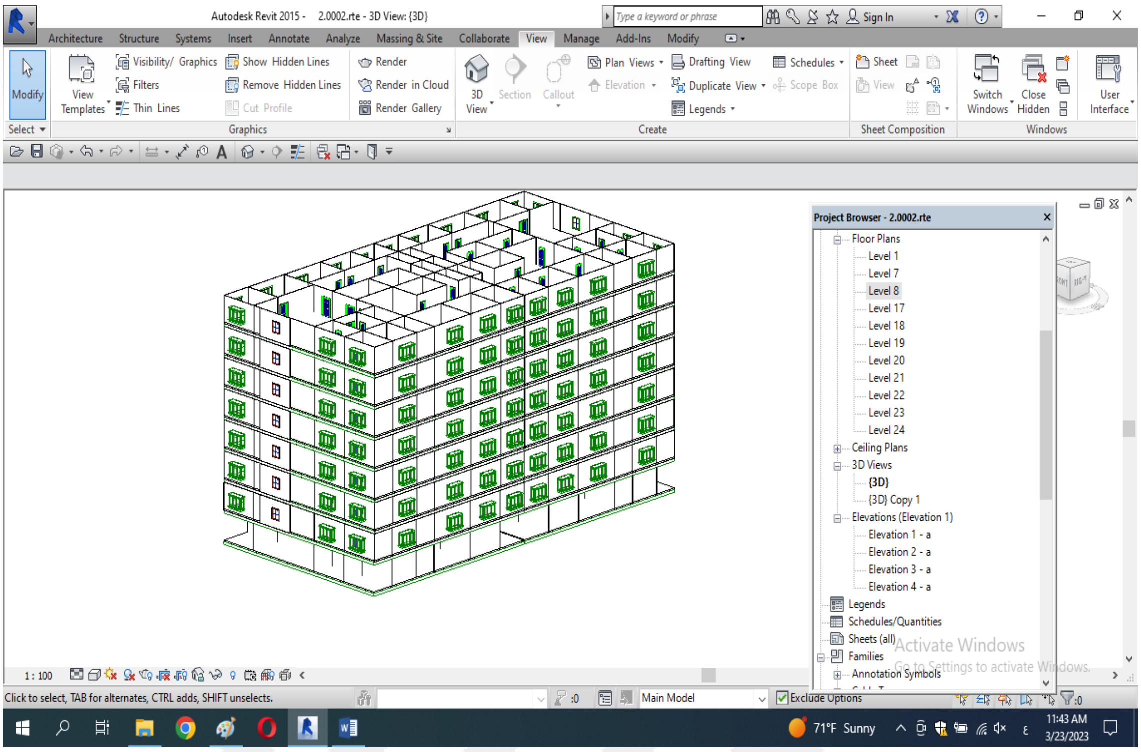

Figure 3.4: Applying Floor Specifications.

Revit allows you to modify both individual 3D shapes and the construction of a structure or assembly (within the constraints of a project, of course) (in the family editor environment). Modelling software can utilize previously created real-world objects or downloadable geometry models. Revit is a modeler, so it cannot modify the shapes that comprise a model. Roofs, platforms, terrain, and the massing environment are the only physical features that deviate from the pattern. A proficient user can not only incorporate pre-made models, but also create their own realistic and precise homes, complete with furniture and lamps. This feature is in addition to the already existing option to incorporate models from elsewhere. It is possible to create Revit families from dimensioned and property-laden parametric models. Certain components can be modified by modifying their set characteristics, such as their height, breadth, or position in an array. An instance of a type can undergo any number of modifications, and each possible set of attributes is recorded as a type. The purpose of a family is to make a shape appear identical across a range of values. In the end, the additional and asymmetrical conditions depicted in figure 3.6, including the building's summit and first floor, will be implemented.

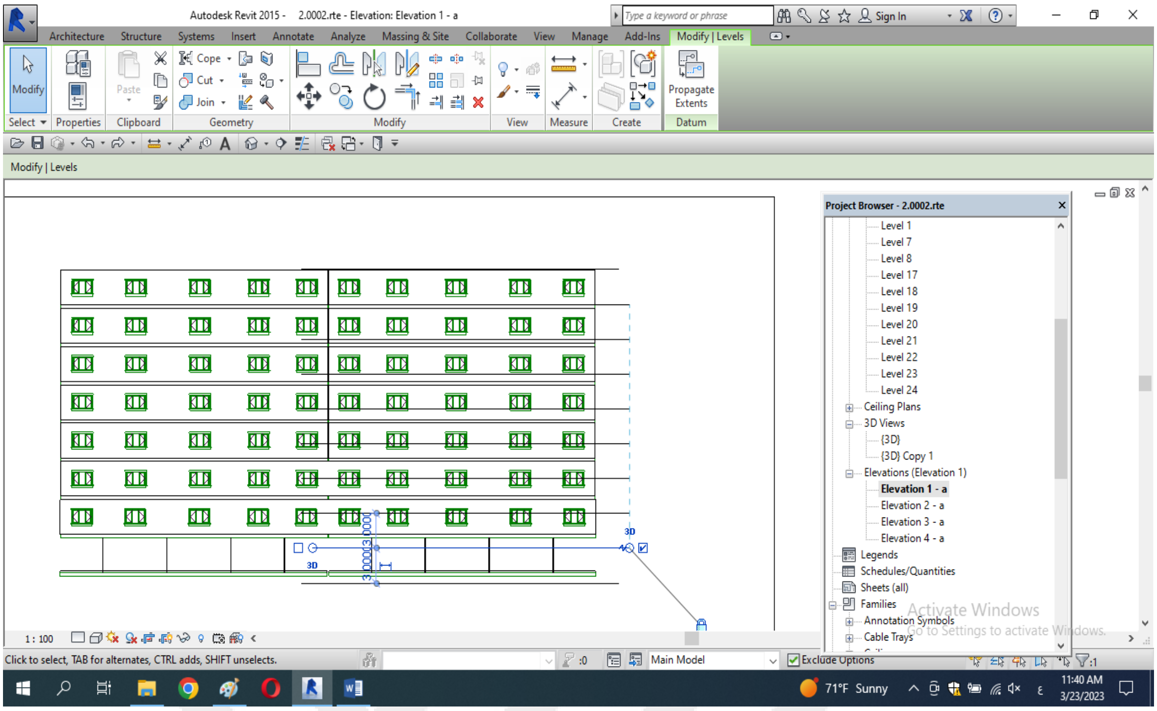

Figure 3.5: Adding Elements.

3.4 SVM TECHNIQUE

Support vector machine (SVM) is capable of solving both categorization and regression problems simultaneously. It can be used interchangeably for both linear and nonlinear problems, as it is effective for both. The SVM's fundamental concept is as follows: A line or hyperplane will be drawn by the program to divide the data into classes. A modified variant of the Support Vector Classifier technique can be used to address regression issues. The technique is also known as "support vector regression," which is merely a pretentious moniker. Due to the fact that the cost function used to build the model disregards points outside the margin, the model resulting from support vector classification only partially utilizes the available data. Support Vector Regression is another model-building technique that utilizes limited data. This is because the cost function disregards examples that are comparatively close to the objective. There are two types of SVMs, which are:

One type of support vector machine is linear support vector machines, also known as Straightforward support vector machines. This particular SVM is utilized for information with perfect linear separability. If a dataset can be divided into two equal portions using only a straight line, it is said to be linearly separable. This capability yields a classification model known as a "linear SVM classifier." Typically, it is employed in linear regression and classification problems.

Second, nonlinear support vector machines (SVMs) are utilized to combine data sets that are not amenable to linear classification. Here, a non-linear support vector machine (SVM) classification is utilized. To incorporate nonlinear data, the model can be modified to fit a hyperplane rather than a two-dimensional space by adding more characteristics. This enables modeling of more complex connections.

There are numerous advantages to utilizing the Support Vector Machine Program. Examples include the following: SVM uses a subset of training points in the decision function or support vectors, thereby conserving memory; it works well on datasets with multiple features; it works well when the number of features exceeds the number of data points; it transforms complex non-linearly separable data into linearly separable data; and it works well on datasets with multiple features.

When defining the decision function, users are permitted to provide their own kernels rather than relying on the provided kernels.

There are several problems with the Support Vector Machine Algorithm:

As the quantity of information increases, efficacy degrades. • In certain circumstances, the time required for teaching SVMs can be substantial:

Due to the possibility of overfitting, care must be taken when selecting kernel functions and regularization terms. Support Vector Machines (SVMs) are successful with a large number of features, but their training procedure is protracted. This is due to the fact that SVMs use an expensive fivefold cross-validation method to determine probability forecasts.

a. steps to apply the algorithm

The SVM method used in this investigation can be broken down into the stages listed below:

First, we will carefully review the incoming material:

When we reach this stage, the information garnered from the questionnaire will be referred to as "raw data" and will pertain to the characteristics we discussed in the previous section.

The subsequent step is the implementation of a linear regression model:

On the "transformed" data sets, the fitlm(X,y) utility in MATLAB was used to conduct a linear regression analysis with the "linear" model formulation as the default. In this function, both the effective cost factor group (represented by X) and the highest number of survey responses (represented by y) are vectors. The subsequent regression models make use of the MATLAB function predict to estimate the variables that contribute significantly to construction costs (mdl,valid). mdl is the MATLAB model object that stores the regression model in this procedure, and valid is the validation data collection.

Third, evaluate each component's likelihood of success separately.

Using MATLAB's (predict()) syntax, we will now classify the data using a support vector machine (SVM) using the SVM classification. For evaluation purposes, data presented in a numerical grid or graphic format. Each row of the matrix X represents a single observation, whereas each column represents a single independent variable. The arrangement of X's components and the predictor variables must be consistent. The predicted class names as a cell array of characters, a category array, a logical vector, or a number vector. label has the same length and data type as X and all other identified class labels (y). (The program internally represents strings as character vector vectors. If an observation fits into multiple containers, the predict function will allocate it to the bucket that produces the greatest number. The function assigns a value to an observation and positions it in the class with the greatest total number of names. This category is defined by the number of identifiers gathered during surveillance. (Additional details can be found at www.mathworks.com/predict.html.)

In step four, the SVM factor effect is computed as the ultimate result of the procedure.

Fifth, designate a point value to the accomplishment. The procedure's final result will disclose the ratings of the factors.

3.5 DEVELOPING THE CONTROL CHART

A control chart is a form of graph that plots a quality metric over time, with control lines added to emphasize any statistically significant outliers. Variations of a sizeable magnitude may have assignable or exceptional causes, and as such, they merit investigation. Various management techniques have been investigated, and the results have been disseminated. The fundamental structure of these diagrams is identical, but each employs a distinct statistical procedure for data visualization. There are two practical applications for control maps. First, it demonstrates a dynamic progression of accomplishment over time. Second, it keeps track of your accomplishments (Wood 1995). Control charts are one of the most fundamental statistical instruments when it comes to monitoring and managing processes. They are straightforward to construct, analyze, and comprehend. Shewhart x-Charts, also known as x-Charts, are utilized to track the procedure's median. It includes a median line from previous iterations of the process as well as upper and lower control boundaries. A graph illustrating the data's mean over time is exhibited. The transmission of an "out-of-control" signal occurs whenever the sample mean deviates excessively from the predetermined limits. Three sigma is the typical distance between control lines and medians. Sigma represents the standard deviation from the group's norm. Typical Shewhart maps consist of the x and R graphs. Using the x chart, also known as the mean control chart, one can monitor the mean or average of the selected quality attribute. Indicator (p) on the grid of control The letter I is displayed whenever the group mean, xi, is displayed. The provided procedure can be used to calculate the demographic median.

$$\overline{xi} = \frac{xi1 + xi2 + \cdots + xin}{n} \tag{3.6}$$

xij is the x for the nth observation in sample I for j = 1, 2,..., n. n represents the total number of observations in the sample. If the group mean falls within the control limits, it is said that the process is under control. Alternatively, if a sample yields results that are inconsistent with the control limits, then the process is not under control, and it is necessary to investigate the contributing factors. The mean of the quality attribute under consideration will be represented by the line in the middle of the x chart with a value of 0. UCL and LCL, which stand for "Ultra Control Limit" and "Lower Control Limit," refer to the same concept.

$$UCL = \mu_0 + L\frac{\sigma_0}{\sqrt{n}}$$

$$LCL = \mu_0 - L\frac{\sigma_0}{\sqrt{n}} \tag{3.6}$$

where L is a quantity selected to guarantee that only significant variations in the process are identified, μ: mean of data, σ: standard of division, n: is the samples munber. The Shewhart figure, which shows the probability of something bad happening, and the average return level (ARL) are both highly sensitive to even small changes in L. When n is higher than 1, the range of each sample can be calculated using R charts, also called the control chart for the range (Montgomery, 2013). Time I shows the sample range, represented by Ri in the control image. The control limits and center line of the R chart are based on the acceptable relative limit (if any) and the sample number, n, where n is less than two (ARL). The sample size (n) is used in the formulas of the center line (d20), upper and lower confidence limits (D20), and the standard deviation (SD) (D10). D1, D2, and d2 numbers are listed in a chart in Montgomery's Appendix VI (2013).

4. RESULTS AND DISCUSSION

To complete a task and achieve the desired results, you must provide ongoing direction and guidance. You can only achieve this objective by accepting these responsibilities. It is expected that the individuals in control of the project, and particularly the project manager, will be able to reduce costs as much as possible without compromising the project's quality. However, this is not the only method to achieve this result. There are also a few others. A project manager must not only steer the project toward its objectives, but also monitor all associated costs. If a project manager fails to do this, the project management process as a whole will fail. The answer to this query has a significant bearing on whether or not the business will be profitable. To be considered a standard method of cost management, a budget must be established and rigorously adhered to from the outset of project planning. The budget will include all necessary costs and expenses that will be incurred throughout the project's duration. The project managers are responsible for performing all mathematical calculations and determining how well the project is performing relative to the projection. To provide the correct response, you must first determine whether the proposed undertaking will result in a valid evaluation. Utilizing SVM's value-at-risk results, the findings of this study led to a new method for monitoring project costs and deadlines. This concept states that the method was developed so that project expenses and development could be monitored. The current procedure ensures that all changes to the project and how they impact the various responsibilities are documented. To evaluate the SVM system, we employ a real-world scenario involving the concrete and walls of an actual construction project. Managing the alterations that arise throughout an undertaking requires an individualized strategy. Change control methods must be established so that modifications can be made to the project as it progresses. The management strategy used to determine the various budget variances in this thesis is predicated on the fact that actual expenses are the primary cause of those variances. If you have this information on hand, it will be much simpler to monitor project expenses as the work progresses. It is essential to compare actual expenditures with budgeted expenditures on a regular basis. Depending on the anticipated duration of the undertaking, these objectives could be defined weekly, monthly, or annually.

4.1 SURVEY RESULTS

By "data collection," we refer to the methodical gathering of information by means of observation or assessment. Whether you're working for a university, a private company, or the federal government, the first and most crucial stage in getting a leg up on the competition is gathering data. Data collection refers to the process of gathering relevant information from various sources for the purpose of evaluating possible outcomes, such as the solution of study issues, the discovery of patterns and possibilities, etc. Simply put, "data collection" means gathering information for analysis. In case you're curious, you can find details further down. Deciding what kind of formal structure best communicates the underlying qualitative and quantitative ideas being used in a specific study is crucial when constructing representations of the data that are accurate and useful. There is no strict metric for these ideas; they can be intuitive or quantifiable. If you invest effort into carefully planning and crafting your data gathering process, you will be rewarded with better results. You'll have to put in some work to accomplish this. The first step in monitoring or assessing an initiative is determining what data will be gathered and how it will be used. Appropriate appraisal of the monitoring or evaluation questions that will lead any review requires careful consideration of the review's context, the constraints that are already in place, access, scheduling, budget, and available data. In order to ensure that the data collected is valid and reliable, it is important to give careful consideration to the following aspects of planning for data collection: the intended use of the data, the intended methodology of the data collection, the intended resources of the data collection, and the intended duration of the data collection. In this regard, one can look into the potential for gathering data via a qualitative strategy, a quantitative approach, or a hybrid of the two. The stages of the project devoted to information gathering, study, and evaluation will be profoundly influenced by the answers to these questions. If you want to get the most out of your survey, it isn't just about the topics you pose; it's also about how many various approaches you try. In the first place, it's important to put the poll's results and opinions ahead of the survey itself. Data format determination is the first stage in making effective use of available data. One of the first steps in developing a high-quality poll is to develop a clear mental picture of the desired result. There were a total of 35 individuals working as expert managers, as shown in table

4.1. Of these, 15 had roughly 20 years of engineering experience, while the remaining 20 had experience between 10 and 20 years.

4.1.1 Foundation Process Effect

Table 4.1: Foundation Factors Overall Results.

code	factor	effect	item weight	total effect
F1	Type of structure	0.5	0.67	0.335
F2	Type of loading pattern	0.55	0.61	0.3355
F3	Location of the building (region of buildi	0.42	0.69	0.2898
F4	Lifespan of structure	0.46	0.7	0.322
F5	Water table level	0.22	0.66	0.1452
F6	Types of material that will used in constı	0.32	0.69	0.2208
F7	Soil Settlement	0.52	0.72	0.3744
F8	Soil Erosion	0.44	0.76	0.3344
F9	Foundations in Sand and Silt	0.23	0.75	0.1725
F10	Collapsible Soils	0.29	0.7	0.203

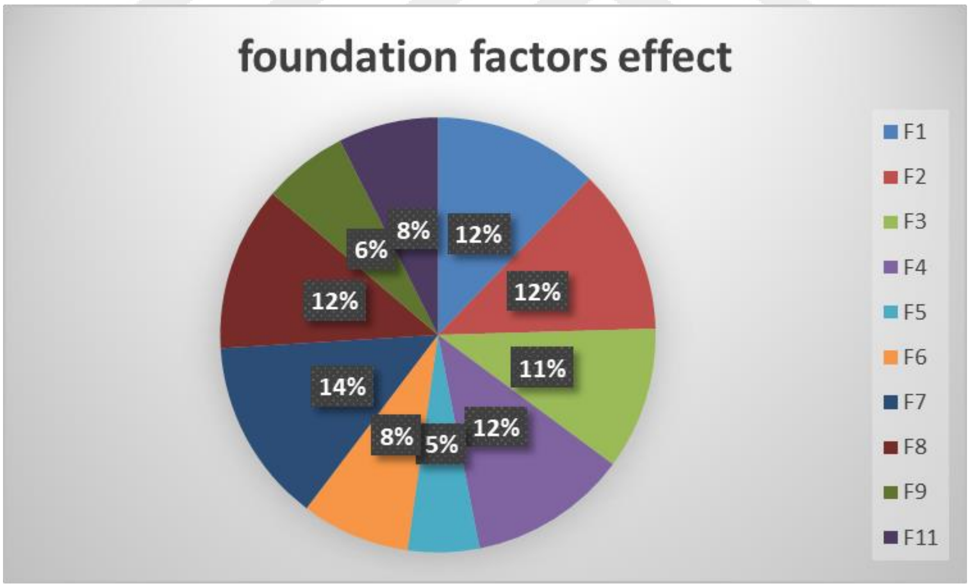

Figure 4.1: Foundation Factors Effect Results.

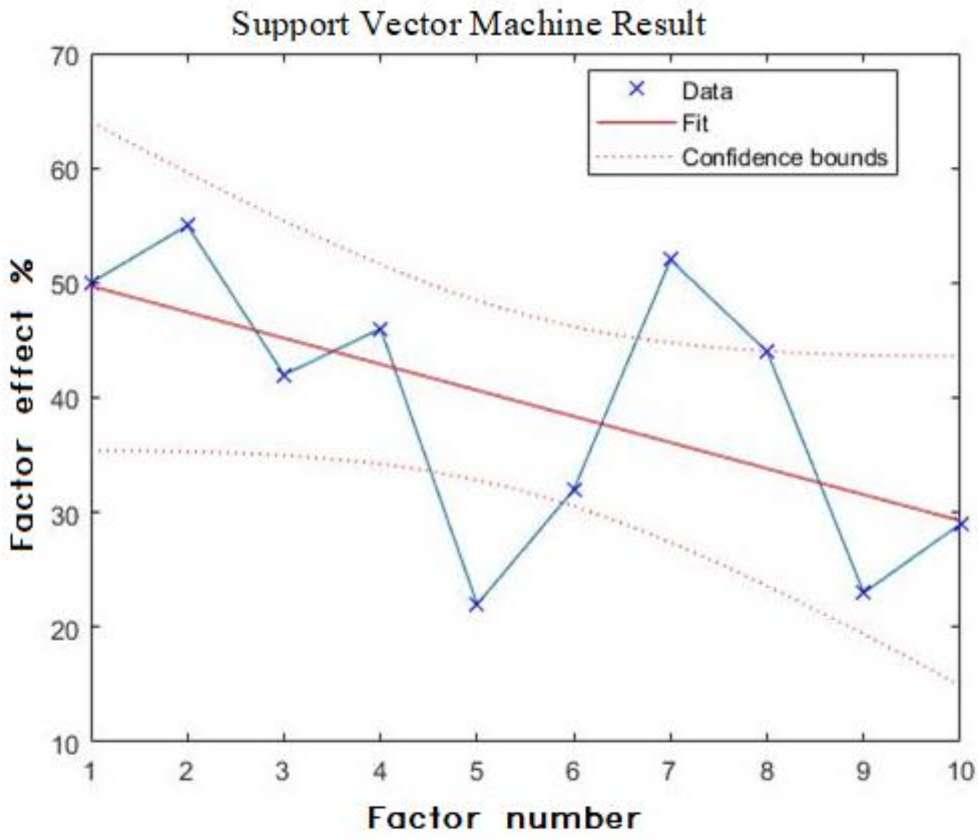

Figure 4.2: SVM Foundation Factors Effect.

4.1.2. Structural Effects

Workforce productivity, also known as labor productivity, is the pace of economic growth that is measured in terms of the amount of output created per hour of labor. Labor productivity growth is measured by the yearly rate of change in economic output per employee hour. There is a significant difference between employee output and labor productivity. The output of workers takes into account how much effort each person puts into the whole. Increases in worker efficiency lead to more money being spent, which raises the quality of life for everyone. Workers can produce more goods and services for the same investment of time and energy if their output rises. When output rises, so does availability of the goods and services it generates. Changes in tangible capital, developments in cutting-edge technology, and human capital are the main contributors to an increase in worker efficacy. Changes in any of these three areas, based on the context, are usually responsible for the general rise in labor output. In this sense, "physical capital" refers to the resources (such as buildings, equipment, and tools) that are made accessible to employees in order to facilitate their ability to generate an output. Technology advancements like assembly lines and robotics allow for greater output with the same or greater input. Human capital is on the rise because more people in the workforce have graduate degrees and/or expertise in a particular area. One way to approximate the complete impact of these tendencies is to track changes in worker output, which could signal either a temporary uptick in economic health or a change in the trajectory of the economy. Employees have become more effective if they are able to maintain the same level of output while working fewer hours. This occurrence is not only caused by the aforementioned three things, but also by economic downturns, when workers put in extra hours to avoid being laid off as unemployment rises. The accompanying bar graphic details the various outside factors that impact worker output.

Table 4.2: Structural Factors Overall Results.

code	factor	effect	item weight	total effect
F11	purpose of building	0.41	0.67	0.2747
F12	friendly neighborhood	0.32	0.71	0.2272
F13	available facilities	0.32	0.66	0.2112
F14	government laws	0.45	0.64	0.288
F15	shape & size	0.54	0.59	0.3186
F16	terrain condition	0.21	0.72	0.1512
F17	type of ground soil	0.34	0.68	0.2312
F18	natural light & air	0.37	0.75	0.2775
F19	environmental condition	0.44	0.74	0.3256
F20	site requirements	0.47	0.79	0.3713

The Labor productivity factors effect on quantity per floor and floor heights in different ways as in below.

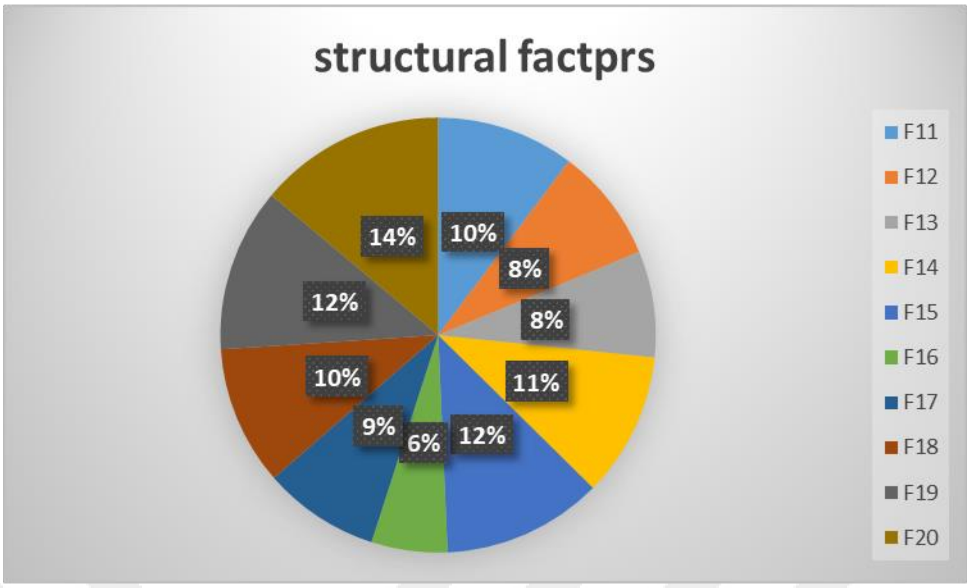

Figure 4.3: Structural Factors Effect Results.

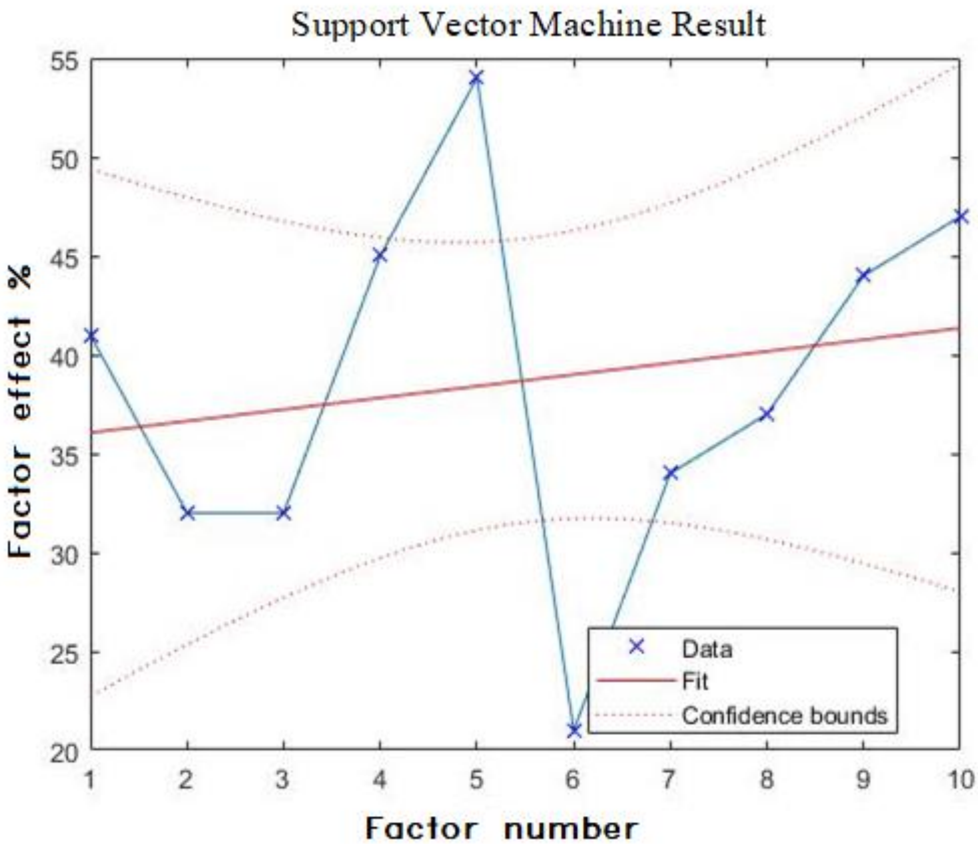

Figure 4.4: SVM Structural Factors Effect.

4.1.3 Implementation Factors

Building a multi-level building necessitates completing a large amount of work that is repeated across all floors. Employees on the ground floor and the top floor may both be less productive than usual. Still, as the building progresses, a trend may emerge in terms of the efficiency of the workers. Using the information recorded in the project records, we can calculate the efficiency of the workers responsible for rebar and formwork. Consistent with the results of prior studies, the authors of this study decided against including a cellar in their output analysis due to the vast differences between the basement and other floors. As a result, structural procedures have a similar return on investment. Similarities between the layouts of Floors and Floors can be seen in Floor 1. Images showing the effects of factors on worker output are provided.

Table 4.3: Implementation Factors Overall Results.

code	factor	effect	item weight	total effect
F21	Material processing time	0.43	0.73	0.2059
F22	Work scheduling method	0.44	0.65	0.273
F23	number of supervisors	0.36	0.7	0.301
F24	workers experience	0.41	0.72	0.3168
F25	Change job tasks	0.32	0.64	0.2304
F26	equipment availability	0.32	0.67	0.2378
F27	equipment scheduling efficiency	0.54	0.61	0.208
F28	maintenance quality	0.44	0.69	0.208
F29	Suitability of equipment	0.34	0.7	0.1827
F30	Availability of transportation	0.37	0.66	0.2665

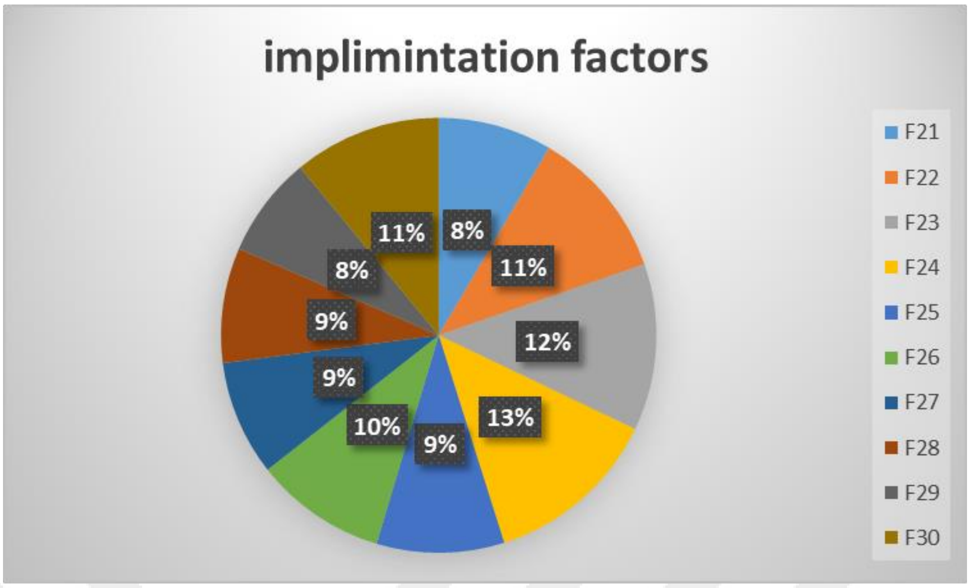

Figure 4.5: Implementation Factors Effect Results.

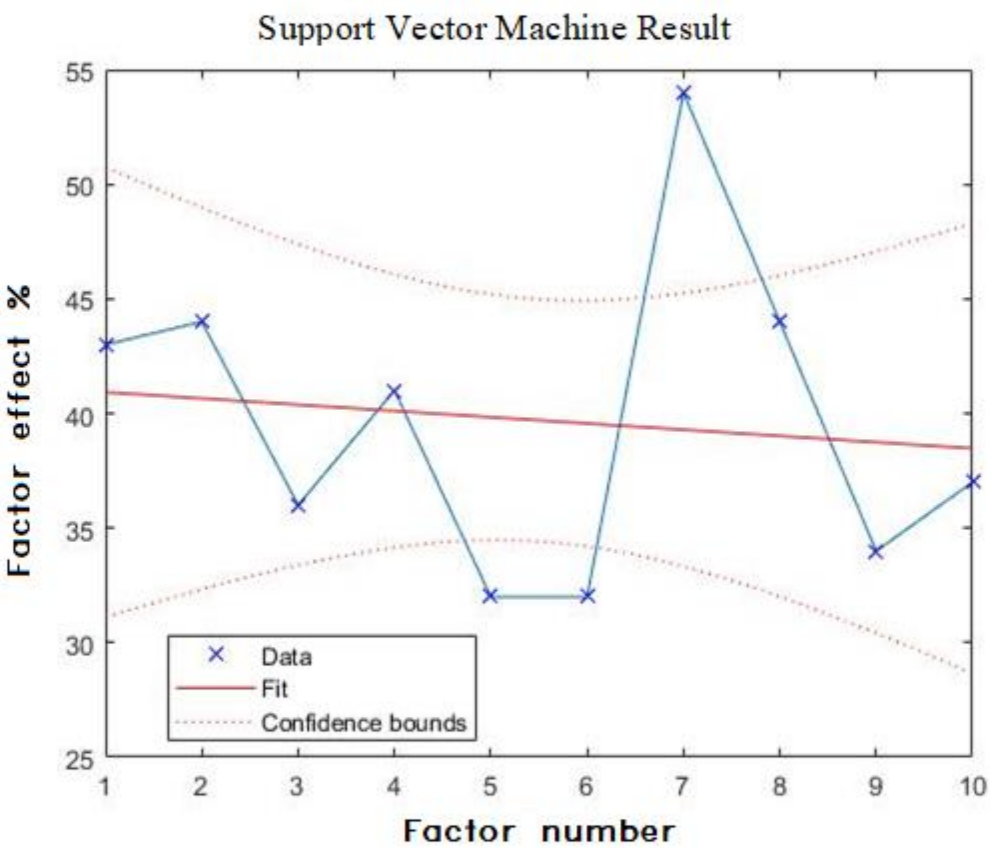

Figure 4.6: SVM Implementation Factors Effect.

4.1.4 External Factors

Work organization methods are crucial because without them, tasks cannot be completed in a timely manner or to a satisfactory level. Despite being evaluated as extremely weak by the majority of respondents due to ineffective management, inadequate scheduling, and low output, 45% of respondents gave this element a grade of extremely powerful. On top of that, the project manager's failure to account for the team's true skill set led to an unrealistically short timeline. The "work plan" of an employee specifies the times and places where they must be present and actively engaged in the performance of their tasks. The majority of workplaces have predetermined schedules that include a set number of days and hours worked each week. Staff scheduling requires careful preparation to meet everyone's requirements, account for everyone's tastes, and maximize productivity. In addition, it is your responsibility to ensure that your business complies with all applicable labor laws and rules in order to maximize output while minimizing costs. This is a fundamental requirement for any enterprise hoping to thrive. It is much easier for a company to keep in touch with its casual workers when their schedules are publicized.

Table 4.4: External Factors Overall Results.

code	factor	effect	item weight	total effect
F31	Political factor	0.29	0.71	0.2059
F32	Economic factor	0.42	0.65	0.273
F33	Technology factor	0.43	0.7	0.301
F34	construction materials.	0.44	0.72	0.3168
F35	Management factors	0.36	0.64	0.2304
F36	materials in the market factoı	0.41	0.58	0.2378
F37	Finance factors	0.32	0.65	0.208
F38	equipment productivity factc	0.32	0.65	0.208
F39	Provides space to store mateı	0.29	0.63	0.1827
F40	Method of transferring mater	0.41	0.65	0.2665

Companies that rely heavily on human labor must carefully plan the work schedules of their workers in order to achieve their output goals and other important business objectives. An efficient shift schedule can lay the groundwork for a win-win result by creating a fruitful workplace, as shown by a committed team.

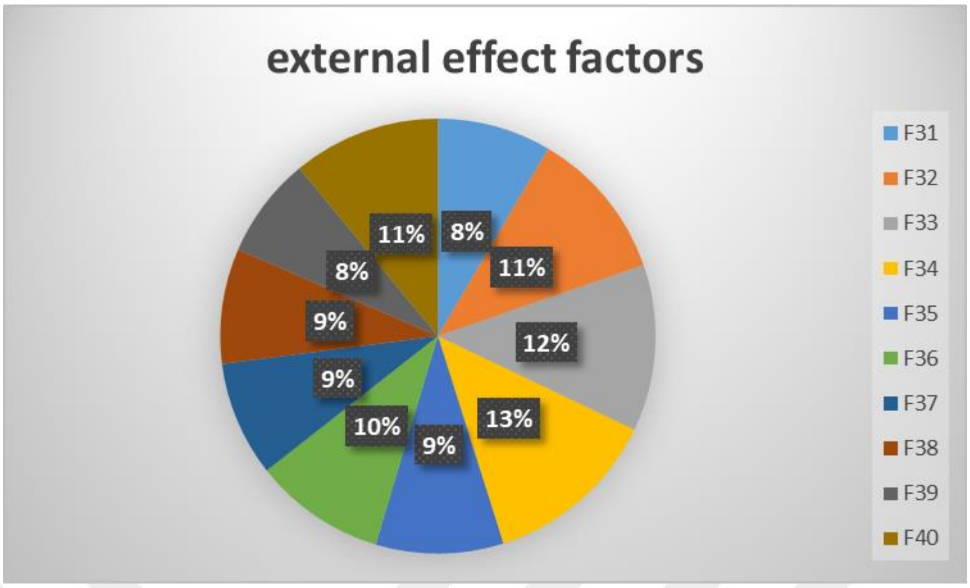

Figure 4.7: External Factors Effect Results.

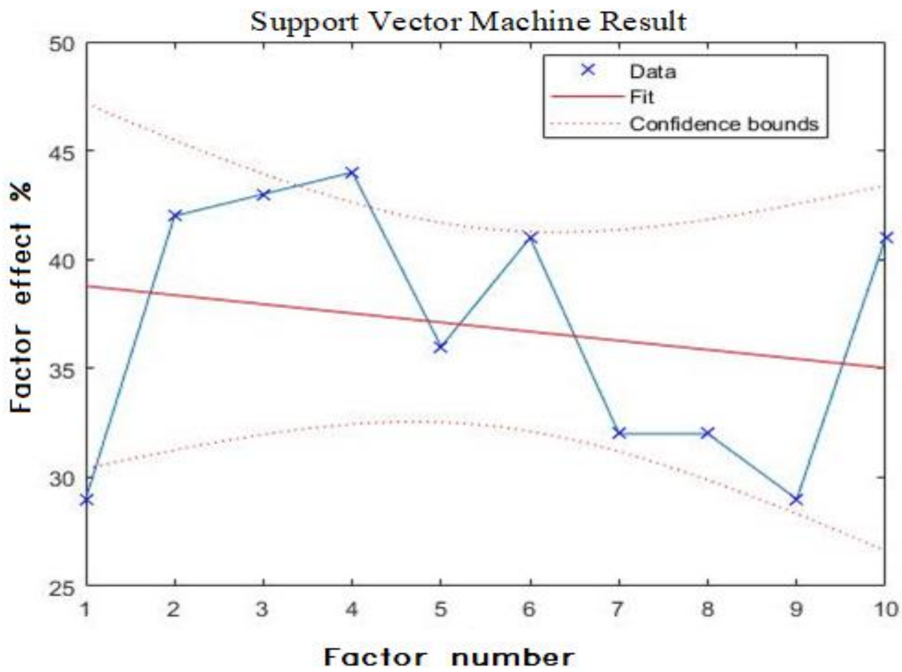

Figure 4.8: SVM External Factors Effect.

The Support Vector Machine Result is one well-known supervised learning technique. Its potential applications extend beyond simple classification and regression. Its primary use in the field of machine learning is the solution of classification issues. In order to categorize data in an n-dimensional space, the Support Vector Machine (SVM) is the method of choice. Any new data points we receive in the future will be readily and swiftly categorized. We call this optimal decision boundary a hyperplane. The hyperplane's extreme points and vectors are chosen via support vector machines. The term "support vector" is used to describe these out-of-the-ordinary occurrences, which is how the Support Vector Machine earned its moniker. Check out the image below for a visual explanation. It demonstrates how two groups can be separated using a decision boundary and a hyperplane [27]. Different hyperplanes can be utilized to separate the two classes of information. Our goal is to locate the plane that separates the two groups of data by the greatest feasible margin. When the margin distance is largest, some reinforcement is provided, increasing the confidence with which subsequent data points can be classified. Using hyperplanes as decision boundaries aids in clustering the data. Classification of all data points on both sides of the hyperplane is feasible. The total number of surface characteristics also affects the size of a hyperplane. If there are only two input features, the hyperplane is a simple straight line. When only three input features are considered, the hyperplane flattens out to a two-dimensional plane. As the number of traits increases past a certain point, the difficulty of conception increases as well. The position and orientation of a hyperplane are said to be supported by support vectors if they are influenced by surrounding data points. Making use of these support vectors allows us to increase the classifier's margin to its maximum. Taking away the support vectors will cause the hyperplane to shift. These parameters are relevant for the improvement of our SVM[14]. Because it chooses the best line along which to position each of your data points, the linear support vector machine (SVM) method is preferable to other classification methods like k-nearest neighbors. The line that most effectively separates the data is chosen, and it is placed as far away as feasible from the data points that are closest together. What we have, in brief, is a grid with some data points on it. Classifying these data points into the category requires doing so without misclassifying any of the underlying data. In other words, we want to find the line that joins the points that are most closely spaced while still allowing for some variation in distance between the other points. As a result, the two spots that are geographically closest to one another will serve as the line's support vectors. That dividing line is also known as the decision boundary.

4.2 PROJECT CONTROL RESULTS

In the realm of industrial quality control, a quality-control chart based on multivariate exponentially weighted moving average is a useful tool for regulating error (MEWMA). For locating the discrepancy in circumference that must be near the target, MEWMA has proven to be the method of choice. This is because even slight modifications can cause issues. When the process mean value fluctuates by a small amount, MEWMA will be affected (Masood I. and Adnan H. 2012). Here, for your reference, is the MEWMA graphic for the same information covered in the previous section. The results clearly demonstrate the effectiveness of the disruption detection function. One of the reasons it's more precise than a multivariate control chart is that it can infer the process values that are out of control from the sample data (I-Chart). Points that occur in a row off to one side of the middle are said to be in a range. The existence of a non-random pattern or a sign of transition can be inferred from the presence of significantly fewer or more frequent passes or crossings of the center line. Find out how many times the data line goes above or below the middle point and add one to that figure. Number of trials that are both above and below the norm will be displayed. The assignable factors that contributed to the fluctuation in the first place must be found and eradicated when a control chart shows an out-of-control situation (a point that goes outside the control boundaries or that meets one or more of the criteria in the rules that follow). Results from classifying a set of synthetic designs according to Nelson's run guidelines. The minimal number of test data points required to uniquely identify each run rule, label, and signal. In this section of the study, we will try to apply Nelson's run rules to a number of different types of established patterns. The common pattern was analyzed, and it was found that some of the rules produce a false warning, but that the combination of rules did not occur during the exercise. The logical inference that can be drawn from this is that monitoring the reliability.

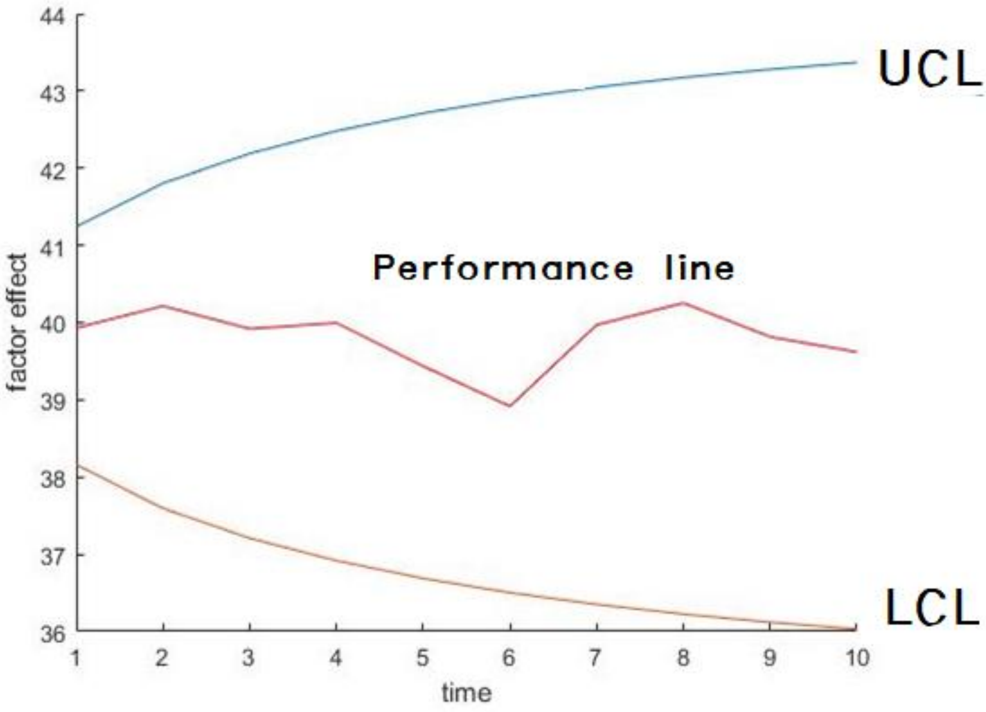

Figure 4.9: SPC Foundation Factors Effect Results.

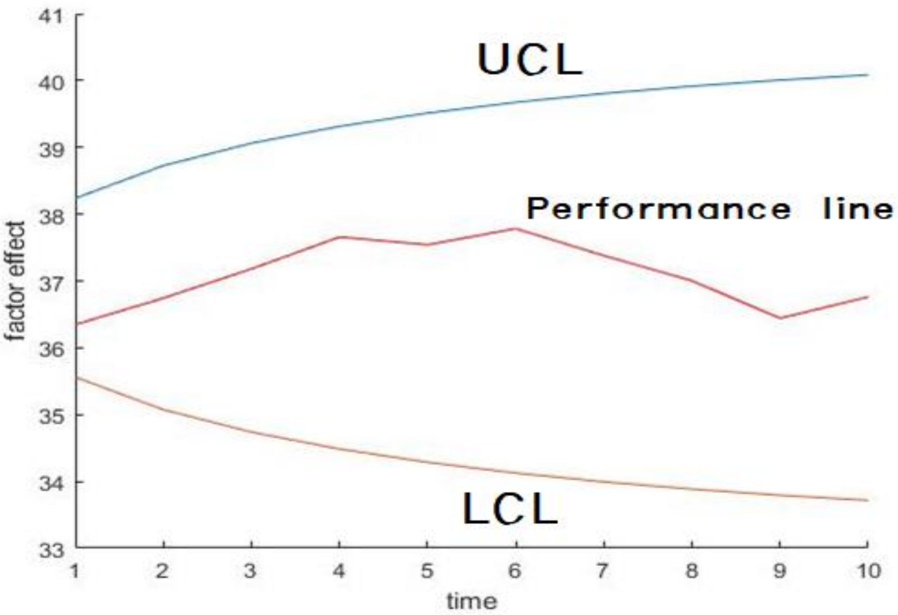

Figure 4.20: SPC Structural Factors Effect Results.

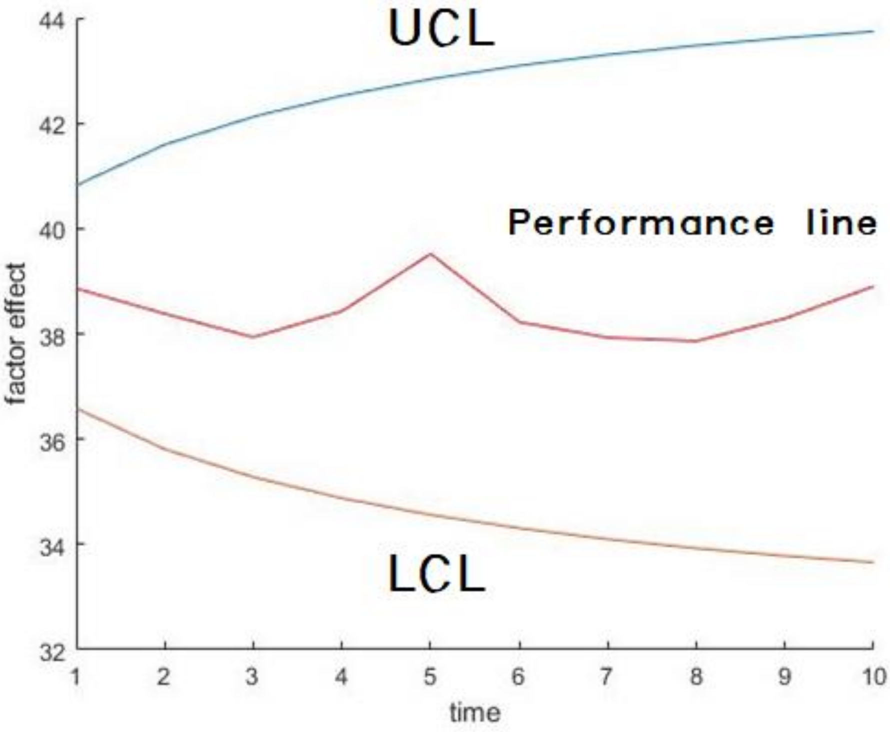

Figure 4.11: SPC Implementation Factors Effect Results.

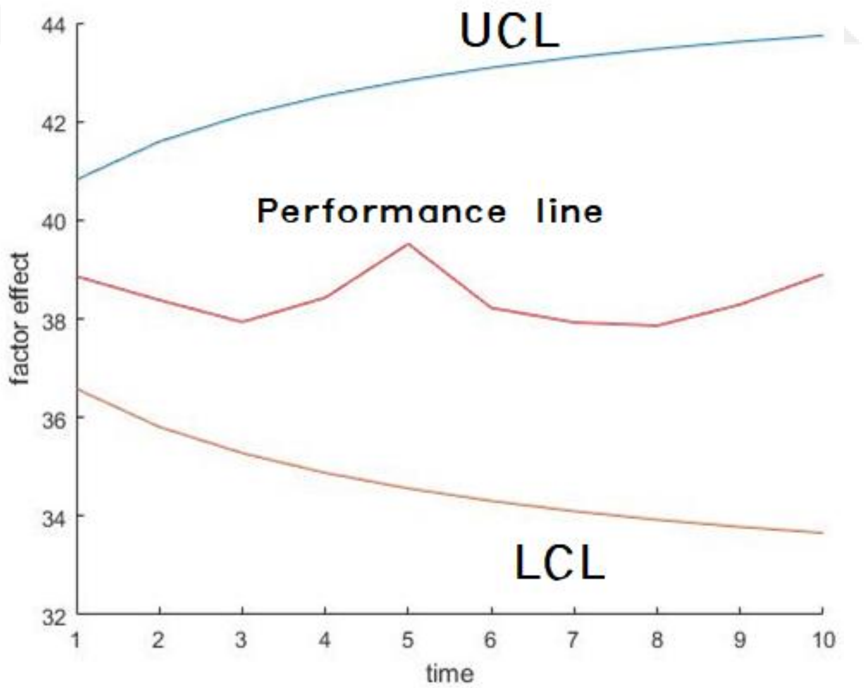

Figure 4.12: SPC External Factors Effect Results.

The main purpose of building drawings is to depict the final product as accurately as possible before it is installed. Clear and well-coordinated building drawings should be used whenever feasible to avoid confusion and miscommunication. When the designs are well-organized, they can be finished more swiftly and with less ambiguity. All the parts, concepts, and processes that need to be implemented to complete the works will be laid out in detail in the specs. All necessary information, such as assembly instructions, dimensions, and materials lists, is graphically represented in the building plans. Some of the information in the details may be repeated here, but it's best to prevent duplication whenever feasible by pointing readers in the direction of the relevant choices. The results of the Revit drawing account for all of the relevant numbers and percentages. The case study building is depicted in Figure 4.19; it has ten stories and occupies a total area of 420 square meters. See the attached spreadsheet for a breakdown of the prices.

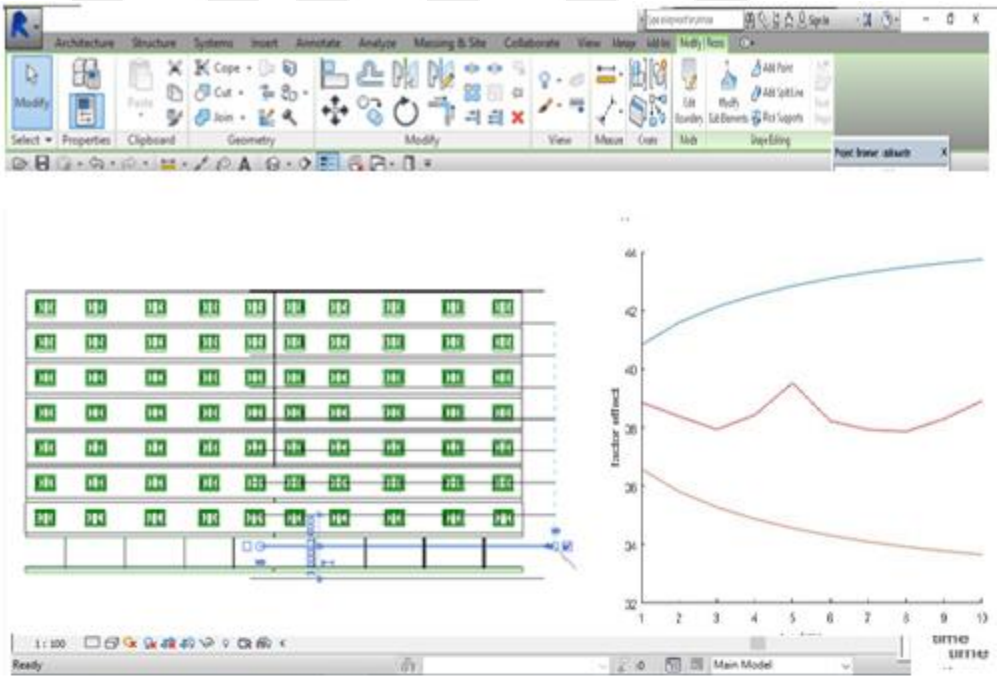

Figure 4.13: The Case Study Cost Estimation.

Table 4.5: Cost Estimation of the Case Study.

Revit quantities results	Area	estimated unit price USD	total price USD
Wall quantities	15729	174	15903
Floor quantities	4595	347	4942

5. CONCLUSION AND FUTURE WORK

Providing ongoing guidance and instruction is essential for concluding a project and attaining the intended outcomes. Accepting these responsibilities is the only way to guarantee that you will arrive at your destination. To this end, it is anticipated that the project's leadership, and the project manager in particular, will seek to reduce costs without sacrificing quality. This is a crucial objective for the undertaking. However, there are other methods to accomplish the task. There are a few more of them in addition to those. A project manager's responsibilities include monitoring budgets and ensuring the project is proceeding as planned. If a project manager fails to do so, the entire project management process and project completion will suffer. Knowing the answer to this question is crucial, as it will have a significant impact on the eventual success or failure of the company. This method of cost management must establish and adhere to a budget from the outset of project planning in order to meet the criteria necessary for it to be considered the industry standard. All mandatory costs and expenditures that are anticipated to be incurred throughout the duration of the activity will be included in the budget. The project administrators are responsible for conducting all required mathematical operations, including calculating the project's performance relative to the forecast. If you want to provide a satisfactory response to this question, you must determine whether the suggested action will actually produce a reliable outcome. Using the results of SVM's value-at-risk analysis, this study's findings influenced the development of a novel method for monitoring project costs and schedules. This theory posits that the methodology was created so that project costs and progress could be monitored in real time. The current system ensures that a record of all project modifications and their effects on designated tasks will be kept. This document will be kept as long as the current procedure remains in effect. The SVM system was put through its trials by simulating an actual building construction task, including the pouring of concrete and construction of walls. To deal with the unavoidable changes that occur throughout any endeavor, you need a plan that is uniquely suited to you. In order to make alterations to the project as it nears completion, it is necessary to establish change control procedures. The management strategy utilized to generate the variable budget discrepancies described in this thesis is predicated on the notion that the primary reason for these discrepancies is the actual expenditures made. The topic of discussion is the financial variances used to generate the variances in this thesis.

If you already have this information, monitoring the project's costs will be much easier. It is essential to compare your actual expenditures to what you had allocated on a regular basis in order to keep your finances on track and avoid deviating from them. Depending on the anticipated duration of the project, these objectives could be assessed weekly, monthly, or annually. The anticipated duration of the project should be used to determine the frequency of these audits.

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APPENDIX A

MATLAB code

```
clc;clear;close all
ws=1;
%X = randn(ws,100)';
%MPG = randn(ws,100)'*5;\
foundation = [ 50   55  42  46  22  32  52  44  23  29]
structural_factors = [ 41   32  32  45  54  21  34  37  44  47]
implimintation_factors = [43    44  36  41  32  32  54  44  34  37]
external_effect_factors = [ 29  42  43  44  36  41  32  32  29  41]
factor    = [1    2   3   4   5   6   7   8   9   10      ];
Effect = [41     32  32  45  54  21  34  37  44  47];
figure

mdl = fitlm(factor,Effect)
mdl.Coefficients
anova(mdl,'summary')
plot(factor,Effect)
hold on
plot(mdl)

ADADP = Effect
a1 = ADADP; % Read the
d= length(a1);
a = a1;  % input data
fEDI= a1;
%INPUT_DATA = [DPI SPI CPI];

L=3.2;
Q=std(fEDI);
T=0.07;
K=1:d;
factor=1:d;
i=1;
g=mean(fEDI);
 z(i)= T*fEDI(i)+((1-T)*g);

for i = 1:d-1

    z(i+1)=T*fEDI(i+1)+((1-T)*z(i));

end
for  o=1:d;
     UCL(o)=g + (L*Q)*sqrt(T*(1-(1-T)^(2*o) )/(2-T));
     LCL(o)=g - (L*Q)*sqrt(T*(1-(1-T)^(2*o) )/(2-T));

end

figure
hold on
  plot(K,z,'r-')
  plot(K,UCL);
  plot(K,LCL);
```

```
xlabel('time');
ylabel('load factor');
```

APPENDIX B

Revit results							
Area	Count	Family	Width	Volume	Type	Structural Material	
76 SF	1	Basic Wall	125	30.98 CF	125	Concrete - Cast-in-Place Concrete	
25 SF	1	Basic Wall	125	10.11 CF	125	Concrete - Cast-in-Place Concrete	
26 SF	1	Basic Wall	125	10.73 CF	125	Concrete - Cast-in-Place Concrete	
17 SF	1	Basic Wall	125	6.90 CF	125	Concrete - Cast-in-Place Concrete	
330 SF	1	Basic Wall	125	135.41 CF	125	Concrete - Cast-in-Place Concrete	
34 SF	1	Basic Wall	125	13.78 CF	125	Concrete - Cast-in-Place Concrete	
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete	
119 SF	1	Basic Wall	125	48.60 CF	125	Concrete - Cast-in-Place Concrete	
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete	
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete	
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete	
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete	
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete	
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete	
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete	
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete	
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete	
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete	
44 SF	1	Basic Wall	125	18.13 CF	125	Concrete - Cast-in-Place Concrete	
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete	
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete	
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete	
330 SF	1	Basic Wall	125	135.41 CF	125	Concrete - Cast-in-Place Concrete	
35 SF	1	Basic Wall	125	14.29 CF	125	Concrete - Cast-in-Place Concrete	

49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.60 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
26 SF	1	Basic Wall	125	10.50 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
330 SF	1	Basic Wall	125	135.41 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	21.04 CF	125	Concrete - Cast-in-Place Concrete
112 SF	1	Basic Wall	125	45.93 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete

123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
330 SF	1	Basic Wall	125	135.41 CF	125	Concrete - Cast-in-Place Concrete
35 SF	1	Basic Wall	125	14.38 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.60 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
26 SF	1	Basic Wall	125	10.50 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
302 SF	1	Basic Wall	125	123.85 CF	125	Concrete - Cast-in-Place Concrete
32 SF	1	Basic Wall	125	13.07 CF	125	Concrete - Cast-in-Place Concrete
45 SF	1	Basic Wall	125	18.47 CF	125	Concrete - Cast-in-Place Concrete
108 SF	1	Basic Wall	125	44.49 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.01 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.57 CF	125	Concrete - Cast-in-Place Concrete

45 SF	1	Basic Wall	125	18.47 CF	125	Concrete - Cast-in-Place Concrete	
119 SF	1	Basic Wall	125	48.66 CF	125	Concrete - Cast-in-Place Concrete	
119 SF	1	Basic Wall	125	48.66 CF	125	Concrete - Cast-in-Place Concrete	
62 SF	1	Basic Wall	125	25.55 CF	125	Concrete - Cast-in-Place Concrete	
82 SF	1	Basic Wall	125	33.57 CF	125	Concrete - Cast-in-Place Concrete	
23 SF	1	Basic Wall	125	9.54 CF	125	Concrete - Cast-in-Place Concrete	
112 SF	1	Basic Wall	125	45.87 CF	125	Concrete - Cast-in-Place Concrete	
117 SF	1	Basic Wall	125	48.04 CF	125	Concrete - Cast-in-Place Concrete	
24 SF	1	Basic Wall	125	9.74 CF	125	Concrete - Cast-in-Place Concrete	
8 SF	1	Basic Wall	125	3.34 CF	125	Concrete - Cast-in-Place Concrete	
19 SF	1	Basic Wall	125	7.62 CF	125	Concrete - Cast-in-Place Concrete	
8 SF	1	Basic Wall	125	3.34 CF	125	Concrete - Cast-in-Place Concrete	
115 SF	1	Basic Wall	75	28.39 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.40 CF	125 2	Concrete - Cast-in-Place Concrete	
38 SF	1	Basic Wall	75	9.37 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.37 CF	125 2	Concrete - Cast-in-Place Concrete	
37 SF	1	Basic Wall	75	9.19 CF	125 2	Concrete - Cast-in-Place Concrete	
2 SF	1	Basic Wall	75	0.46 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.44 CF	125 2	Concrete - Cast-in-Place Concrete	
31 SF	1	Basic Wall	75	7.59 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.37 CF	125 2	Concrete - Cast-in-Place Concrete	
77 SF	1	Basic Wall	125	31.48 CF	125	Concrete - Cast-in-Place Concrete	
52 SF	1	Basic Wall	125	21.21 CF	125	Concrete - Cast-in-Place Concrete	
532 SF	1	Basic Wall	125	218.32 CF	125	Concrete - Cast-in-Place Concrete	
332 SF	1	Basic Wall	125	135.98 CF	125	Concrete - Cast-in-Place Concrete	
291 SF	1	Basic Wall	125	119.52 CF	125	Concrete - Cast-in-Place Concrete	
31 SF	1	Basic Wall	352	36.32 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

54 SF	1	Basic Wall	352	62.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
31 SF	1	Basic Wall	352	35.60 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
52 SF	1	Basic Wall	352	60.47 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
31 SF	1	Basic Wall	352	35.60 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
52 SF	1	Basic Wall	352	60.47 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
31 SF	1	Basic Wall	352	35.60 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
49 SF	1	Basic Wall	352	56.46 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
31 SF	1	Basic Wall	352	35.60 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.84 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
9 SF	1	Basic Wall	352	10.49 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
19 SF	1	Basic Wall	352	21.49 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
51 SF	1	Basic Wall	352	58.58 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

51 SF	1	Basic Wall	352	58.58 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
51 SF	1	Basic Wall	352	58.58 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
51 SF	1	Basic Wall	352	58.58 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
40 SF	1	Basic Wall	352	46.19 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
206 SF	1	Basic Wall	352	238.75 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
188 SF	1	Basic Wall	352	217.74 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.06 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
223 SF	1	Basic Wall	352	257.76 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
121 SF	1	Basic Wall	352	140.23 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
221 SF	1	Basic Wall	352	255.82 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
223 SF	1	Basic Wall	352	257.92 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.56 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
224 SF	1	Basic Wall	352	258.94 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
38 SF	1	Basic Wall	352	43.81 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

69 SF	1	Basic Wall	352	80.33 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.74 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
55 SF	1	Basic Wall	352	63.86 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
38 SF	1	Basic Wall	352	43.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.43 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	30.73 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
37 SF	1	Basic Wall	352	42.61 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
26 SF	1	Basic Wall	352	29.77 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
40 SF	1	Basic Wall	352	46.23 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
29 SF	1	Basic Wall	352	33.73 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
66 SF	1	Basic Wall	352	76.40 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
28 SF	1	Basic Wall	352	32.40 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
56 SF	1	Basic Wall	352	64.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
70 SF	1	Basic Wall	125	28.73 CF	125	Concrete - Cast-in-Place Concrete	
21 SF	1	Basic Wall	125	8.62 CF	125	Concrete - Cast-in-Place Concrete	

26 SF	1	Basic Wall	125	10.73 CF	125	Concrete - Cast-in-Place Concrete
17 SF	1	Basic Wall	125	6.90 CF	125	Concrete - Cast-in-Place Concrete
330 SF	1	Basic Wall	125	135.41 CF	125	Concrete - Cast-in-Place Concrete
34 SF	1	Basic Wall	125	13.78 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.60 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
44 SF	1	Basic Wall	125	18.13 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
330 SF	1	Basic Wall	125	135.41 CF	125	Concrete - Cast-in-Place Concrete
35 SF	1	Basic Wall	125	14.29 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.60 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete

124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
26 SF	1	Basic Wall	125	10.50 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
330 SF	1	Basic Wall	125	135.41 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	21.04 CF	125	Concrete - Cast-in-Place Concrete
112 SF	1	Basic Wall	125	45.93 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
330 SF	1	Basic Wall	125	135.41 CF	125	Concrete - Cast-in-Place Concrete
35 SF	1	Basic Wall	125	14.38 CF	125	Concrete - Cast-in-Place Concrete

49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.60 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
86 SF	1	Basic Wall	125	35.20 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
26 SF	1	Basic Wall	125	10.50 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
9 SF	1	Basic Wall	125	3.65 CF	125	Concrete - Cast-in-Place Concrete
302 SF	1	Basic Wall	125	123.85 CF	125	Concrete - Cast-in-Place Concrete
32 SF	1	Basic Wall	125	13.07 CF	125	Concrete - Cast-in-Place Concrete
45 SF	1	Basic Wall	125	18.47 CF	125	Concrete - Cast-in-Place Concrete
108 SF	1	Basic Wall	125	44.49 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.01 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.57 CF	125	Concrete - Cast-in-Place Concrete
45 SF	1	Basic Wall	125	18.47 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.66 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.66 CF	125	Concrete - Cast-in-Place Concrete
62 SF	1	Basic Wall	125	25.55 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.57 CF	125	Concrete - Cast-in-Place Concrete
23 SF	1	Basic Wall	125	9.54 CF	125	Concrete - Cast-in-Place Concrete

112 SF	1	Basic Wall	125	45.87 CF	125	Concrete - Cast-in-Place Concrete	
117 SF	1	Basic Wall	125	48.04 CF	125	Concrete - Cast-in-Place Concrete	
24 SF	1	Basic Wall	125	9.74 CF	125	Concrete - Cast-in-Place Concrete	
8 SF	1	Basic Wall	125	3.34 CF	125	Concrete - Cast-in-Place Concrete	
19 SF	1	Basic Wall	125	7.62 CF	125	Concrete - Cast-in-Place Concrete	
8 SF	1	Basic Wall	125	3.34 CF	125	Concrete - Cast-in-Place Concrete	
115 SF	1	Basic Wall	75	28.22 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.40 CF	125 2	Concrete - Cast-in-Place Concrete	
38 SF	1	Basic Wall	75	9.37 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.37 CF	125 2	Concrete - Cast-in-Place Concrete	
37 SF	1	Basic Wall	75	9.19 CF	125 2	Concrete - Cast-in-Place Concrete	
61 SF	1	Basic Wall	75	14.99 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.44 CF	125 2	Concrete - Cast-in-Place Concrete	
31 SF	1	Basic Wall	75	7.59 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.37 CF	125 2	Concrete - Cast-in-Place Concrete	
77 SF	1	Basic Wall	125	31.48 CF	125	Concrete - Cast-in-Place Concrete	
52 SF	1	Basic Wall	125	21.21 CF	125	Concrete - Cast-in-Place Concrete	
533 SF	1	Basic Wall	125	218.71 CF	125	Concrete - Cast-in-Place Concrete	
332 SF	1	Basic Wall	125	136.09 CF	125	Concrete - Cast-in-Place Concrete	
291 SF	1	Basic Wall	125	119.52 CF	125	Concrete - Cast-in-Place Concrete	
31 SF	1	Basic Wall	352	36.32 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
62 SF	1	Basic Wall	352	71.50 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
31 SF	1	Basic Wall	352	35.60 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.84 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

31 SF	1	Basic Wall	352	35.60 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.84 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
31 SF	1	Basic Wall	352	35.60 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
49 SF	1	Basic Wall	352	56.46 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
31 SF	1	Basic Wall	352	35.60 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.84 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
9 SF	1	Basic Wall	352	10.49 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
19 SF	1	Basic Wall	352	21.49 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
59 SF	1	Basic Wall	352	67.95 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
59 SF	1	Basic Wall	352	67.95 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
59 SF	1	Basic Wall	352	67.95 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
59 SF	1	Basic Wall	352	67.95 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
35 SF	1	Basic Wall	352	40.88 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
47 SF	1	Basic Wall	352	54.41 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
206 SF	1	Basic Wall	352	238.75 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

122 SF	1	Basic Wall	352	141.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
188 SF	1	Basic Wall	352	217.74 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.06 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
223 SF	1	Basic Wall	352	257.76 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
121 SF	1	Basic Wall	352	140.23 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
221 SF	1	Basic Wall	352	255.82 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
223 SF	1	Basic Wall	352	257.92 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.56 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
224 SF	1	Basic Wall	352	258.94 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
57 SF	1	Basic Wall	352	66.23 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
105 SF	1	Basic Wall	352	121.77 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.66 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
47 SF	1	Basic Wall	352	54.11 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

38 SF	1	Basic Wall	352	43.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.43 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
24 SF	1	Basic Wall	352	28.03 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
33 SF	1	Basic Wall	352	38.07 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
23 SF	1	Basic Wall	352	27.07 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
36 SF	1	Basic Wall	352	41.25 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
24 SF	1	Basic Wall	352	27.71 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
57 SF	1	Basic Wall	352	65.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
28 SF	1	Basic Wall	352	32.40 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
56 SF	1	Basic Wall	352	64.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
76 SF	1	Basic Wall	125	30.98 CF	125	Concrete - Cast-in-Place Concrete	
21 SF	1	Basic Wall	125	8.66 CF	125	Concrete - Cast-in-Place Concrete	
26 SF	1	Basic Wall	125	10.73 CF	125	Concrete - Cast-in-Place Concrete	
17 SF	1	Basic Wall	125	6.90 CF	125	Concrete - Cast-in-Place Concrete	
323 SF	1	Basic Wall	125	132.56 CF	125	Concrete - Cast-in-Place Concrete	
26 SF	1	Basic Wall	125	10.71 CF	125	Concrete - Cast-in-Place Concrete	
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete	
115 SF	1	Basic Wall	125	46.99 CF	125	Concrete - Cast-in-Place Concrete	

51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
44 SF	1	Basic Wall	125	18.13 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
323 SF	1	Basic Wall	125	132.56 CF	125	Concrete - Cast-in-Place Concrete
27 SF	1	Basic Wall	125	11.23 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
115 SF	1	Basic Wall	125	46.99 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete

26 SF	1	Basic Wall	125	10.50 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
323 SF	1	Basic Wall	125	132.56 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	21.04 CF	125	Concrete - Cast-in-Place Concrete
109 SF	1	Basic Wall	125	44.56 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
323 SF	1	Basic Wall	125	132.56 CF	125	Concrete - Cast-in-Place Concrete
28 SF	1	Basic Wall	125	11.31 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
115 SF	1	Basic Wall	125	46.99 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete

124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
26 SF	1	Basic Wall	125	10.50 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
295 SF	1	Basic Wall	125	121.00 CF	125	Concrete - Cast-in-Place Concrete
25 SF	1	Basic Wall	125	10.27 CF	125	Concrete - Cast-in-Place Concrete
45 SF	1	Basic Wall	125	18.47 CF	125	Concrete - Cast-in-Place Concrete
105 SF	1	Basic Wall	125	42.95 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.01 CF	125	Concrete - Cast-in-Place Concrete
78 SF	1	Basic Wall	125	32.03 CF	125	Concrete - Cast-in-Place Concrete
45 SF	1	Basic Wall	125	18.47 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.66 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.66 CF	125	Concrete - Cast-in-Place Concrete
62 SF	1	Basic Wall	125	25.55 CF	125	Concrete - Cast-in-Place Concrete
78 SF	1	Basic Wall	125	32.03 CF	125	Concrete - Cast-in-Place Concrete
23 SF	1	Basic Wall	125	9.54 CF	125	Concrete - Cast-in-Place Concrete
112 SF	1	Basic Wall	125	45.87 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.04 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	9.74 CF	125	Concrete - Cast-in-Place Concrete
4 SF	1	Basic Wall	125	1.80 CF	125	Concrete - Cast-in-Place Concrete
19 SF	1	Basic Wall	125	7.62 CF	125	Concrete - Cast-in-Place Concrete
4 SF	1	Basic Wall	125	1.80 CF	125	Concrete - Cast-in-Place Concrete

115 SF	1	Basic Wall	75	28.22 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.40 CF	125 2	Concrete - Cast-in-Place Concrete	
38 SF	1	Basic Wall	75	9.37 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.37 CF	125 2	Concrete - Cast-in-Place Concrete	
37 SF	1	Basic Wall	75	8.99 CF	125 2	Concrete - Cast-in-Place Concrete	
2 SF	1	Basic Wall	75	0.46 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.44 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.39 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.37 CF	125 2	Concrete - Cast-in-Place Concrete	
77 SF	1	Basic Wall	125	31.48 CF	125	Concrete - Cast-in-Place Concrete	
52 SF	1	Basic Wall	125	21.21 CF	125	Concrete - Cast-in-Place Concrete	
533 SF	1	Basic Wall	125	218.71 CF	125	Concrete - Cast-in-Place Concrete	
332 SF	1	Basic Wall	125	136.09 CF	125	Concrete - Cast-in-Place Concrete	
291 SF	1	Basic Wall	125	119.52 CF	125	Concrete - Cast-in-Place Concrete	
28 SF	1	Basic Wall	352	32.31 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
54 SF	1	Basic Wall	352	62.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.59 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
52 SF	1	Basic Wall	352	60.47 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.59 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
52 SF	1	Basic Wall	352	60.47 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.59 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

42 SF	1	Basic Wall	352	48.24 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.59 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
52 SF	1	Basic Wall	352	60.47 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
8 SF	1	Basic Wall	352	9.07 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
19 SF	1	Basic Wall	352	21.49 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
51 SF	1	Basic Wall	352	58.58 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
51 SF	1	Basic Wall	352	58.58 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
51 SF	1	Basic Wall	352	58.58 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
51 SF	1	Basic Wall	352	58.58 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

40 SF	1	Basic Wall	352	46.19 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
206 SF	1	Basic Wall	352	238.75 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
188 SF	1	Basic Wall	352	217.74 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.06 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

223 SF	1	Basic Wall	352	257.76 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
121 SF	1	Basic Wall	352	140.23 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
221 SF	1	Basic Wall	352	255.82 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
223 SF	1	Basic Wall	352	257.92 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.56 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
224 SF	1	Basic Wall	352	258.94 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
38 SF	1	Basic Wall	352	43.81 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
69 SF	1	Basic Wall	352	80.33 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.74 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
55 SF	1	Basic Wall	352	63.86 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
38 SF	1	Basic Wall	352	43.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.43 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
28 SF	1	Basic Wall	352	32.15 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

37 SF	1	Basic Wall	352	42.61 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
26 SF	1	Basic Wall	352	29.77 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
40 SF	1	Basic Wall	352	46.23 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
29 SF	1	Basic Wall	352	33.73 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
66 SF	1	Basic Wall	352	76.40 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
28 SF	1	Basic Wall	352	32.40 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
56 SF	1	Basic Wall	352	64.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
70 SF	1	Basic Wall	125	28.73 CF	125	Concrete - Cast-in-Place Concrete	
21 SF	1	Basic Wall	125	8.62 CF	125	Concrete - Cast-in-Place Concrete	
26 SF	1	Basic Wall	125	10.73 CF	125	Concrete - Cast-in-Place Concrete	
17 SF	1	Basic Wall	125	6.90 CF	125	Concrete - Cast-in-Place Concrete	
315 SF	1	Basic Wall	125	129.24 CF	125	Concrete - Cast-in-Place Concrete	
26 SF	1	Basic Wall	125	10.71 CF	125	Concrete - Cast-in-Place Concrete	
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete	
115 SF	1	Basic Wall	125	45.90 CF	125	Concrete - Cast-in-Place Concrete	
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete	
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete	
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete	
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete	
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete	
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete	

82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
44 SF	1	Basic Wall	125	18.13 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
323 SF	1	Basic Wall	125	132.56 CF	125	Concrete - Cast-in-Place Concrete
27 SF	1	Basic Wall	125	11.23 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
115 SF	1	Basic Wall	125	45.90 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
26 SF	1	Basic Wall	125	10.50 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
323 SF	1	Basic Wall	125	132.56 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	21.04 CF	125	Concrete - Cast-in-Place Concrete

109 SF	1	Basic Wall	125	44.56 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
323 SF	1	Basic Wall	125	132.56 CF	125	Concrete - Cast-in-Place Concrete
28 SF	1	Basic Wall	125	11.31 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.20 CF	125	Concrete - Cast-in-Place Concrete
115 SF	1	Basic Wall	125	45.90 CF	125	Concrete - Cast-in-Place Concrete
51 SF	1	Basic Wall	125	20.98 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
47 SF	1	Basic Wall	125	19.37 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
124 SF	1	Basic Wall	125	51.02 CF	125	Concrete - Cast-in-Place Concrete
65 SF	1	Basic Wall	125	26.79 CF	125	Concrete - Cast-in-Place Concrete
82 SF	1	Basic Wall	125	33.59 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	10.01 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.10 CF	125	Concrete - Cast-in-Place Concrete
123 SF	1	Basic Wall	125	50.37 CF	125	Concrete - Cast-in-Place Concrete

26 SF	1	Basic Wall	125	10.50 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
20 SF	1	Basic Wall	125	8.23 CF	125	Concrete - Cast-in-Place Concrete
5 SF	1	Basic Wall	125	1.97 CF	125	Concrete - Cast-in-Place Concrete
295 SF	1	Basic Wall	125	121.00 CF	125	Concrete - Cast-in-Place Concrete
25 SF	1	Basic Wall	125	10.27 CF	125	Concrete - Cast-in-Place Concrete
45 SF	1	Basic Wall	125	18.47 CF	125	Concrete - Cast-in-Place Concrete
105 SF	1	Basic Wall	125	41.95 CF	125	Concrete - Cast-in-Place Concrete
49 SF	1	Basic Wall	125	20.01 CF	125	Concrete - Cast-in-Place Concrete
78 SF	1	Basic Wall	125	32.03 CF	125	Concrete - Cast-in-Place Concrete
45 SF	1	Basic Wall	125	18.47 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.66 CF	125	Concrete - Cast-in-Place Concrete
119 SF	1	Basic Wall	125	48.66 CF	125	Concrete - Cast-in-Place Concrete
62 SF	1	Basic Wall	125	25.55 CF	125	Concrete - Cast-in-Place Concrete
78 SF	1	Basic Wall	125	32.03 CF	125	Concrete - Cast-in-Place Concrete
23 SF	1	Basic Wall	125	9.54 CF	125	Concrete - Cast-in-Place Concrete
112 SF	1	Basic Wall	125	45.87 CF	125	Concrete - Cast-in-Place Concrete
117 SF	1	Basic Wall	125	48.04 CF	125	Concrete - Cast-in-Place Concrete
24 SF	1	Basic Wall	125	9.74 CF	125	Concrete - Cast-in-Place Concrete
4 SF	1	Basic Wall	125	1.80 CF	125	Concrete - Cast-in-Place Concrete
19 SF	1	Basic Wall	125	7.62 CF	125	Concrete - Cast-in-Place Concrete
4 SF	1	Basic Wall	125	1.80 CF	125	Concrete - Cast-in-Place Concrete
115 SF	1	Basic Wall	75	28.22 CF	125 2	Concrete - Cast-in-Place Concrete
30 SF	1	Basic Wall	75	7.40 CF	125 2	Concrete - Cast-in-Place Concrete
38 SF	1	Basic Wall	75	9.37 CF	125 2	Concrete - Cast-in-Place Concrete
30 SF	1	Basic Wall	75	7.37 CF	125 2	Concrete - Cast-in-Place Concrete
37 SF	1	Basic Wall	75	8.99 CF	125 2	Concrete - Cast-in-Place Concrete
61 SF	1	Basic Wall	75	14.99 CF	125 2	Concrete - Cast-in-Place Concrete

30 SF	1	Basic Wall	75	7.44 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.39 CF	125 2	Concrete - Cast-in-Place Concrete	
30 SF	1	Basic Wall	75	7.37 CF	125 2	Concrete - Cast-in-Place Concrete	
77 SF	1	Basic Wall	125	31.48 CF	125	Concrete - Cast-in-Place Concrete	
52 SF	1	Basic Wall	125	21.21 CF	125	Concrete - Cast-in-Place Concrete	
532 SF	1	Basic Wall	125	218.32 CF	125	Concrete - Cast-in-Place Concrete	
332 SF	1	Basic Wall	125	135.98 CF	125	Concrete - Cast-in-Place Concrete	
291 SF	1	Basic Wall	125	119.52 CF	125	Concrete - Cast-in-Place Concrete	
28 SF	1	Basic Wall	352	32.31 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
62 SF	1	Basic Wall	352	71.50 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.59 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.84 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.59 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
60 SF	1	Basic Wall	352	69.84 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.59 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
42 SF	1	Basic Wall	352	48.24 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
27 SF	1	Basic Wall	352	31.59 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
52 SF	1	Basic Wall	352	60.47 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

8 SF	1	Basic Wall	352	9.07 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
19 SF	1	Basic Wall	352	21.49 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
59 SF	1	Basic Wall	352	67.95 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
59 SF	1	Basic Wall	352	67.95 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
59 SF	1	Basic Wall	352	67.95 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
59 SF	1	Basic Wall	352	67.95 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
32 SF	1	Basic Wall	352	36.87 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
47 SF	1	Basic Wall	352	54.41 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	

131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
206 SF	1	Basic Wall	352	238.75 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
131 SF	1	Basic Wall	352	151.37 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
244 SF	1	Basic Wall	352	281.85 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.13 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
188 SF	1	Basic Wall	352	217.74 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
122 SF	1	Basic Wall	352	141.06 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
223 SF	1	Basic Wall	352	257.76 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	
121 SF	1	Basic Wall	352	140.23 CF	Exterior - Brick on Mtl. Stud	Metal - Stud Layer	