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Optimal time for contractors to enter infrastructure projects

A case study of a Swedish ECI project

Master's thesis in Design and Construction Project Management

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DEPARTMENT OF ARCHITECTURE AND CIVIL ENGINEERING
DIVISION OF CONSTRUCTION MANAGEMENT

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ABSTRACT

The design- and construction stage of infrastructure projects are often two separate, fragmented processes. Early contractor involvement (ECI) is a project delivery method where the goal is to include construction knowledge into the design phase. This is done by procuring the contractor during the design phase of a project. There are different approaches to which time the contractor is introduced. This thesis aims to identify which aspects that are affected by the timing of the contractor's involvement, and to suggest the optimal time for contractors to enter infrastructure projects. In order to do this, an empirical study was conducted, where nine representatives from an ongoing Swedish ECI road project were interviewed. The studied project was procured by the Swedish Transport Administration, and the contractor entered the project at the beginning of the design phase, before a land acquisition plan had been developed. This is the first time in Sweden that a contractor has been procured this early in a road project. The empirical study was supported by a literature review focusing on the concept, benefits, and barriers of ECI, as well as a document study of the processes included in the development of a land acquisition plan. The findings from the interviews show that responsibility, understanding, innovation, risk management, relationship building and implementation are the aspects that have been affected due to ECI. By analyzing and discussing the results, it was concluded that involving the contractor as early as in the studied has been beneficial, and that involving the contractor as early as possible in infrastructure project is favorable.

Keywords: Early contractor involvement, ECI, Collaborative management model, timing

Optimal tidpunkt för involvering av entreprenörer i infrastrukturprojekt

En fallstudie av ett svenskt TEM-projekt

Examensarbete inom masterprogrammet Design and Construction Project Management

FREDDY ANTONSSON

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Institutionen för Arkitektur och Samhällsbyggnadsteknik
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SAMMANFATTNING

Utvecklings- och konstruktionsfasen i infrastrukturprojekt är ofta två separata, splittrade processer. Tidig Entreprenörsmedverkan (TEM) är en metod för projektleverans där målet är att inkludera konstruktionskunskap i utvecklingsfasen. Detta görs genom att involvera entreprenören under designutformningen av projektet. Vid vilken tidpunkt entreprenören involveras varierar från projekt till projekt. Syftet med denna masteruppsats är att identifiera vilka aspekter som påverkas av entreprenörens tidiga involvering, och bestämma vilken tidpunkt som är optimal för entreprenören att inträda i projekt. För att undersöka detta genomfördes en empirisk studie där nio representanter från ett pågående svenskt TEM-projekt intervjuades. Det studerade projektet är upphandlat av Trafikverket och entreprenören introducerad i början av utvecklingsfasen, innan en vägplan hade utformats. Det är första gången i Sverige som en entreprenör anskaffas så tidigt i ett vägprojekt. Den empiriska studien stöddes av en litteraturstudie med fokus på konceptet, fördelarna och hindren med TEM, samt en dokumentstudie av de processer som ingår i utvecklingen av vägplan. Resultaten från intervjuerna visar att ansvar, förståelse, innovation, riskhantering, relationsbyggande och implementering är de aspekter som har påverkats av TEM. Genom att analysera och diskutera resultaten drogs slutsatsen att det har varit fördelaktigt att involvera entreprenören så tidigt som i det studerade projektet och att involvera entreprenören så tidigt som möjligt i infrastrukturprojekt är gynnsamt.

Nyckelord: Tidig entreprenörsmedverkan, TEM, samverkan, ECI, Trafikverket, samverkansprojekt

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Preface

This master thesis has been conducted at the Department of Architecture and Civil Engineering at Chalmers University of Technology. Due to the Covid-19 pandemic, the thesis was written from home and not on campus. The work with the thesis started in February 2021 and ended in June 2021.

First, we would like to thank our supervisors Rasmus Rempling and Johan Lagerkvist for their time, support and guidance throughout this master thesis. Thanks to you we have been able to discuss and exchange ideas and thoughts which has truly contributed to the outcome of this thesis.

We would also like to thank all the interviewees who agreed to take part of our study. Without you, this thesis would not have been possible to realize.

Finally, thanks to the project group at the Norwegian University of Science and Technology, the workshops we conducted provided valuable input and helped us develop a greater understanding of the topic ECI.

Göteborg June 2021

Freddy Antonsson
David Lindvall

1 Introduction

The traditional separation between the design and construction phase in infrastructure projects was acknowledged as a major issue in the 60s (Mosey, 2009). It is accompanied by extensive rework when entering the construction phase, inefficient designs, as well as claims and disputes between the main actors, the contractor, design team and client (Mosey, 2009). Mosey argues that the most efficient way to add value and challenge risks brought on by excluding the contractor in the design phase is for the client, contractor and design team to form a team in the early stages of the project. To reach higher project efficiency and performance, several innovative management concepts have been introduced to the construction sector (Song et.al., 2009). In the 90s, Latham (1994) and Egan (1998) introduced the concept of two stage procurement and the concept of open book accounting in the UK. In comparison with traditional procurement methods such as design-build (DB) and design-bid-build (DBB), these concepts made it possible to include the contractor in the design phase and laid the foundation to the project delivery model we now call Early Contractor Involvement (ECI).

1.1 Background

Collaborative management models such as ECI have been established in the Swedish construction sector since the beginning of the 21st century but has mainly been applied to building projects (Rosander et.al., 2020). In 2009, The Swedish Agency for Public Management in Sweden published the report "Sega gubbar*"* which demonstrates a lower productivity development in the construction industry compared to other industries (Statskontoret, 2009). The Swedish Transport Administration (STA) has since its founding in 2010 had the mission to promote innovation and productivity in the infrastructure sector (Trafikverket, 2018). In 2012, the STA initiated an organization-wide rework to become *Renodlad Beställare* ,which roughly translates to "a pure client", where the STA released their focus on construction to take on a more strategic role as clients. This put a lot of focus on strategically working with procurement methods and incentives for contractors to promote innovation and efficiency. Since then, several new policies, guidelines and project delivery models have been developed (Trafikverket, 2018).

One of these models is *Tidig Entreprenörs Medverkan* (TEM), which is the Swedish translation of ECI. The Swedish TEM model follows the model used in the UK which is a two-stage procurement model with separate contracts for each part, the design phase and the construction phase (Rosander et.al., 2020). In the first phase, the contractor supports the design team with the development of the design. This is done in collaboration with the client and during this phase, the contractor is usually paid by the hour. The client and contractor later negotiate a target price and pain/gain share incentives for the construction phase (Rahman & Alhassan, 2012). If an agreement is reached and the client is satisfied with the contractor, the contractor will be awarded the contract for the construction phase.

An infrastructure project's life cycle can be divided into the four sub-phases: internal preparation, project definition and design, project execution, and use and disposal (Walker & Lloyd-Walker, 2012). These phases will in this thesis be labeled: Phase 0 to Phase 3, as shown in Figure 1. In Phase 1 the client, design team and contractor collaborate to develop the design. Various expected benefits of including the contractor in Phase 1 can be found, such as improved constructability, risk management and innovation (Eadie & Graham, 2014). Phase 1 in infrastructure ECI projects can span over several years and involving the contractor too early can cause increased bureaucracy and expenses, while including them too late in Phase 1 can result in losing the expected benefits (Wondimu et.al., 2016; Af Hällström & Bosch-Sijtsema, 2020). Wondimu et.al. (2020) identify three core questions which the client should ask themselves before involving the contractor early:

- When do they want them to become involved?
- Why do they want them to become involved?
- How to achieve this involvement?

In Sweden, the TEM-model is the dominant approach to ECI and it has been implemented in a few transport infrastructure projects as of today. The experience gained from these projects highlights the need for asking the same questions in a Swedish contest.

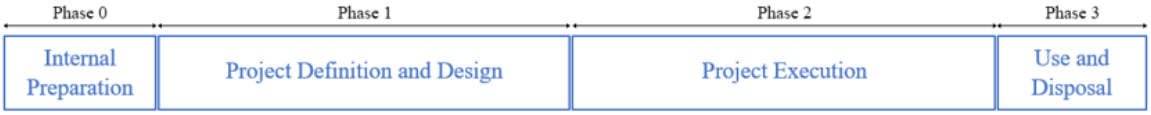

Figure 1. The life cycle of an infrastructure project (adapted from Walker & Lloyd-Walker, 2012).

2 Purpose and objectives

The concept of Early Contractor Involvement is mentioned as a positive project delivery method in order to achieve better project result on several aspects. However, since ECI is referred to when the contractor is involved earlier than usual in construction projects, several alternatives of how early the contractor can be involved exist. Should the contractor for instance be involved as soon as the design team starts working with the development of the design, or should they be involved a few months before the design is finished? The purpose of this thesis is to figure out which aspects of a project that are affected by the early introduction of the contractor and at which time it is best for the contractor to be involved. In other words, this study focused on the first question of Wondimu et.al. (2020), regarding when the client should involve the contractor in the project. Further, the second question was studied in order to pinpoint different possible benefits of involving the contractor at specific steps of Phase 1.

2.1 Research questions

The following research questions define the purpose:

1. How early should the contractor be involved and why?
2. Which aspects are affected depending on how early the contractor is involved in an ECI project?

3 Research approach

The research methods that define the chosen research approach are presented, argued for and explained in this chapter. The thesis began with a broad research question which was formed together with supervisors at Chalmers University of Technology, which was "How early is early in ECI?". The goal would be to identify when it is most beneficial to include the contractor in ECI projects. To reach this goal a case study was conducted together with interviews with project participants.

The thesis was initiated with a literature review which continued throughout the study. This was done to get a sense of how much research had been done on the subject and to identify a suitable approach to continue the thesis. One project was found where the contractor entered earlier than usual which was deemed relevant as a comparison to existing research. Since the studied case was ongoing and could not fully be evaluated in terms of cost, quality and time, we wanted to get the personal experience of involved people in the project to know which aspects they perceived to have been affected by the early contractor involvement. Interviews with several project participants were deemed a suitable approach due to the qualitative nature of the research. While conducting the literature review, it was realized that we had to have a proper understanding of the processes involved in Swedish ECI projects. A document study was therefore conducted to investigate the processes included in Phase 1 of Swedish ECI infrastructure projects. During the literature review and interview analysis, the research question was refined and adapted to better continue the research. The workload of writing the thesis was equally shared between the two authors.

3.1 Literature review

The literature review was initiated early in the project and continued throughout the whole research process. The purpose of the literature review was to frame the scope of the research and to find high level themes for the interviews and the analysis of the empirical data. Information from previous literature that has studied cases of ECI, its benefits, as well as barriers was reviewed. The scientific database Scopus and the search engine Google Scholar was used to find articles, and combinations of the search words *early contractor involvement, ECI, collaborative procurement, delivery model, TEM, incentives* and *infrastructure* were used. The titles, abstracts and conclusions of articles were reviewed to determine the relevance to our subject and research questions. Furthermore, the number of citations of the articles were assessed to confirm creditability. Some of the references in the chosen articles were also studied and used as sources. The software Mendeley desktop was used to manage the references.

3.2 Empirical research

Qualitative research is the most suitable research method if subjective experience is what is looked for, while a quantitative research method is suited when the researcher wants to study distributions and frequencies (Flick, 2018). Therefore, a qualitative research method was chosen, since our goal was to gather the experience of people

involved in the ECI project. Interviews were the chosen data collection method, as we wanted people's thoughts, experience and knowledge regarding the studied case. To make sure that information that would contribute to answering the research questions was received, semi-structured interviews were chosen as the interview type. This is a suitable method when the interviewer wants to lead the interview while still being flexible and able to ask potential follow up questions (Bell et.al., 2011).

3.2.1 Interview design

The interviews were done with three representatives from each of the three parties: contractor, client and design team, resulting in a total of nine interviews. To prepare for the interview, an interview guide was constructed (Bell et.al., 2011). This was done to make sure that we got answers on questions that we needed to be able to answer the research questions. The interview guide was based on the interview guide created and used by Marius Lium in his paper "Valdresmodellen" (2020), who studied a similar ECI project in Norway. The guide was translated to Swedish, and some questions were changed, removed or added to better fit the research questions and the studied case, see Appendix. The interview questions focused on the work progression of the project, differences compared to a more traditional road projects, advantages as well as challenges with ECI. To test the interview guide and the kind of answers we would get from the questions, a trial interview was conducted with a person working at the STA, who also had a good insight in the project. The guide was altered on a few points after the trial interview thanks to feedback from the interviewee.

3.2.2 Ethical consideration

Bell et.al (2011) cite Diener and Crandall (1978) when presenting the main ethical principles that should be considered when conducting business research. The four areas that should be taken into consideration are: avoiding harm to participants, informing participants the extent of their participation and inform about consent, protecting the privacy of the participants and being honest about the nature of the research. To avoid harm to the participants we chose to anonymize the participants as well as the studied case. Since the project is a STA project, which is relevant to our study, it was important for us to simplify our case description to the point where it would be challenging to identify while not losing the important aspects. Because of this, there are no references in the case description. Before each interview the participants were informed of the purpose of our research, how their interview would be used and that their participation would be anonymous. Further, we asked if the interviews could be recorded, for analytical purposes, which they all agreed to. Prior to finalizing the thesis each participant who is cited in the report was asked to approve the citation in its written context. The citation and its context were sent to the interviewees for approval.

All personal information regarding the interviewees and data acquired from the interviewees was handled in accordance with the General Data Protection Regulation (GDPR).

3.2.3 Interview approach

The interviews were conducted online due to the Covid-19 pandemic, using the video communication platforms Zoom, Skype and Microsoft Teams, depending on which software the interviewees were allowed to use according to their company's policies. All interviews were recorded with the interviewees approval and were later automatically transcribed with the software SimonSays. Thereafter, the transcriptions were manually checked by listening to the recordings and altering text that had been incorrectly transcribed by the software. Most transcriptions were transcribed manually instead of altering the automatically generated text, as it was deemed to be more time efficient due to the poor result of some of the transcriptions. Before the transcriptions were analysed, a workshop was held together with a collaborative project group from the Norwegian University of Science and Technology (NTNU) who were simultaneously conducting a similar study on ECI in Norway. The aim of the workshop was to discuss the interview progression and in which way the transcriptions were to be analysed.

3.2.4 Analysis of empirical data

Thematic analysis was used to analyse the interview data. Thematic analysis implies that the data gathered from the interviews is analysed to identify themes (Braun & Clarke, 2006). These themes can be more or less prevalent, however, they should all contribute to answering the research questions or provide different aspects (Braun & Clarke, 2006). To find themes and analyse the interview results, the transcriptions were imported to the software NVivo 12.

The transcriptions were analysed in accordance with the steps mentioned by Braun and Clarke (2006), where the first step is to get familiarized with the data. This was done by reading the transcriptions several times. Secondly, initial codes were created by creating nodes in NVivo 12. This means that information related to the same topic is gathered into the same category, where each node represents a code. These codes are referred to by Braun and Clarke (2006) as the most basic form of the data, which are the parts that will form the themes. The third step is to start analysing the codes on a broader level, looking for similarities between the codes, to find the themes of the gathered data. Not all codes have to be used to create themes, some can be discarded because they do not fit in any theme, while others might be merged. Some codes were not considered to fit into a theme, which were often more formal aspects and information of the project. These were codes that were not considered relevant to answer our research questions. The codes that are used to form a theme are called subthemes. The fourth step is to review the themes and subthemes that were found. When this was done, we realised that some of the subthemes fit better under other themes, while others did not seem to fit under any theme, after being reviewed. The fifth step regards naming the themes and analysing them. The analysis process was iterative, and several of the steps were redone during the analysis as we got more familiar with our codes and themes. The sixth, and final step mentioned by Braun and Clarke (2006) is to write the results of the analysis in the report, which was done after we were satisfied with our thematic analysis. They also mention that it is important to

not only present the data in the results, but also to make arguments regarding it, connected to the research questions.

After the interviews had been analysed, another workshop was held together with the collaborative project group from NTNU to discuss and compare preliminary results.

3.3 Document study

The document study was conducted to get an understanding of what the formal process of planning and designing a road in Sweden includes, which is the main part of Phase 1. This also gave us further knowledge and understanding of the information that was received from the interviews.

3.4 Case outline

The Swedish Transport Administration (STA) which is the department responsible for large infrastructure projects in Sweden and the studied case is described shortly in this chapter.

3.4.1 Swedish Transport Administration

The Swedish Transport Administration (STA) was formed in 2010 when former *Banverket, Vägverket* and a couple of smaller authorities within the infrastructure sector were merged (Trafikverket, 2015). After the merge there was a need to establish the STA's new role. It was decided that the STA would transition from a role as infrastructure builders, with a primary focus on the technical aspects, towards the role of community developers with a broader field of work with a higher focus on the functionality of Sweden's infrastructure. Their new role as community developers is based on three main components (Trafikverket, 2015). The first component is the shift of focus from primarily focusing on the constructing of Sweden's infrastructure towards promoting its functionality. The second component focuses on raising the cooperative level between the STA and other actors that develop the community. The third component is to get involved early in projects to continuously follow the development and meet the needs which arise. These three components set the foundation of the STA's role. By focusing on cooperation and early involvement, the STA seek to identify mutual set of problems, goals, roles and responsibilities of actors.

The newly formed STA has the responsibility to oversee, develop, build and maintain the Swedish public road, train, aviation and seafaring network (Trafikverket, 2015). In short this means that the STA has the responsibility to make sure that the Swedish transport network is working.

3.4.2 The case

The studied project is a road project in Sweden with the purpose of increasing safety and availability by building a new road and broadening parts of the already existing

road. The project is an ECI project procured by the STA, where the contractor submitted a tender together with a design team, with project start a few years ago. The contractor is the one who is responsible for the design of the land acquisition plan which means that the design team has a contract with the contractor, and not with the STA, which they usually have. This is the first project in Sweden where the contractor has been involved this early, before the process of developing the land acquisition plan has begun. The case is mainly using ECI approach number 5 as explained by Wondimu et.al. (2018), which is a DB contract where the contractor enters the project earlier than in traditional DB contracts. In this case the contractor enters the project earlier than recommended in Wondimu et.al. (2018), who recommend involving the contractor during the pre-engineering stage. The stage where the contractor was introduced is shown in Figure 2.

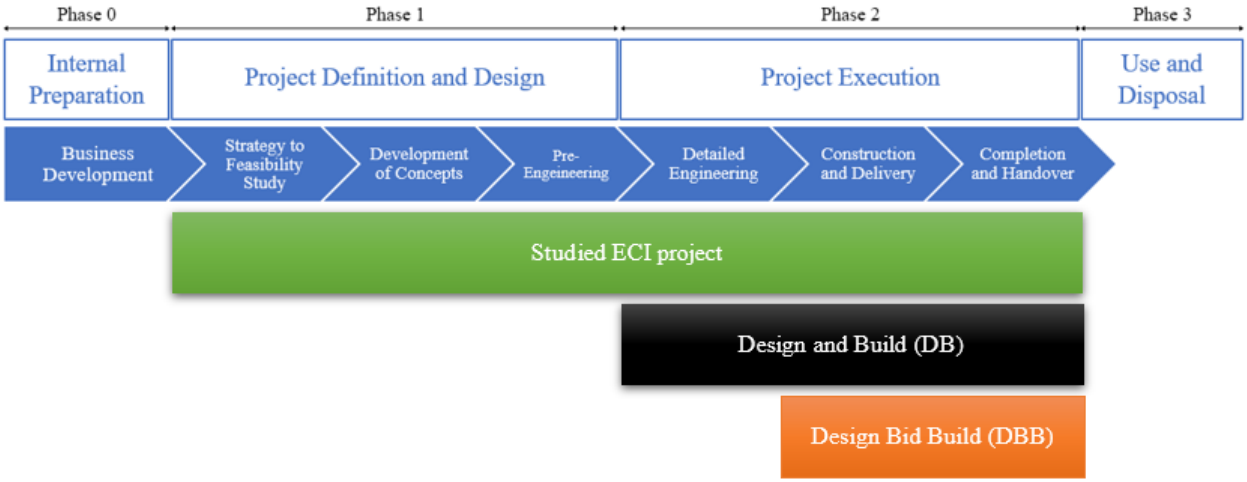

Figure 2. Illustration of where the contractor entered the studied case (adapted from Walker & Lloyd-Walker, 2012).

3.5 Delimitations

This master thesis rest on a Swedish setting, on a case study based on a publicly procured road project, where the Swedish Transport Administration is the client. The project was ongoing at the time of the study and is using a DB contract from start to finish. At the time, the project had just entered the construction stage, therefore, the thesis will mainly be based on experiences and opinions regarding Phase 1, which consist of processes related to the development of the design. Furthermore, the total success of the case regarding quality, time and economy will not be evaluated, since the project is not yet completed.

4 Literature review

In this chapter, the concept of ECI will be presented, as well as how the concept has been adopted in a Swedish setting.

4.1 Early contractor involvement

Early contractor involvement (ECI) is a project delivery method that regards involving the contractor earlier than usual in construction projects. Usually, the design -and construction/delivery phase of construction projects are separate, fragmented processes, where the design team and contractor work separately (Song et.al, 2009). However, by using ECI, the contractor is involved at an earlier stage, and is therefore able to contribute to the development of the design. Traditionally, the design team lacks the production knowledge that the contractor possesses, potentially leading to designs that are challenging to implement (Arditi et.al., 2002). Due to this, the design team and contractor risk working towards unsimilar goals. By involving the contractor in the design phase, these aspects can be taken into consideration, thereby reducing possible problems during construction (Raviv et.al., 2021).

Even though the main idea of ECI is the same, to involve the contractor earlier than usual, the realization and terms used for the concept alters in different countries (Wondimu et.al., 2016). Some countries focus on the relationship aspects throughout the whole lifecycle of a project, while others focus more on specific parts of the project, to later transition into more traditional working methods and contracts. According to Walker and Lloyd-Walker (2012) and Wondimu et.al. (2018), there are several variations of ECI, which differs in how early and for how long the contractor is involved. Hence, what is specifically referred to by using the term ECI may differ depending on the case.

According to a study by Eadie and Graham (2014), projects with a traditional DB contract were completed at a lower cost compared to ECI projects. However, the ECI projects were all ranked higher in terms of quality. ECI can still contribute to cost savings, with better potential the bigger and more complex the project is (Eadie & Graham, 2014). Other literature mention improved constructability/buildability, risk management, relationship between workers and innovation as possible benefits with ECI (Eadie & Graham, 2014: Love et.al., 2014: Rahmani, 2021). However, Rahmani (2021) mention that, to enable the enhancement of innovation in ECI projects, the client must be willing to apply innovative solutions in the project. Although, the client must be "very clear about their expectations" (Rahmani, 2021, p.74). Malvik et.al. (2021) also emphasise the importance of the client being clear with their expectations, especially in the early stages of the contractor's involvement. Otherwise, it will be challenging to form a shared vision which will result in unnecessary arguments (Malvik et.al., 2021).

Even though ECI has the potential to improve several parts of construction projects, there are possible barriers that need to be overcome. For instance, if there is a prevalent resistance to cultural change, a project with early involvement of the contractor may not achieve its potential benefits because the involved people in the project do not realise the purpose of ECI and its gains (Song et.al., 2009). Love et.al

(2014) found three main barriers to implementing ECI successfully: fear of opportunistic behaviour by the contractor, the client and contractor's lack of experience working in ECI projects, and a less competitive tendering. Trust between the contractor and designer (Af Hällström & Bosch-Sijtsema, 2019) and trust between project owner and contractor (Wondimu et.al., 2016; Eadie et al., 2012; Rahman & Alhassan, 2012) is essential for a better contribution from the contractor. Furthermore, trust is also needed for the contractor to openly share their proposed solutions.

4.2 ECI in infrastructure projects in Sweden

ECI is a concept that has been used only a few times by the STA before and where the method of application and reasoning of usage has differed between cases. Through G. Domås (personal communication, 13 April 2021), it was found that in 2016, the first two projects were procured with this approach, and until 2020, nine other projects have been procured by STA using this collaborative method. The contracting model that has been applied by the STA is a two-stage model, where Phase 1 regards the development of the design, and Phase 2 detailed design and construction (Eriksson et.al., 2020). The contractor is procured during the design phase partly based on soft criteria and is often paid hourly for their involvement during the phase based on standardized consultancy contracts (Erikson et.al., 2020). Before Phase 2 begins, the STA and the contractor develop a target price for Phase 2 together. However, if the parties cannot reach an agreement, or the STA feel unsatisfied with the contractor, the STA has the possibility to not proceed with the contractor into the next phase of the project. If the STA however is satisfied, an option within the contract can be triggered which will extend the contract with the contractor through the next stage of the project (Eriksson et.al., 2020). During Phase 2, detailed design and construction, a DB contract is often used together with pain- and gain share incentives (Eriksson et.al., 2020; Eriksson & Hane, 2014). According to STA's guidelines, these incentives should be 80/20 for the client, which means that if the final cost is below target price, STA earns 80% of the bonus and the contractor 20% (TDOK 2016:0233). If the target price is overrun, the same ratio is applied, meaning that the STA pays 80% of the extra cost and the contractor 20%.

4.3 Timing of contractor involvement

Integration of construction knowledge and experience is most beneficial in the early stages of a project (Lahdenperä, 2013). The earlier stages are characterized by a high potential to influence the design with a low impact on cost (Kristensen et.al., 2015), which is illustrated in Figure 3.

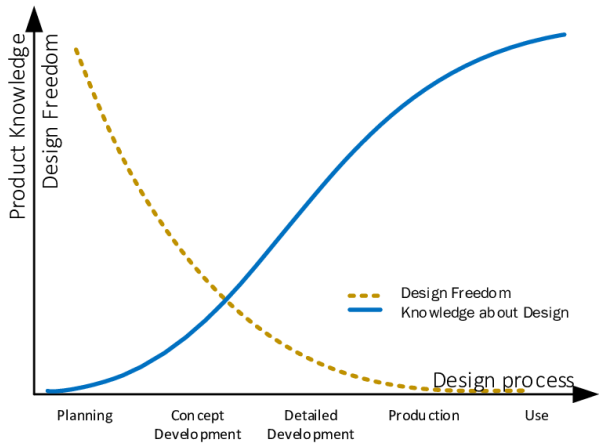

Figure 3. Illustration of how the design freedom correlates to the design process (Müller, 2018).

Wondimu et.al. (2018) argue that if the contractor is involved too early, their influence on major decisions can be too high, making the client lose some control over the project leading to increased bureaucracy. If the client is an active client and involved in the processes it can result in less bureaucracy in the planning and decision phase (Af Hällström & Bosch-Sijtsema, 2020). On the contrary, if the contractor enters too late, there is a difficulty to accept and implement their proposed solutions due to a lack of time to control and approve the solutions, in addition to client resistance. Eriksson et. al (2019) found that the duration of collaboration is what sets the limit for innovation and increased efficiency in the project, where early involvement strengthens the potential for more innovation and potentially higher efficiency. Hence, projects with a high level of complexity, where innovative solutions are essential, would benefit from involving the contractor as early as possible (Eriksson et.al., 2019; Wondimu et.al., 2016). Af Hällström and Bosch-Sijtsema (2020) argue that an active client is essential for successful collaboration in the early stages, implying that involving the contractor early does not necessarily result in a successful collaboration by its own. There are various approaches to involving the contractor and it is imperative to find which approach that suits the specific project. For example, DB contracts in large complex project might lead to a higher cost since the contractor might inflate the price to buffer against uncertainties (Wondimu et.al., 2018).

As mentioned, involving the contractor too early can meet some challenges. Apart from the project-specific challenges there are also legislative ones which a public client face. The contractor selection method involved in projects procured with ECI defy established standards and involving a contractor before the project is described in detail faces several challenges. The STA needs to follow “LOU” which is a Swedish law that, amongst other things, specifies that public owners need to use a transparent team selection with several selection criteria, where each contractor uses the same basis for proposals (Regeringskansliet, 2016). Furthermore, using price as a criteria before the project has been described in detail is challenging due to various uncertainties in the project (Lahdenperä, 2013).

5 Document study of the land acquisition plan process

The phase after the feasibility study is completed before construction begins is called Phase 1. Phase 1 includes several sub-phases which run parallel or subsequent for several years. The following explanation of the land acquisition plan process is all based on the STA document "Planläggning av vägar och järnvägar", which translates to "Planning of road and railways" (Trafikverket, 2014).

Before the production of a road begins, a land acquisition plan must be formed and approved. It must be approved by concerned parties such as individuals, governmental instances and organizations that will be affected. These concerned parties must be informed of why and how the road is supposed to be built and get the chance to voice their concerns and ask questions about the project. The steps included in forming a land acquisition plan are shown in Figure 4 and consist of four stages with sub-instances which will be briefly explained below.

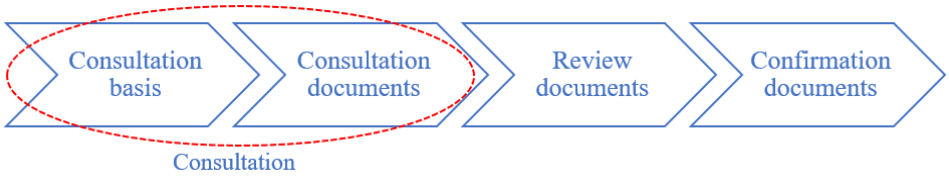

Figure 4. The process of developing the land acquisition plan (adapted from Trafikverket, 2014).

5.1 Consultation

During the consultation stage of Phase 1, the STA must include concerned governmental instances, individuals and organizations who will be affected by the project. This is where external actors can voice and discuss their concerns. This process will be ongoing until the consultation documents are approved. Depending on the size of the project and to what degree it will affect different parties, the consultation phase is conducted in different ways. It can be done by sending out information materials, contact over telephone, letters, personal- or general meetings etc. The information should also be published on the STA's webpage and should be updated continuously. Every opinion must be documented and in some instances of this phase, it must be submitted when applying for different approvals.

5.1.1 Consultation basis

During the first instance of the consultation stage, the objective is to get the project approved by the county administrative board. This is done by producing sufficient material for them to judge if the project will entail considerable environmental impact. Information which must be provided is:

- Project goal, purpose and extent.
- Geographic area that will be affected.
- Preparatory project study.
- Conditions, needs and risks.

- Effects on concerned interests.
- Extra information that the county administrative board might need to judge effects on the environment.

The county administrative board use this to decides and motivate if the project needs to produce an environmental impact statement and to what extent.

5.1.2 Consultation documents

After the county administrative board has approved the documents and decided on the environmental impact statement, the project enters the next instance of the consultation stage. The STA must now produce a satisfying environmental impact statement, if needed, which includes identifying, describing and assessing different corridor alternatives from an environmental standpoint. Furthermore, they must assess the different options in terms of economic, social and technical feasibility to produce the most advantageous corridor. If the project is large and/or complex and alternative corridors are produced, the project might need to be approved by the government. The material which is sent for approval should focus mostly on environmental effects and effects on national interests and less on technical specifications. After approval, the corridor is set, and the STA must produce a final plan proposal to clarify land needs for land acquisition and should include:

- Road design.
- Technical solutions with effects and consequences.
- Environmental measures.

Cost-effectiveness and socio-economic benefits are also assessed, considered and included in the final plan proposal. This is the end of the consultation stage and when the final plan proposal and environmental impact assessment has been approved, the project enters the review instance of Phase 1.

5.2 Review and confirmation documents

The project is reaching the end of Phase 1 and the plan proposal will be examined and adjusted as a result from the consultation stage and announced to the public. This will be the last opportunity for concerned parties to give their statement and view on the project and the land acquisition plan will be adjusted and completed. The finished document and the environmental impact assessment will be sent for approval to the county administrative board and when approved, the project has become final and will enter Phase 2 to begin detailed design and production.

6 Case description

As stated in the case outline, the studied case is the first of its kind in Sweden, since a contractor has not been procured this early in a road project before. In the project, the contractor is responsible for the design of the land acquisition plan, however, when the tender was submitted, the contractor teamed up with a consulting firm who would be responsible for designing the land acquisition plan in collaboration with them. The contractual relationships are shown in Figure 5.

The STA has a DB contract with the contractor during Phase 1, with an option which can be triggered to extend the contract through Phase 2 if the STA are satisfied with Phase 1. The pain- and gain share incentives for the project differ from the ones in STA's guidelines, being 60/40 for the contractor if the price ends up below the target price and 50/50 if the target price is overrun. When the project was announced for tendering, an initial target price was set. This price was adjusted after Phase 1 had been completed as new conditions appeared and a greater understanding of the projects' extent had been developed. The STA and contractor reached an agreement regarding a new target price after long discussions and continued the project together. When the interviews were conducted, the construction stage of the project had just been initiated.

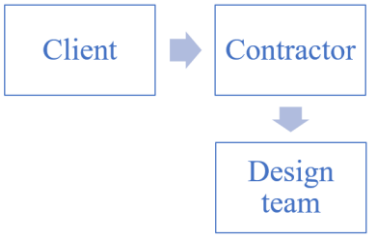

Figure 5. Visualisation of the contractual relationships.

7 Empirical results

A summary of the results from the thematic interview analysis is presented in Table 1. The themes are the main findings from the analysis and represent aspects that have been recognized as being influenced by ECI. The process to obtain the themes is described in Section 3.2.4. To clarify what the themes originate from, the two main subthemes of each theme are presented. To enable a demonstration of opinion owners, subtheme statements were formed. These subtheme statements are based on the interview results and were established after the interviews were analysed to enable a representation of what the interviewees stated regarding the subthemes.

Green indicates that all representatives of the actor who mentioned the subtheme agrees with the statement. Yellow indicates that the opinion about the statement differs between interviewees, while red represents that all the interviewees who mention the subtheme disagree with the statement.

Table 1. Summary of the thematic analysis together with subtheme statements and opinion owners.

Theme	Subtheme	Subtheme statement	Client	Designer	Contractor
Responsibility	Communication	Communication paths have been different due to ECI			
	Internal project organization	The internal project organization of the actor is different compared to traditional road projects			
Implementation	Design of land acquisition plan	The design of the land acquisition plan has been affected because of ECI			
	Constructability	The constructability has been improved in this project compared to traditional road projects			
Relationship building	Collaboration	The level of collaboration for the actor has been affected by ECI			
	Co-location	ECI has contributed to an increased level of co-location for the actor			
Understanding	Comprehension	The contractor has gotten a better comprehension of the land acquisition plan processes			
	Challenges	New challenges have occurred because of ECI			
Risk management	Uncertainties	Uncertainties have been recognized earlier in this project compared to traditional road projects			
	Working environment	The consideration of working environment during construction has been affected by ECI			
Innovation	Process innovation	New ways of working have been used in the project due to ECI			
	Technical innovation	The possibility for new technical solutions has been higher compared to traditional road projects			

8 Findings and discussion

The results from the thematic analysis will be discussed in this chapter. All the presented themes are relevant to answer the research question of which aspects that are affected by ECI. With the help of these findings, the research question regarding when the contractor should be involved and why will be answered.

8.1 Which aspects are affected depending on how early the contractor is involved in an ECI project?

The following themes were identified during the analysis of the interview results.

8.1.1 Responsibility

Responsibility is something that has been affected due to the procurement form of this ECI project. The contractor is the one responsible for the development of the land acquisition plan, which is something they are not used to. One of the interviewees from the design team mention how they have had to remind themselves to include the contractor in the communication paths, even though the contractor might not have an answer to the question. It is important to remember them in the communication since the design team has a contract with the contractor, and not the STA.

Regarding decision making, it is the client who makes the settling decisions, which is said to be the same as in other projects. One of the design team interviewees wish that it would be possible to take faster decisions during design meetings, because in this project, the client has often had to bring questions from the meetings to their experts and return with an answer at a later moment. During meetings with the STA's experts, if a question is raised regarding economy, the question must be brought to the client's project manager. One of the contractor representatives says that one of the differences regarding decision making is that the contractor has been able to be a part of it, which they are not in traditional projects, as they are not involved this early.

The client mentions that their project organisation looks the same as in other projects, and that the difference regarding the development of the land acquisition plan is that they have procured a contractor instead of a design team. This is mentioned as a risk for the client since they do not have their own design team. Usually, the client's design team continues with construction follow-up when the contractor's design team enters the project to continue with the design development. In this case the construction follow-up team entered the project at a later stage with no prior knowledge and without any requirement specifications set by the client. This was seen as a challenge which would be overcome but something to consider in future project. The organisation of the design team was also similar to traditional road projects, while the contractor has a new kind of organisation for this project due to them being responsible for the development of the land acquisition plan during Phase 1.

8.1.2 Relationship building

ECI models aim to close the boundary between actors involved in large projects by increasing the level of collaboration. This is a new way of approaching projects and put pressure on all actors involved to cooperate and build trust, both on an inter

organizational level but also on a personal level. The contractor entered this project with the designer at the beginning of Phase 1, at least four years before they enter traditional infrastructure projects. Both the contractor and design team believe that the ECI model has affected the level of cooperation within the project, with contributing aspects such as: higher level of trust gained by working together for years, co-location and a will to make it work from all participants. The project delivery model made it possible for the contractor to choose which designer to team up with which made it possible to get a head start in cooperation between the client and contractor.

"If we would be paired with a random contractor, then I think it would not be the same" (Design team representative)

The client has noticed positive effects by the cooperation level between contractor and designer but has not been involved much more than in traditional infrastructure projects. A smooth and safe organization with a low conflict level is something that was mentioned as a positive effect of ECI, emphasizing that the contractor's knowledge when discussing solutions felt like a safety net keeping them away from bad solutions.

Co-location has been used in Phase 1 between the contractor and design team, as the contractor has been located at the design team's office one or two days each week to easily discuss and make fast decisions. One of the interviewees from the contractor mentions how the co-location has led to an improved relationship between the design team and contractor as they get to know each other better and can talk informally during breaks.

8.1.3 Implementation

All actors entered the project with the idea that the contractor's involvement would affect the chosen corridor and buildability of the design. During the consultation stage, it became evident that the area of this project's location has a high level of natural and cultural value, which became the governing elements in this project. If the project would be located elsewhere and be less controlled by these environmental properties, the involved parties believe that the contractor would be able to affect the chosen corridor to a greater extent. Affecting the corridor refers to the connection between location and chosen technical solutions, where the contractor has an easier time identifying possible risks and hardships with the chosen location. It has been evident for the design team that including the contractor early in Phase 1 has affected the final design, as they believe that the contractor's knowledge on construction has resulted in fewer design errors connected to buildability. Including the contractor early has had several other positive effects connected to the implementation, such as a greater foresight in the project and better planning of mass handling. The design team has also been able to focus more on what is important in the design, stating that the contractor has been able to specify how much information they need on different parts of the project, saving the design team from producing more information than needed. As stated by one of the design team interviewees:

"Then we can adapt the design to how to contractor wants it, while at the same time following the client's framework, instead of doing it on our own based on how we think the contractor wants it. I think this is much better." (Design team representative).

The project delivery model has made for a pleasant way of working for the client and contractor, the stress factor has been low and both actors agree that this has affected the project in a positive manner. The contractor states that being paid hourly and not on a fixed price has made their work more precise and not generalized while the design team believe that the quality of the design and product will be higher when designing before building, and not while building as they do in some other contracts. Furthermore, the project delivery method has allowed for a smoother transition from the design phase to the construction phase since the contractor is familiar with the design.

8.1.4 Increased project understanding

When the contractor is included early in Phase 1 they gain an understanding of the processes and preparatory work which is required to produce a land acquisition plan. The contractor believes that gaining this understanding will save time and money in future contracts since they will not spend time questioning as much as they usually would. One interviewee from the client's side suggest that the contractor could benefit from taking a course on what it means to produce a land acquisition plan, thus gaining the knowledge through different means. The client believes the contractor will benefit from this knowledge when calculating offers in future projects, ECI contracts but also traditional contracts. Further, gaining an understanding of the processes included in Phase 1 might affect the activity level of the contractor during this phase in future potential ECI projects. As one of the design team representatives stated:

"In the beginning there were a lot of new things, and they (the contractor) were more just listening. Next time they can probably be even more active in the earlier stages of the project, and even more active in the development of the design than they have been." (Design team representative).

Apart from gaining an understanding of the processes included in Phase 1, the contractor has gained an understanding as to why the project ended up with the chosen design and solutions. The contractor believes this will save the project both time and money, stating that they usually find "1000 things they want to change" when reading up on the project documents in traditional projects. Most of the contractors' suggested changes would not be applicable to the project and stems from a lack of understanding, while it would have been advantageous for some of those changes to have been suggested at an earlier stage.

While the contractor had less impact than anticipated on the chosen corridor in this specific project, there is consensus amongst the involved that the knowledge and understanding that the contractor has gained by their early involvement translates to a qualitative benefit for the project moving forward.

Gaining a better understanding of the project could help counteract several challenges identified by the interviewees. Identified challenges include: involving personnel with

the right attitude, contractor's patience, new work roles and keeping the knowledge within the project. Several interviewees emphasized the importance of using personnel with the "right attitude", stating that labeling a project as collaborative does not necessarily create a collaborative atmosphere. Collaboration, by definition, is when a group of people work towards a common goal. Understanding the project aim and goal as well as the project prerequisites and foundational idea aid the participants in forming a shared vision. Hence, involving the contractor early has fostered a project with a collaborative atmosphere. The contractor also stated that since they are new to working in the early phases and unfamiliar with the processes, there was a demand of personnel who had patience and a strong will to participate, collaborate and work in an unfamiliar setting.

8.1.5 Risk Management

Everyone involved in the project agrees that the contractor has contributed to a design which is safer to construct. The design phase has had an increased focus on risk management, as the contractor has identified solutions in the design which would add unnecessary risks and supported the design team in choosing safer solutions from a construction perspective. During the design phase, work safety has been item number one on every project meeting, gaining a higher priority than in traditional contracts. There has also been specific "risk meetings" where the client, contractor and design team discuss risks regarding quality, work environment, design, as well as environment. Apart from recognizing risks within the design, an early contractor involvement facilitates for an earlier and more accurate safety and health plan. One of the contractor representative's states:

"*It is something we as contractors believe is usually overlooked in the design phase. We always get a health and safety plan, but it usually consists of the Swedish Work Environment Authority's 13 risks and maybe a few additional ones*." (Contractor representative).

Gaining the opportunity to thoroughly examine and prepare for each part of the construction has made the contractor confident that the construction will be safer to execute. Going into the construction phase, the contractor will bring "a long list of risks" which were identified in the design phase, emphasizing the challenge of identifying construction risks when working as a designer with no field experience.
The contractor has also been able to identify geotechnical risks and has been able to control the number of samplings they would need to ensure confidence in that the construction would be safe and successful, while also being able to identify possible reinforcement needs.

8.1.6 Innovation

All actors in the project believe that the studied project is of non-complex nature. Representatives from the STA mention that because of this, there has been no new technical solutions. However, one interviewee mention that there has been a greater possibility to use new solutions compared to traditional road projects. This statement is something that both the design team and contractor partly disagree with, as they

both mention that it has been hard to get new possible solutions accepted by the STA and their experts. For instance, one of the interviewees from the contractor mention a solution that would have been economically beneficial for them, but because they are not allowed to credit from this, they did not use it. Another reason mentioned by one of the contractor representatives to why it has been hard to implement innovative solutions, is the question of quality and responsibility. If a technical solution that has not been used before is used, who is responsible for the future quality?

"*We have been looking at several solutions but ended up not really using any innovative ones. It basically entails an extra risk for the STA. "No, we have not tested this method before, how will it last after ten years? Who is responsible?""* (Contractor representative).

The design team further mention how several possible solutions have been discussed, but how they have been complicated to implement after reviewing them with the STA, and that the STA have many requirements to follow. Furthermore, one design team interviewee mention that considering that the project is not that complicated, the contractor might feel comfortable with working as they are used to. However, at the same time, the design team representative mention that thanks to ECI, there has been a bigger opportunity to implement innovative solutions. Considering the interview results regarding technical innovation, there seems to have been a greater possibility to come up with new solutions, however, because of the client's attitude and requirements as well as the non-complexity of the project, these have not been implemented.

The design team mention how they have worked in a different way during the design process in this project, as they have transferred parts of the design development to the contractor. These were parts of the design where the contractor had competence and experience with and could therefore design themselves. The contractor has worked in a completely new way, as they have never been a part of the development of a land acquisition plan before. Because of this, new roles like design manager and environmental specialists were introduced in the contractor's organisation. The STA, however, have worked in a similar way as usual.

8.2 How early should the contractor be involved and why?

The purpose of this study was to investigate how early should the contractor be involved and why? All themes mentioned previously are affected by when the contractor is involved. Responsibility is mostly dependent on how the project is procured and does not affect the project directly in the same way as the other themes do. The project owner always has the responsibility for the project due to legislative instances and this does not change regardless of contractor involvement. Responsibility within the contract is settled before a contractor is appointed since the project needs to be specified before it is procured. Hence, trust was a non-decisive aspect when the public project owner specify responsibility within the contract. Wondimu et.al. (2016) found that the level of trust between client and contractor was a decisive aspect for how much responsibility the client would put on the contractor and that DB contracts require a high level of trust. Therefore, building trust as early as possible during publicly procured DB infrastructure projects is important for project

success. During the first phase of the project, the contractor could help the client make decisions which would otherwise be made by the client alone. This made the client feel safer in their decision making due to the client trusting the contractor's knowledge of the project and expertise on the subject. In this instance the client has not regretted decisions made with the help of the contractor, furthering the trust-based relationship. If the contractor would enter the project at a later stage in the project, these trust-building decisions would be taken by the client and risk being questioned by the contractor later on in the project.

Regarding the way in which this project was procured, the contractor was able to choose which design team to team up with. By choosing a design team they had worked with previously, it could be assumed that a "base trust" was already settled between the two actors. However, being able to decide which design team to work with is not exclusive to ECI projects, as this is something that is the case in normal DB contracts as well. As found in literature, Af Hällström and Bosch-Sijtsema (2020) identified trust between contractor and designer as one important aspect to achieve the full benefits of the ECI model. The interviewees mentioned that working together for years had created an open atmosphere, a will from all participants to move the project forward and few disagreements (except during the target price discussion, where there were some disagreements, which were more connected to the pain/gain- share ratios). This implies that the duration of cooperation between actors has a positive effect on the project. It could be argued that the contractor's early involvement made them more compliant, since the contractor mentioned the risk of working for years in a project and then losing the right to build would be a huge disappointment. On the other hand, if the client and contractor do not agree, the STA must find a new contractor, which probably result in resource extensive work.

Collaboration has been an important success factor throughout the project with the interviewees mentioning several positive effects stemming from a close collaboration between the contractor and designer. Collaboration between the client and contractor was not mentioned as much and we got the feeling that the client was acting rather passive, only involving themselves in matters which they would traditionally be a part of, discussing decisions internally with their in-house experts before returning to the contractor and design team with decisions. Being an active client is essential for successful collaboration early in the project (Af Hällström & Bosch-Sijtsema, 2020) which in turn is important to form a shared vision (Malvik et.al., 2021) and according to the interviewees: trust. This leads to a better contribution from the contractor (Wondimu et.al., 2016; Eadie et al., 2012; Rahman & Alhassan, 2012) and less unnecessary arguments (Malvik et.al., 2021). We believe the lower level of collaboration than anticipated between client and contractor occurred due to several reasons. Partly because the conservative nature of the STA, the actors' inexperience of working in this kind of project, which is mentioned as a barrier by Love et.al. (2014), and the changing of key personnel in the STA's project organisation during the project. However, both the client and contractor believe that the project will be successful and that their collaboration has been enough to see the expected benefits of the project delivery model. Involving the contractor at a later stage than when they were involved could further the collaboration between client and designer but risk losing valuable benefits from contractor – designer collaboration as well as client – contractor collaboration.

Part of why the contractor was to be involved early was to use their construction knowledge when choosing the road corridor. In this case, the contractor was unable to substantially affect the chosen corridor due to cultural and environmental findings. However, by being involved early, the contractor gained an understanding of why the corridor was chosen and they could begin identifying possible challenges and solutions to these. As stated by Malvik et.al (2021), it is important for the contractor and client to form a shared vision as early as possible, otherwise the client's needs and the contractor's understanding of those needs might differ. This can result in unnecessary arguments throughout the duration of the project. Since the contractor was included in the beginning of Phase 1 and was a part of forming the consultation documents, they could avoid these unnecessary arguments. By gaining an understanding of the project and being involved from the beginning of the design development, the contractor could specify the level of detail of the design needed when going into the construction phase. The design team felt this made for a more efficient way of working, saving them from doing unnecessary work. At the same time, the designers had a close collaboration with the contractor, discussing possible solutions and challenges surrounding them. If the contractor would enter the project at a later stage, for instance just to check constructability, the understanding of the conditions of the project would not be on the same level as it is in this project. This would risk limiting the contractor to only make suggestions for smaller changes since larger changes would demand a holistic understanding of the project and demands a greater amount of time for investigation and approval.

Since the contractor is the actor who will construct the road, there has been a greater focus on working environment risks and possible risks connected to specific solutions during the development of the design. At the same time, the contractor and design team have had the opportunity to discuss innovative solutions, however, due to this project being not that complex, many traditional solutions have been used. Nevertheless, some new solutions were considered, but because of STA's requirements and stance, these were not used. This can be related to what is mentioned in the study by Rahmani (2021), stating the importance of the clients' mindset. If this project would have been of a more complex nature, and there would have been more challenging circumstances, the early involvement of the contractor would most likely allow for good problem solving together with the design team. This could as well lead to innovative solutions, assuming the STA approve these solutions and that the contractor is able to be credited for these.

By entering the project during the consultation basis, the contractor can be involved when providing the county administrative board with information about the project. Information such as geographic area, conditional risks and needs of the project and a preparatory project study is information which the contractor can help specify and which will further the contractor's understanding of the project. Involving the contractor any later than this would shorten the duration of collaboration and risk losing a part of the project understanding the contractor would gain during the consultation basis. A lower understanding of the project could lead to misunderstandings, proposed solutions which cannot be implemented and an overall reduced impact from the contractor. This does, however, not mean being involved later than the consultation basis will have no positive impact on the project.

Due to the project being a two-stage procurement it is possible for the project to enter the construction phase with a different contractor. If the client and contractor do not agree on a price for the construction phase, the project will enter a new procurement phase similar to a DB project. If this happens, there is a risk that the new contractor will question the design and try to change design solutions to better fit their organization. Since the new contractor has not been involved early and will not have created a foundation of trust and cooperation, many of the benefits of involving a contractor early will be lost. However, some parts of the design, such as risk management and constructability should be higher than for a regular DB contracts due to input from an involved contractor.

9 Conclusion

Responsibility, relationship building, implementation, understanding, risk management and innovation are aspects of the studied case that were all affected by the early contractor involvement. In this project, the contractor got involved in the beginning of Phase 1 and was a part of the whole land acquisition plan process. Due to locational circumstances, the contractor was not able to affect the chosen road corridor as much as the actors expected, but thanks to the early involvement many other aspects were enhanced. The contractor has gotten an understanding of the processes that are included in the land acquisition plan development and the reason why the road will be in the chosen corridor. This is expected to lead to less questions and questioning by the contractor during the construction stage as well as lead to better collaboration through mutual understanding.

Involving the contractor as early as in the studied case has resulted in an extended duration of relationship building which has led to a project built on trust and collaboration. If the contractor would have been involved at a later stage of the project, this experience and relationship building time would be lost. In this case, the contractor and design team knew each other from previous projects, however, if they did not, this initial period can be assumed to be of even more importance.

The contractor has been able to contribute with constructability knowledge as well as, with their presence, put an increased focus on work environment risks. As a result of this, the design team has been able to develop a design that from the start has had input from the contractor and has allowed for a smooth transition from Phase 1 to Phase 2, compared to if the project would have been executed with a more traditional project delivery method. This could be accomplished by involving the contractor a bit later than in this case, but proposing substantial changes to the design, which demand an understanding of the project prerequisite, would be challenging. Both due to the lower level of understanding but also due to a lack of time for evaluations.

The understanding of the specific project that the contractor gets by being involved from the beginning of Phase 1 seem to add a qualitative aspect to the project. Also, raising the quality of risk management, proposed solutions and to some extent increasing the collaboration between all three actors. Hence, involving the contractor in the beginning of Phase 1 is beneficial to the project. To state exactly how beneficial, would require further research and comparisons to other infrastructure projects.

9.1 Future research suggestions

Our conclusion is that involving the contractor as early as possible is beneficial. However, how large part of the contractor's project organization that should be involved from the earliest stage of the project is something that should be further studied. Furthermore, once the project is completed, it would be worthwhile to compare the project to similar ECI and non-ECI projects, regarding cost, quality and time. Other ECI projects that have different pain-/gain ratios can also be compared to evaluate how these ratios affect the projects.

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11 Appendix

Interview guide used when interviewing the client, contractor and design team.

Del 1 – Bakgrund

1. Ditt namn, och berätta om din bakgrund och erfarenhet från branschen
2. Vad är din roll i projektet?
3. Har du erfarenhet av något som liknar det här projektet?

Del 2 – Upphandlingsfasen

1. Annonsering av projektet
    a. Hur annonserades projektet av Trafikverket till potentiella anbudsgivare?
2. Prekvalificering eller ej? Om ja:
    a. Vilka kriterier användes som grund för prekvalificeringen?
    b. Hur utformades dessa? (Trafikverket)
3. Tilldelningskriterier
    a. Vilka var tilldelningskriterierna och hur vägdes dessa?
    b. Hur tror du att tilldelningskriterierna och deras viktning speglar projektets mål?
    c. Hur uppfyllde anbuden förväntningarna kring tilldelningskriterierna? (Trafikverket)
4. Konkurrenspräglad dialog?
    a. Genomfördes någon konkurrenspräglad dialog? Om ja, hur?
    b. Vad fick du ut av dialogen?
    c. Hur påverkade dialogen anbudet? Hur förhåller sig anbuden till "traditionella anbud"?
    d. Hade ni tillräckligt med tid för denna del?
5. Ersättning för beräkningsarbete
    a. Hur kompenserades de andra entreprenörerna? En viss andel, helt? (Trafikverket)

Del 3 – Utvecklingsfasen (Fas 1)

1. Kontraktstyp
a. Vilken typ av kontrakt används? (Fast pris osv ...)
2. Riktpris
    a. Hur kom ni fram till riktpris?
    b. Ändrades vissa ansvarsområden under förhandlingarna? I så fall, på vilket sätt?
    c. Hur låg konfliktnivån under förberedelserna?
3. Öppen bok (i hela fasen?)
    a. Hur har principen om öppen bok fungerat i projektet?
4. Vägplansutformning
    a. Vem är ansvarig för vägplansutformningen?

   b. Hur har utformningen av vägplan påverkats av ECI?
5. Har insikten i vägplansutformningen som entreprenör påverkat det senare arbetet?
6. Organisationsstruktur
   a. Berätta om organisationsstrukturen i projektet. Vem har vilka ansvarsområden? Finns det nya ansvarsområden för detta koncept?
   b. Har åtgärder genomförts för att uppnå kontinuitet (låg personalomsättning)?
   c. Vem fattar beslut och hur fördelas ansvaret? Hur lång är tiden för beslutsfattande?
7. Beslutsvägar och kommunikationsvägar?
   a. Finns det en tydlig skillnad mellan beslutsvägar (officiella beslut) och kommunikationsvägar (diskussion och förslag)?
8. Kontakt med intressenter
a. Vem för dialog med intressenter? Grannar, kommuner etc.
9. Involvering av UE och underkonsulter
   a. Hur involveras UE för samverkan? Skiljer det ifrån traditionella arbetsmetoder?
10. Kontraktsignering
   a. Fanns det exitmöjligheter?
   b. Kontraktstyp för genomförandefasen?

Del 4 – Din erfarenhet av projektet så här långt

1. Vad har blivit annorlunda pga. entreprenörens tidiga involvering i projektet?
   a. Gränser för arbetsområde?
   b. Masshantering?
   c. Byggbarhet?
   d. Industrialisering/repetitiva moment under byggnation?
   e. Tidplaner?
   f. Något annat?
2. Möjligheter till nya lösningar
   a. Har nya typer av lösningar använts som ni inte har använt tidigare?
   b. Om så är fallet, hur har detta fungerat?
   c. Har entreprenörens lokala bakgrund påverkat valet av lösningar mot kvalitet, kostnad och tid? Om så är fallet, hur?
3. Gynnsamhet av att involvera entreprenör tidigt
   a. Ser man att det har varit gynnsamt att entreprenören involverats så tidigt som i detta fall? Om inte, när skulle E ha involverats?
   b. Om ja, på vilket sätt (exempel)?
4. Ser du en framtid där tidig involvering av E blir vanligare?
   a. Kommer ni (E+K) lämna anbud på projekt med liknande arbetsmetod i framtiden?
   b. Vad har varit det svåraste med denna arbetsmetod?
   c. Vad är den största lärdomen från detta projekt, hittills?

5. Ser du några motsättningar i renodlad beställare och ECI? (Trafikverket)

Del 5 – Genomförandefasen (Fas 2)

1. Riktpris
   a. Ändrades riktpris inför genomförandefasen? Hur/varför?
   b. Om ja, hur var konfliktnivån under förhandlingen av nytt riktpris?
2. Incitament
   a. Vilka typer av incitament finns det för projektet och hur fungerar dessa?
3. Hälsa- och säkerhetsarbete (HS)
   a. Hur kommer det dagliga och övergripande HS-arbetet ske (skyddsronder, buller, stress, ergonomi etc.)?
   b. Har entreprenörens tidiga engagemang påverkat HS-arbetet?
4. Kommunikation med konsulter
   a. Ser involvering av konsulter annorlunda ut i detta projekt jämfört med andra?
   b. Har ert arbete påverkats av att arbeta mot entreprenör istället för beställare?
6. Beslut - tillsammans?
   a. Hur kommer de vanliga byggmötena fungera?
   b. Vem fattar pågående beslut?
7. Genomförande
   a. Hur kommer projektet genomföras? Arbetas det på flera sträckor / fronter samtidigt, hur är detta strukturerat och påverkat av ECI?
8. Grad av UE och eget arbete
   a. Hur mycket av arbetet kommer utföras av UE? Hur väljs dessa?
   b. Hur har samarbetet med UE påverkats av upphandlingsmodellen?
9. Samlokalisering
   a. Kommer projektet att vara samlokaliserat?
   b. Hur tror du att detta kommer att påverka kommunikation och samarbete?
10. Tid
    a. Hur är projektet enligt schemat?
    b. Har framtida osäkerheter identifierats? Om ja, hur jobbar ni för att minska dessa? Om nej, hur kommer det sig?
11. Kvalitet
    a. Hur kommer kvalitén på vägen att säkerställas? Finns det uppföljning av UE? Skiljer det sig från “traditionella projekt”?

Del 5 – Summering

1. När ser du att det hade varit mest gynnsamt att ta in entreprenören i detta projekt?

   a. Tidigare/senare/samma?

2. Är det något du glömt / känner för att lägga till?
3. Kan du kontaktas ytterligare med fler frågor?

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