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Atle Engebø and Haavard Haaskjold

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Concept report no. 75



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Morten Welde

Norwegian University of Science and Technology

Torbjørn Aass

Norwegian University of Science and Technology

Atle Engebø

Norwegian University of Science and Technology

Haavard Haaskjold

Norwegian University of Science and Technology

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English summary

This study presents key findings on using design-build contracts in public construction projects, focusing on competition, cost performance, and progress. It also delves into other crucial aspects, such as conflict management, quality, and the availability of experience-based data for the client.

In design-build contracts, the contractor assumes the responsibility for planning and design. This contrasts design-bid-build contracts, where the client specifies the work to be executed. While the basis for the design may vary in detail, the key point is that the responsibility for technical and functional solutions, and consequently the risk, is transferred to the contractor upon contract initiation. Design-build contracts are often associated with a fixed price but can also be based on other price formats. Therefore, the contract format should be viewed as a way of organising the design and execution of contract work, with the contractor playing a pivotal role in this process, ensuring a smooth and efficient project execution.

Various factors can influence the client's decision to opt for design-build contracts. One significant factor is the improved predictability of cost and time. Previous studies have demonstrated the wide variation in final cost compared to the original contract sum in design-bid-build contracts. Design-build contracts, particularly with a fixed price, are expected to enhance cost predictability. Similarly, it is anticipated that if the contractor assumes a larger part of the responsibility for design and production planning, this will lead to a quicker and more efficient implementation. Many client organisations also anticipate that the contractor's experience and expertise can offer superior and more cost-effective solutions than if the client were to manage the design themselves. Design-build contracts also necessitate substantial resources for planning and production follow-up. Therefore, design-build contracts can be an option if the client lacks the necessary expertise and capacity for this, highlighting the crucial role of the contractor in this process.

Contractors who bid for design-build contracts must possess project and engineering management expertise. In recent years, the size of contracts, especially within the construction industry, has also increased. This can limit

the opportunities to participate in contract competition, and small and medium-sized contractors have criticised the increased use of larger design-build contracts to favour large contractors.

But are these assumptions valid? We are unaware of Norwegian studies documenting the effects of using design-bid contracts in larger samples. In other words, the choice of design-build contracts is based on several expectations, but the actual experiences are only documented to a limited extent.

The empirical literature on design-build contracts is limited. There are many American studies, but we have not found any Norwegian studies, and hardly any from other European countries. Almost all studies show that design-build contracts have better predictability of progress and fewer/smaller delays than design-bid-build contracts. For cost, the picture is somewhat more complex. In the American studies, most show smaller cost deviations in design-bid-build contracts than in design-build contracts. Still, the literature does not provide a clear conclusion in this area. There is little documentation on the connection between the type of contract and the attractiveness of competition.

In other words, there is limited documentation on how design-build contracts work in construction projects. This study aims to contribute more knowledge and help client organisations make informed project choices.

The research questions in the study are as follows:

1. How good is the competition for design-build contracts?
2. What cost uncertainty comes with design-build contracts?
3. Do design-build contracts provide predictable and efficient progress?
4. Are there other positive and negative aspects to design-build contracts?

The study presents data from a larger selection of design-build contracts in quantitative and qualitative form and discusses what the findings might mean. The purpose is to shed light on the themes in the research questions without aiming to make a systematic comparison between contract types.

The empirical data in the study consists of data from contracts for road construction (Statens vegvesen and Nye Veier), public buildings (Statsbygg and Forsvarsbygg) and railways (Bane NOR). The selection consists of 109 unique contracts, of which two-thirds are contracts for building and one-third

are construction contracts. The contract sizes range from contracts worth tens of millions of kroner to large contracts worth several billion kroner. As a supplement to the quantitative data, we carried out interviews with 23 representatives from the industry, representing clients, contractors and consultants.

Regarding the competition for the contracts, we found the following:

- The market showed good interest in large design-build contracts, with an average of eight applications for prequalification for contracts of between NOK one and five billion. The number of actual bids was just under three, which can probably be attributed to the selection of a limited number of actors in the further process and negotiations.
- The competition for small (< NOK 1 billion) and large (> NOK 1 billion) construction contracts had an average of three bids.
- For all construction contracts, the average number of bids was three, but among contracts of over NOK 200 million, there were over four.

When considering participation in competitions, contractors emphasise the nature and risk of the competition/contract. Contract size, chances of winning compared to the costs of participating, and the need for specific expertise are other elements of importance in this context.

In the study, we examined the cost development in the contracts by looking at payments linked to changes compared to the payments on the originally agreed contract scope, as well as the number of changes. Here we found the following:

- The construction contracts for infrastructure had an average change volume of 13 % and a median of 12 %. A third of the contracts had changes below 5 %, and approximately half had changes below 10 %.
- The majority of construction contracts for buildings had a change volume of between 5 and 10 %, with an average of 14 % and a median of 10 %. Half of the contracts were below 10 %.
- Several contracts had many changes initiated by the client and the contractor. The number of changes per NOK 100 million in contract sum amounted to an average of 32 construction contracts, with a median of 10. The average of changes for building contracts was 88, and the median was 71.

- The variance in the number of changes in individual contracts was large, but the results show in all cases that the need for resources for change management on the client's side is not insignificant.

The source of changes can be regarded as the result of uncertainty in the contract and the client's needs. The volume of changes showed that both the design-build contracts for construction and building have a significant residual risk related to deficiencies and uncertainty in the scope of works and the client's desire to change, add to, or further specify the services. In the interviews, the contractors criticised the clients for often transferring risk to the contractor, which is difficult to price and creates unbalanced contracts with great potential for conflict. Design-build contracts must, therefore, not be regarded as a means of removing all risk for the client. Predictability is achieved by getting an overview of the risk as early as possible.

In examining the progress of the contract works, compared to the originally agreed deadlines, we found the following:

- 75 % of construction contracts were completed within the planned schedule. In contrast, the opposite was the case for the building contracts, where only a quarter was completed by the originally agreed deadline.
- The average deviation from the contractual time for completion was zero and three months, respectively, for both the civil engineering and building contracts. However, the construction contracts had significantly greater variance. The construction contracts can, therefore, be said to have greater predictability despite delays in three out of four contracts.
- The design-build contract format can be a tool for faster and more cost-effective progress, both because the contractor often has good expertise in planning and managing production and because design-build contracts enable a greater degree of parallel planning and construction. Design-build contracts are also well suited for remuneration formats that incentivise efficient progress.
- The prerequisite for design-build contracts to produce effects in the form of more predictable and faster production is that the contractor is free to plan and manage production and is not subject to too strict requirements for completion. Many clients are not aware of this.

We only had the interviews as sources of conflicts, quality and access to experience data. The results were as follows:

- In design-build contracts, there are fewer conflicts, but the disputes are often more complex and involve larger amounts than in design-bid-build contracts.
- A pitfall that is particularly relevant in design-build contracts is that responsibility and risk are transferred to the contractor as an omnibus item and that the performance descriptions in parts of the contract basis are too detailed so that the contractor does not have sufficient leeway to plan the assignment, and the risk sharing becomes unclear.
- Establishing a common understanding of risk and clarifying risk sharing between the parties before entering a contract can reduce conflict.
- It is well known and accepted that the quality of deliveries in design-build contracts is set at a “minimum” that satisfies requirements for function and current requirements unless otherwise specified.
- One way to ensure good quality and solutions is to assign the contractor the responsibility for operation and maintenance for a longer period after the project.
- The price formats often used in design-build contracts provide less insight and detailed information about contract prices. This will weaken the client’s ability to collect data on prices and price trends in the long term.

In the interviews, it was clear that the contractors had focused on production and the associated risks and were less concerned with quality and value. The contractor's expertise is most relevant in the planning and managing production, including buildability and alternative solutions. Of course, the contractor can also have something to add regarding solutions or quality. Still, the incentives aim to carry out the project quickly and efficiently and avoid unnecessary risk.

An overall question is whether design-build contracts are suitable for achieving cost-effective projects. This study documents that design-build contracts have several advantages related to progress and efficient production management. However, using the contract form does not provide any particular predictability for cost, and challenges with quality and conflicts must still be dealt with. Benefits from the design-build contract format require that the contractor is given the necessary scope and freedom to choose solutions in product and production. If these prerequisites are met or the client wants to manage the details of solutions and design-bid-build, other contract forms

should be considered. When choosing an implementation model and contract form, client organisations should be aware that all contract forms have advantages and disadvantages and know the prerequisites that must be met for the respective model to work.

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Concept er lokalisert ved Norges teknisk- naturvitenskapelige universitet i Trondheim (NTNU), ved Fakultet for ingeniørvitenskap og teknologi. Programmet samarbeider med ledende norske og internasjonale fagmiljøer og universiteter, og er finansiert av Finansdepartementet.

The Concept research program aims to develop know-how to help make more efficient use of resources and improve the effect of major public investments. The Program is designed to follow up on the largest public projects over a period of several years, and help improve design and quality assurance of future public projects before they are formally approved.

The program is based at The Norwegian University of Science and Technology (NTNU), Faculty of Engineering Science and Technology. It cooperates with key Norwegian and international professional institutions and universities, and is financed by the Norwegian Ministry of Finance.

Address:

The Concept Research Program
Høgskoleringen 7A
N-7491 NTNU
Trondheim
NORWAY

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