The Role of Feasibility Studies in Civil Engineering: The Effect of Planning and Execution Stage in Preparing These Studies

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Abstract

This study examines the critical role of feasibility studies in civil engineering projects and investigates the impact of the planning and execution phases on the quality and outcomes of these studies. Civil engineering projects, particularly large-scale ones, typically progress through three critical phases: feasibility and briefing, engineering and construction, and commissioning and maintenance, each contributing to the overall enhancement of project performance. The research emphasizes that a carefully executed feasibility study is essential for decision-making, ensuring that a proposed project is technically, commercially, and environmentally viable prior to the allocation of significant resources.

The study further examines the engineering phase, encompassing design, contracts, construction procedures, risk assessment, and resource planning. To find out what caused the most delays in the design phase, a field survey and structured questionnaire were given to design engineers, consultants, and project owners. The findings show that most project delays are caused by inefficiencies in administration, budget constraints, and project owners taking too long to make decisions. The consultants' lack of technical skills and resource management skills makes these delays even worse, which affects the accuracy of feasibility studies and project performance.

The paper shows the best way to plan the layout of a building site while taking safety and cost into account. The idea uses crane safety standards and hazard mitigation to make the site safer and speed up the movement of materials, workers, and equipment. The results show that good site layout design makes operations safer, costs less, and makes feasibility studies more reliable by setting realistic limits on costs, time, and resource use.

The study contends that thorough feasibility evaluations, supported by systematic planning, risk management, and coordinated execution strategies, are essential for achieving

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sustainable, timely, and cost-effective outcomes in civil engineering initiatives.

Keywords: Feasibility studies; Civil engineering; Project management; Design stage delays; Risk assessment; Planning and execution; Site layout optimization; Construction safety; Project success.

The Role of Feasibility Studies in Civil Engineering, the effect of Planning and Execution Stage in Preparing these studies

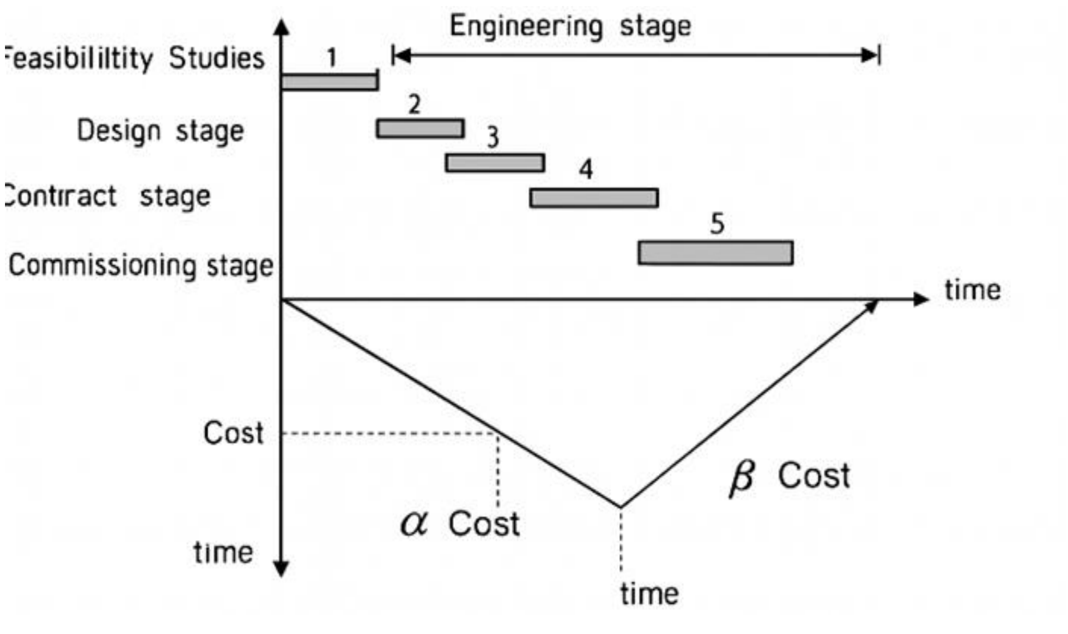
Introduction

The Project Construction especially (Large-Scale Projects) passes through three Main stages. These stages form what is termed as "the Engineering Process". They are divided into groups of activities and requirements. The science of "Construction Project Management" as a newer trend of Civil Engineering satisfies the demand for Scheduling Engineering Priorities and achievements. So, the stages can be classified into:

1- Briefing and Feasibility Studies Stage.

2- Engineering Stage which implies (Design, Contract, Bedding, Contractor Selection, Agreement, Construction, Supervising and Evaluation, stages).

3- Commissioning and Maintenance Stage.



Briefing Stage (Feasibility Studies) : The purpose of such a stage is to assure that the specified project realizes its aim and benefits either economically or ethically or any other aspects. So, through this stage of construction, there are many determinants regarding the project like its volume, location, requirements and the basic demands which include:

* Primary Evaluation of the cost and period of construction.

* The presence and abundance of raw materials, labor, instrumentation, and erection facilities.

* The difference allowances in prizes of materials & equipment.

* The influencing factors on performance.

* Initial financial demands and continuous funderizing.

* Determining the cash-flow curve of the execution stage.

* Studying the benefits gained after the implementation process.

Thus, if adequate studies have been operated on these elements individually and collectively, the searching team can state a decision. As a report to the owner, the decision reasons states either to "go on implementing" or to look for alternatives. The second stage will be of the owner; if agree, the financial resources must be offered. If not, what's alternating or can any modifications substitute replacement. After then Legal documentation and tendering process takes place. This leads us to the next stage which is termed as the "Engineering stage or Construction stage".

3- Engineering (Construction) Stage: It starts immediately after deciding the validity of the project, which mainly consists of three elements: Design, tendering or contracting, and execution. It was termed as engineering stage due to that the main role regards Engineers or engineering work.

3-1- Design Stage: It covers the Architectural, structural, executing, and work-shop drawings. It also deals with monitoring all the specifications, standards, requirements, and properties of materials, equipment, and labor. In addition to tables of quantities which must be prepared before bidding the tender.

It should be remembered here, that many factors can delay this stage, like misunderstanding between the designer and the executives or incapability of designers to handle appropriate erection techniques. This leads to either changing the original design or searching for alternatives which spends time and results in time-delay.

The designer-executive well-planning results in time saving and efforts reduction too. As the designer engineer should prepare a "method statement" which identifies the best technique to implement items of tender with the pre-evaluated quantities at the pre-estimated duration (time-schedule).

Meanwhile, due to the nature of construction projects, and the lot of variations expected. Moreover, sudden changes during work may be unexpected. This leads us to the study of risk or "Risk Assessment" especially in complex projects.

"Risk Assessment or Risk Analysis" becomes of great importance in large-scale projects and those associated with severe working conditions like tunnels, infrastructure, sewage plants, power plants, bridges, harbors, and airports.

In these projects, a pre-evaluation study of risk and causes of deterioration must be stated. Not only "Risk-Assessment" studies but it must be accompanied with suggestions and solutions. This kind of studies passes through steps like:

1- Risk Identification.

2- Risk Analysis.

3- Risk Management.

4- Risk Allocation, (verifying responsibilities & duties).

Due to the advance in computing techniques, this branch of science regarding "Risk Assessment associated with Construction Projects" becomes more advanced and precious. It depends mainly upon the theory of "Probabilities" and statistics. Through which the sequences may be predicted. Therefore, these sequences can be identified and studied in terms of time-dependant effect, and cost-dependant effect.

Now, imagine how differs when a sudden drop occurred but at the same time an emergency program or solving procedures introduced. No doubt, it will localize the harming effect and the resultant variation will be minor.

3-2- Contracting stage :

This stage starts either after or during the Design stage. Since almost Architectural and Structural Drawings completed to prepare tables of quantities, procedures of bedding and contractor selection.

We can summarize the important points of this stage:

1- Bedding Documents.

2- Contractor Selection.

3- The Agreement.

4- Legal duties (identifying responsibilities).

Oftenly, the bedding documents contains:

A- Invitation to Bid.

B- Bid form.

C- Construction Contract.

D- General Conditions.

E- Special Conditions.

F- Work included in Contract (Items, Quantities).

G- Specifications and Requirements.

H- Architectural and Structural or executive Drawings.

i- Construction Schedules.

Meanwhile, the contractor selection either by "bedding" or forced tendering, till signing the agreement between the owner or his representatives and the contractor. The Agreement should include all the governing rules and acceptance of both sides to operate the tender and its conditions.

3-3- Construction Stage: This stage represents 85% of the total cost of any project and spends the major portion of its duration.

It transmits what is planned in Drawings into a real structure through the general specifications and conditions pre-determined. The contractor supplies all requirements either resources (materials, equipment, funds) or Labour.

The Construction stage starts with contractor selecting and signing the agreement. When the contractor handles the location of execution, the technical office should revise the time schedule and determine the required resources, raw materials, equipment, labour, temporary facilities (offices, etc...), determining any obstacles and suppliers.

* Organizing work with "Material suppliers" and assuring the suppliment on time to avoid "handling's loss of materials due to frequent transporting of materials".

* Guarantee of easiness of instruments moving from and to the field, it is advised to make it "ONE WAY TRAFFIC" and locating specified Entry and Exit to avoid junk or traffic jam.

* Fixed locations for "stationary equipment" should be selected like spots of "tower-cranes", "batch-plants"; which should be at the middle to cover the project needs without excessive transports to the different parts of the project.

* "Storehouses" should be well-planned to satisfy relative easiness in inputs, outputs of materials. This also includes special conditions for protecting supplies like cement, steel from the harming ambient conditions "Moisture, Rain, Chemicals".

For instance, special considerations for simplification of operations can save time and effort; the overall cost will be reduced as a result.

(1). For supervision and quality control spots, it should be near-by the trucks entry and supplies storehouses.

(2). Suppliment of materials as required just before the time (with adequate period to avoid handling and with quantities appropriate to usage near by the equipment (mixers, plants, tower cranes).

(3). Avoiding interaction of supplies for different activities. Arranging the priorities in activities and the required supplies.

(4). Identifying the elements of the project and link each step with the sequant.

(5). Preparing a "Method Statement" which includes: - Type of used instrumentation - Suggested method of execution. - The labour power required (No. of workers).

(6). Extracting Detailing Programs to the sub-contractors to verify their duties. It is recommended to be in its simplest form a "BAR CHART".

(7). "Resource Levelling and Smoothing" to increase productivity and performance.

(8). Co-operating with the different sectors of the company or contracting firm to ensure delivery of supplies in time especially for "Critical Activities"; sectors like purchasing or Equipment should be aware of time-schedule.

3-4- Commissioning Stage :

Which is considered the last stage in the Construction Process as it proceeds occupation of Project. It is divided into 2 parts: (i) Initial Commissioning of Project. (ii) Final Commissioning of Project.

3-4-1- Initial Commissioning of the Project :

Which implies that all items and quantities recorded in tender have been fulfilled and completed. But, this is accompanied with a Guarantee period (about 1-2 years) under the responsibility of the contractor which is termed as "Commissioning and Guarantee Period" after which the Final Commissioning takes place.

3-4-2- Final Commissioning of the Project :

After the Maintenance and Guarantee period, the contractor is thus considered free from any other duties regarding any item and makes hands-over on the structure. Except the responsibility of safety and stability of the structure.

It is the responsibility of the contractor to ensure the safe performance of the structure without total or partial deterioration of any part to a specified duration (oftenly 10 years after initial commissioning). But, it should be noticed that defects of bad-using practices and improper operations do not attributed to the contractor if he works on repairing some, it should be separated from the original tender.

4- Critical Delay Factors During the Design Stage :

The design stage in the project life cycle requires good management, continuous improvement, new technologies and resources. We will here identify the critical factors and variables that influence the delay in construction projects during the design stage, which are caused by the engineering bureaus, clients and others. Some researches that have been operated in Arab countries like Libya, suggested that the majority of delay factors comes from the clients, in which the administrative procedures, legal requirement, financial tightness are the main concern and they play the major role in such delay.

To achieve the client (owner) objectives in terms of time, cost and quality, construction projects needs resources, skills and good management and a high level of commitment and co-operation among all who are concerned; i-e, owners, engineers and contractors to achieve the targets and satisfy the end user.

Past experiences and practical evidence in many local projects had seen a remarkable delay and cost over runs. Despite that many researchers attribute delay to the construction stage, but studying the delay in Design stage is so important and sensitive and contributed largely on the overall life cycle time and overall project cost.

The design stage needs qualified technical experts, a systematic approach, a well-designed organization, continuous improvement process, new technologies and resources. Most of Bureaus have failed to meet its obligation due to the huge size and complexity of works undertaken.

5- Project Success Factors: Decision makers always faced with the dilemma of making their project succeed, they and their managers have to plan for achieving the project objectives (Quality, time, cost).

In our developing countries, most of the projects executed in the last 30 years have witnessed a delay. In this era, delivery and value of time are considered as one of the most success factors for the organization to withstand and complete.

A real understanding of the project specific objectives, anticipated risks, defining the responsibilities, studying the scope of work, time management, cost management, and legal requirements are among many factors that has to be carefully considered, and must be planned for during all stages of the project.

To understand the management practice during the design stage, a "field survey" was conducted through a "Questionnaire Survey" to investigate the factors that cause delay.

The Questionnaire Focused On:

* Finding the main reasons for the problem of delay during the design stage in the construction projects, which is well-known by the decision makers and even by the supervision parties.

* Classification of the administrative and technical responsibilities between design engineers, design bureaus and clients.

* Determination of the most important factors causing those delays and their effects to help the decision makers to implement the necessary precautions in the suitable time.

* Create a sense of the importance of this problem among all the considered parties including design engineers, owners, researchers and academicians in order to give a chance to seek a deep investigation to the problem through the proposed and recommended results.

6- Questionnaire Design and Survey: The questionnaire is divided into 5 parties as following:

1- Personal Data

2- Information about the designer Engineer.

3- Information about the consultant Engineer.

4- The designer Opinion.

5- Studying the delay factors:- This part aims to know what are the critical delay factors that affect project success and who is responsible of it. It is the main concern of the operated questionnaire, where the respondents were asked about their opinion on the probability of occurrence, degree of prediction and the affect on time of the project for each delay factor that could be caused from either (owner, consultant and third parties) in scale from 1 (low) to 5 (high). The result of the multiplication will give an index of the criticality of the delay factor. The highest score will be 125 which are considered the most critical.

Table (1) shows the list of delay factors which were collected from literatures, interviews and the practical experience of the researchers and the feedback from the "Pilot - Study" conducted at the earlier time of the survey.

7- How to Operate Questionnaire Analysis : As said, the questionnaire is divided into 3 parties where the respondents were asked to determine:

* Probability of Occurance : 1 (low) -> 5 (high)

* Degree of Prediction : 1 (easy) -> 5 (difficult)

* Effect on time : 1 (low) -> 5 (high)

* Criticality factor = Degree/rank of Probability x Degree of Prediction x effect on time.

Highest Score = 5 "as the most probably occurred" x 5 "that difficultly occurred" x 5 "of high effect on time" = 125 "highest score = top Rank".

The criticality index for each delay factor was calculated for each individual respondent, then the average of the twenty responding consulting offices and parties were calculated to identify the critical delay factor caused by the three parties.

8- Critical factors caused by Owner : The following are the top five delay factors and their criticalityindices caused by the owner

:1- Delay factor	2- Cr. Index	3- Rank
a- Delay in procedures of opening Letter of Credits, advance and progress payments.	(75)	(1)
b- Obstacles and complicated procedures and problems with third parties.	(62)*	(2)
c- Instability and Bad Central Administration	(59)*	(3)
d- Presenting old and updated data.	(57)	(4)
e- Slowness in the decision-making action.	(55)	(5)

*these numbers are the average of the twenty parties responded.

9- Critical Delay Factors Caused by the Consultant.

a- Sub consultants are not probably well-selected	(52)	(1)
b- Unavailability of financial and required funding.	(47)	(2)
c- Shortage in human and financial resources.	(46)	(3)
d- The project risks are not predicted, predefined, assessed and prepared for.	(43)	(4)
e- Instability and bad central administration	(42)	(5)

10. Critical Delay Factors Caused by third party.

1- Delay Factor	Cr. Index	Rank
a- Absence of motivation and competitiveness.	(49)	(1)
b- The numerous requirements of legal authorization and acceptances.	(43)	(2)
-- Instability of Prices and exchange Rates.	(41)	(3)

It is clearly evidence that the "Owner" has the major responsibility in the delaying of the projects during the "Design stage" where the top ranked factors among the three parties are dominated by the Owner.

11- Conclusion of the Questionnaire Analysis: As with the implementation stage where much of the attention of the researchers believes that the contractor is responsible for the delay of the projects during the construction stage, the initial results of this questionnaire suggested that the majority of delay factors come under the shoulder of the Owner. The administrative procedures, legal requirements, financial tightness are the main concern and they play the major role in delaying of the project during the most critical stage "Design Stage".

12- The Effect of Planning Constr significant and critical task that should be uction Site and execution Practices On Preparing Feasibility-Studies: Planning construction site layouts involves identifying, sizing and positioning of temporary facilities on site, and accordingly it has a significant impact on the safety and efficiency of Construction Operations.

Although existing site layout planning models are capable of optimizing travel costs of resources on site, they do not consider safety as an important independent objective in planning site layout. Meanwhile, the successful model should integrate two recently developed concepts: safety operations and enhancing the control of hazardous material on site. This will lead to significant improvement in the safety of construction operations and the cost of construction facilities.

12-1- Introduction: Construction site layout planning involves identifying, sizing, and on-site positioning of temporary facilities which may include security fences, access roads, storage sheds, field offices, fabrication shops, sanitary facilities, electric power service, stockpiles of excavations, and batch plants. Developing and maintaining an effective site layout is a

properly operated and updated to:

1- reduce the costs of materials handling.

2- minimize the travel times of labour, material and equipment on site.

3- improve construction productivity.

4- Promote construction safety and quality.

A number of studies were conducted in order to improve site layout planning in construction projects. These studies adopted a wide range of methodologies and development tools including neural networks, knowledge-based systems, heuristics, simulation and optimization models.

Despite the contributions and practical features of available site layout planning models, they all focused on providing a solution that seeks to optimize the single objective of reducing travel distances of resources. In many real-world projects, this is often considered inadequate as other objectives such as improving safety may prove to be equally, if not more significant.

The National Institute for Occupational Safety and Health (NIOSH) ranks the construction industry as the first in causing non-fatal injuries at a rate of 9.3 injuries per 100 full time workers in 1997. Moreover, the Bureau of Labor Statistics (BLS) ranks the construction industry among the top three industries causing fatal injuries in the United States in 2002 with a rate of 12.2 per 100,000 workers costing 15% of the new construction.

This leads to the importance of safety in site planning and sequently on Feasibility Studies Preparation. As safety of construction operations is usually affected by many factors which include the site layout design, safety planning, personal practices and the level of personal training, among others. Several field studies were conducted in order to explore and identify relevant and practical considerations that can enhance

the safety of construction site layouts. This investigation led to identifying the following two key measures: (1) Proper positioning of temporary facilities to improve crane operations safety and minimize accidents caused by falling objects. (2) Control of hazardous material and equipment on site.

12-2- Control of Hazardous Material:

Hazardous material and equipment are often utilized and located on construction sites, exposing construction workers and engineers to safety risks. Hazardous material includes; (1) explosives and blasting devices used in rock excavation, (2) flammable material such as fuel used by construction equipment, (3) toxic substances such as asbestos, coal, tar pitch volatiles, calcium, benzene, formaldehyde, methyl chloride and others identified by the (OSHA); the Occupational Safety and Health Organization. For example, OSHA standard 1926-407 recommends storage facilities, electrical equipment and possible resources of sparks be located away from flammable materials.

In order to improve safety on construction sites, planners need to comply with (OSHA) standards and identify proper storage locations for all hazardous material on site. These locations should be selected to ensure there is adequate separation between the specific locations of materials or equipment can create hazardous conditions on site (explosives and blasting devices), hazardous material and workers in order to support planners in this site layout planning task.

Recently, a newer study possesses a new performance metric named Hazards Control Criterion (HCC). This new performance metric is designed to enable planners to measure and quantify the degree of hazard control on site as a function of:

(1) & the hazard control weight (HCWij) of facilities i and j which represents the degree of hazard that can be encountered on site if the two facilities i and j are not adequately separated. (2) & the separation distance (dij) between facilities i and j. (3) & the value of hazard control weight between facilities i and j is assigned in the range from 0% to 100% for combinations of facilities (i) and (j) that create no hazards to those that pose the highest level of hazard that can't be separated on site.

Hazards Control Criterion (HCC) = $\Sigma_i=1^n \ \Sigma_j=1^n$ $(HCW_{ij} \times d_{ij})$ … (1)

where: $d_{ij} = \sqrt{((x_i - x_j)^2 + (y_i - y_j)^2)}$ … (2)

As:

HCW_{ij}: Hazard control weight that represents the risk of accidents that can be encountered on site if facilities i and j are not adequately separated.

d_{ij}: Separation distance between facilities i and j.

x_i, y_i: Coordinates of center of gravity (C.G.) of facility (i).

x_j, y_j: Coordinates of center of gravity (C.G.) of facility (j).

I: The number of facilities on site.

12-3 - Cost Considerations in Site Layout Planning:

The cost of construction operation is affected by the location of temporary facilities and the travel cost of resources (e.g., materials, equipment, labor) on site. In order to enable the search for and identification of the location of temporary facilities that minimize this type of construction costs, the present model utilizes an objective function that seeks to quantify and minimize the travel costs of resources on construction sites as follows:

* Minimize Travel Cost of Resources =

Minimize $\Sigma_i=1^n \Sigma_j=1^n (C_{ij} \times d_{ij})$ … (3)

where $d_{ij} = \sqrt{((X_i - X_j)^2 + (Y_i - Y_j)^2)}$ … (4)

As:

C_{ij}: Travel cost rate ($/meter) of distance traveled between facilities i and j.

d_{ij}: Distance in meters between facilities i and j.

X_i, Y_i: Coordinates of facility (i).

X_j, Y_j: Coordinates of facility (j).

I: Total number of facilities on site.

12-4- Optimization model for site layout planning:

An optimization model is developed to support construction planners in identifying near optimal locations for all temporary facilities on construction sites such as storage areas of material and equipment, stockpiles of excavation, site offices, fabrication shops, and the batch plants. The considered decision variables in the present model the coordinates (xi, yi) of the centre of gravity of each temporary facility (i=1 to I).

In the present model, these variables are represented by an artificial genetic chromosome that depicts the coordinates (xi, yi) of each facility (i) on site and they are among the main output data of the model.

The designed model enables to evaluate the impact of various site layout (S1 to SN) on safety and travel costs of the resources. The designer needs to provide the dimensions of temporary facilities, while their near optimal locations are identified by the model as shown in the following fig. (2) ;

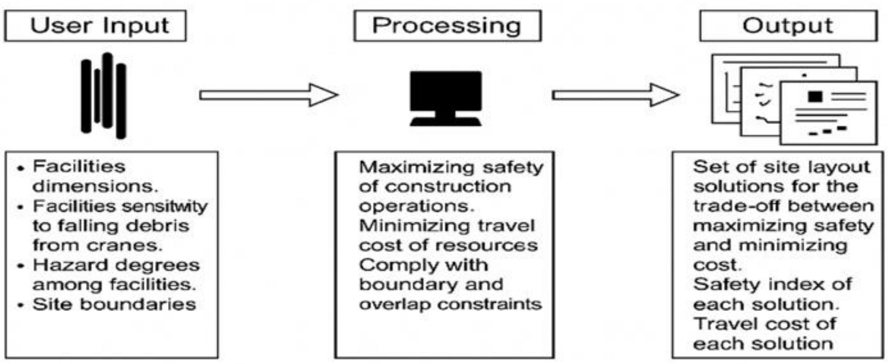


Figure 2: Data Input and Output of the Optimization Model

The optimization model starts its operations with initialization of random site layout solutions and then runs a series of evaluation, modification and combination of good solutions, attempting to reach optimal solution that maximize safety of construction operations and minimize travel cost of resources on site.

Furthermore, it is capable of considering all practical site layout constraints, including (1) boundary constraints & (2) Overlap constraints. The purpose of boundaries is to ensure the temporary facilities are located within the site boundaries. The overlap boundaries are required to avoid the overlap of facilities.

This illustrates the practicality of the developed model and its usefulness in designing appropriate site layouts. It minimizes the risk of crane accidents and falling objects. It should be ensured too, that there is adequate separation between specific combinations of materials, workers and/or equipment that can create hazardous conditions on site. It should be quantified the impact of various site layout plans on construction costs using the optimization model. The model can also be used to search for and generate optimal arrangements of temporary facilities that provide optimal tradeoffs satisfying all practical constraints in the construction problem. The construction planners should satisfy the safety and cost requirements to ensure successful engineering/construction operations.

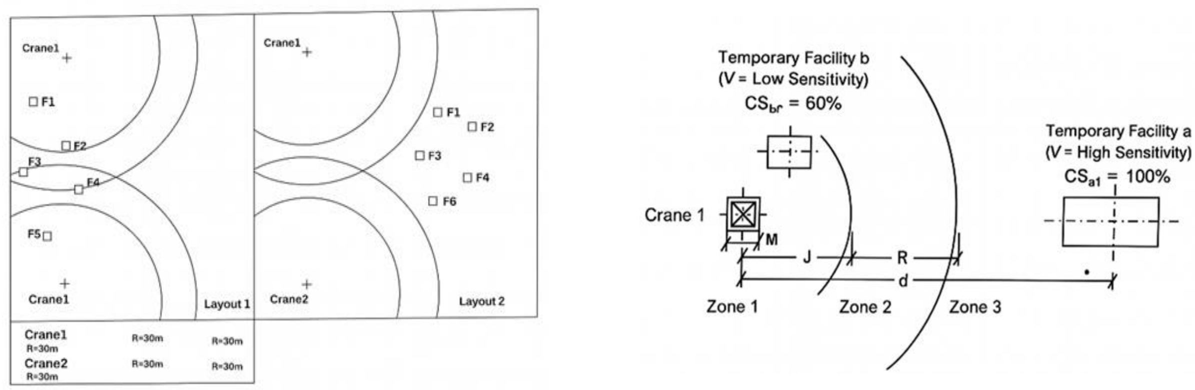


Figure 4 evaluating crane sefety performance of temporary facilities

$$\text{Crane Safety Criterion (CSC)} = \frac{\sum_{k=1}^{K} \frac{\sum_{i=1}^{I}(CS_{ik})}{I}}{K} \qquad (1)$$

$$CS_{ik} = \begin{cases} CS^{1}_{ik} = \begin{cases} 0\% \ (V_i = \text{High}) \\ 25\% \ (V_i = \text{Medium}) \\ 50\% \ (V_i = \text{Low}) \end{cases} & (\text{zone 1: } d_{ik} < J + M/2) \\ (100 - CS^{1}_{ik})(R + J + M/2 - d_{ik})/R + CS^{1}_{ik} & (\text{zone 2: } J + M/2 \le d_{ik} < R + J + M/2) \\ 100\% \ (V_i = \text{High, Medium or Low}) & (\text{zone 3: } d_{ik} \ge R + J + M/2) \end{cases} \qquad (2)$$

where

CS. crane safety performance of temporary facility i due to its proximity to crane k,

CS. crane safety performance of temporary facility i due to its proximity to crane k in zone1

V- sensitivity of facility i to failing objects,

d- distance between facility i and crane k,

i- total number of facilities on site,

K- total number of cranes on site,

J- length of the crane jib,

M- width of the crane mast, and

R- reach of the crane.

For example, Figure 2 shows two site layout scenarios to illustrate the use of the crane safety criterion (CSC) metric. As shown in Table 1, the CSC of site layout 2 is higher than that of site layout 1, reflecting that site layout 2 is safer than site layout 1. To ensure the validity of the proposed model, the safety performance metrics were also tested collectively in larger case studies, taking into account cost considerations3030. The results of all this analysis confirmed the validity and the practicality of the presented concepts3030.

Table 1. Crane safety criterion for layouts 1 and 2

Facility	VI	CS_k	Layout							
			d_1	C5_1	d2	C-S2	d1	C6_2	d_3	CS_2
1	High	50	44.15	0.00	156.49	100.00	121.15	100	162.65	100
2	Medium	25	89.07	81.08	115.19	100.00	146.92	100	171.93	100
3	Low	0	101.35	27.17	88.99	99.37	123.75	100	130.21	100
4	Medium	25	117.05	100.00	85.18	99.80	105.65	100	145.42	100
5	Medium	25	149.95	100.00	50.51	26.00	181.84	100	118.87	100
TCS_s	306.24					356.24	600			500
TC_S,J	61.65					71.63	100			100
IUTCs,U	132.48									200
Crane Safety Criterion (CSC)				66.14%						100.00%

Table 1. Delay Factors Caused by Owner, Consultant and Third Parties.

Owner	Consultant
The project is not properly per-planned	Unavailability of technical expertise's
The feasibility studies are not comprehensive	Unavailability of new and developed software's and techniques for the design and reviews
The shortage in the preparation and the requirements of the scope of work	Shortage in human and financial resources
Procurement system is not properly selected	Unavailability of quality management systems
The technical expertise are not enough	The project definition and process are not preplanned
Continuous change in the requirements and project philosophy	Unsuitability of working conditions
Appointing an overloaded consultant for the job	Complications of project design
Presenting old and an updated data	
Instability and bad central administration	Unrealistic time estimates for the project
Long and complicated chain of procedures and decision making process	The project risks are nor predefined, assessed and prepared for.
Slowness in the decision making action	Unserious and careless consultant
Delay in procedures of opening letter of credits, advance and	Weak organization chart

Owner	Consultant
progress payments	
Obstacles and complicated procedures and problems with third parties	Sub consultant are not properly selected
Clauses of the contract are not tied in case the consultant fails to fulfills his obligation	Subcontracting works with more than one subcontractor
The duties and wrights of each party are not properly defined in the contract	Signing number of contacts more than the consultant capability
Unbalanced risk distribution between parties	Instability and bad central administration
Allowance in the clauses of the contract in case of time and cost overruns	Long and complicated chain of procedures and decision-making process

Obstacles and complicated procedures and problems with third parties
The relationship between the three parties is not well
Unviability of financial and required funding
The duties and weights of each party are not properly defined in the contract
Allowance in the clauses of the contract in case dereliction of the two parties

Third party
* Social direction and guidance
* Compulsory economic plans and programs from the top government
* The numerous requirements of legal authorization and acceptances
* Instability of Prices
* Instability in the exchange rate
* Absence of motivation and competitiveness
* Instability of project contractual regulation and laws

* The Questionnaire of Delay Factors in Design Stage.

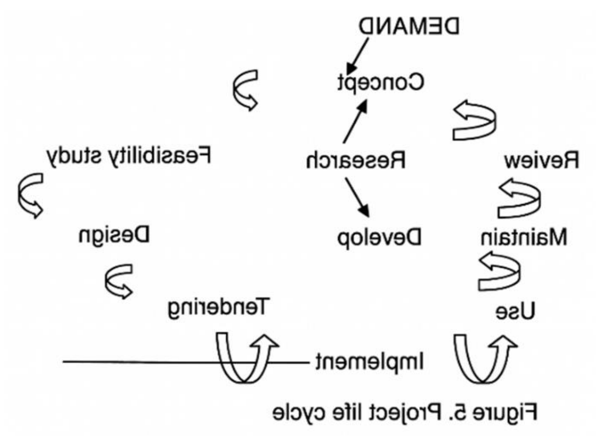


Figure 5. Project life cycle

Conclusion

This research has demonstrated that feasibility studies are essential for successful civil engineering projects, providing a systematic and evidence-based foundation for decision-making before the allocation of significant financial and technical resources. The study demonstrated that the quality and reliability of feasibility studies significantly influence project outcomes, particularly in terms of cost, time, and safety performance, through a comprehensive analysis of the planning, design, and execution phases.The questionnaire survey results show that delays and inefficiencies happen a lot during the design phase, mostly because of administrative problems, long decision-making processes, and consultants and owners not having enough technical knowledge. These delays make projects take longer and make feasibility evaluations less reliable because they depend on accurate estimates of costs, resources, and schedules. To make feasibility studies more reliable, it is important to improve communication, use modern project management tools, and make sure that everyone knows what their roles and responsibilities are.

Moreover, the study underscored that the effectiveness of feasibility studies extends beyond the preliminary phase, impacting the formulation of building site layouts and implementation strategies. Adding safety standards, risk assessments, and cost optimization frameworks to feasibility studies could greatly improve the sustainability and effectiveness of projects. The combination of hazard control and crane safety standards is a good example of how modeling technology can quickly make things safer and lower the overall cost of construction.

In conclusion, this study stresses that feasibility studies should not be viewed merely as procedural formalities but as a dynamic, multidisciplinary process that incorporates technological, financial, and environmental considerations. Adding advanced analytical tools, risk-based planning, and input from stakeholders to feasibility assessment frameworks can make civil engineering projects more sustainable, efficient, and resilient.

Future research should examine digital modeling tools and artificial intelligence applications to improve feasibility assessments in light of the growing complexity of modern construction environments.

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