Improving safety in Dutch construction projects

An exploratory research on improving safety in the Dutch construction industry: incorporating a third party into the UAC-IC 2005, based on FIDIC's Engineer

Stijn Vermeulen

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Preface

This thesis titled "Improving safety in Dutch construction projects" is the result of my research to conclude the Master of Science Construction Management and Engineering at Delft University of Technology. This research was conducted with the help of the university and Witteveen+Bos.

During my Master degree, I was a bit surprised about the fact that I enjoyed the legal course in the first quarter of 2020. What just might have been my biased opinion, turned into enthusiasm for contractual mechanisms, procedures, and accountability. Construction Management and Engineering is a very diverse Master degree, so I did not keep in contact with most of the legal aspects during the remainder of the study. When I was orientating for a possible thesis topic in December 2021, I came across an advert by Witteveen+Bos. This advert highlighted an international contract mechanism: FIDIC. I did not hesitate and instantly replied to the advert. After a few conversations with Rob and Xaief, we mutually decided to go for it.

I could not have conducted the research that is in front of you right now, without the help of my graduation committee. Evelien, Leon, and Ad, a genuine thank you for your time, support, believe, positive feedback, and critique during our meetings. Rob, a genuine thank you for letting me conduct this research at Witteveen+Bos, making me feel at home in your group, and for all your guidance and the conversations we had (on and off topic). Furthermore, I would like to thank my interviewees and other colleagues for their time and knowledge.

I would also like to thank my friends, parents, brother, and sister-in-law. Thank you for your support during the final stages of my Master degree, and having my back whenever I needed. This seven-month journey might not have been as flawless as I would have liked, but I guess that is part of the process.

Stijn Vermeulen
Etten-Leur, October 2022

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Executive summary

Introduction

Any industry is focusing on creating an environment that is as safe as possible for everyone that is involved. This is no different for the construction industry. However, the construction industry is placed second in the ranking of most dangerous industries (Ministerie van Sociale Zaken en Werkgelegenheid, 2021). Hughes and Ferrett (2011) have defined safety as "the protection of people from physical injury". Important types of safety in the construction industry are safety on site and safety of the surrounding area. Safety on site is about controlling the hazards that are present at a working site. This can be done by the implementation controlling interventions. Safety of the surrounding area relates to people that are, for whatever reason, close to the boundaries of the construction site. Besides safety on site and safety of the surrounding area, structural safety is very important. Structural safety is defined by Lin et al. (2019) as "the deformation or destruction of on-going main or temporary structures in construction". During the 21st century, various severe incidents have happened at construction sites in The Netherlands in which workers and civilians were in danger, injured, or even killed. These accidents have shown that there are industry-wide problems related to safety. The Dutch Safety Board, being an independent administrative body, has recommended to integrate a third party into the contractual general terms and conditions such as the UAC for integrated contracts (UAC-IC). A third party named "the Engineer" is already standardised in the general terms and conditions of the Fédération Internationale des Ingénieurs Conseils (FIDIC), a contract publishing organisation whose contracts are widely used internationally. The objective of this research is to examine whether there is any potential to integrate a third party into the UAC-IC 2005 contract. This potential is being examined using a comparison between the UAC-IC 2005 and FIDIC Yellow Book 1999. In this comparison, the main focus points are the "vital tasks & responsibilities" that are necessary in order to safeguard safety on site, safety of the surrounding area & structural safety. To achieve this objective, the research question (RQ) and sub-questions (SQ) which are presented below, need to be answered.

RQ: In what way can safety on site, safety of the surrounding area & structural safety be improved by modelling a third party into the UAC-IC 2005, based on the experience of FIDIC's Engineer?

- SQ1: What are the industry-wide issues related to safety on site, safety of the surrounding area & structural safety in Dutch construction projects?
- SQ2: What is currently being done to tackle these issues?
- SQ3: What are vital tasks & responsibilities that need to be performed in order to safeguard safety on site, safety of the surrounding area & structural safety?
- SQ4: How is the vital task & responsibility distribution in the Yellow Book 1999 edition organised?
- SQ5: How is the vital task & responsibility distribution in the UAC-IC 2005 organised?
- SQ6: What are the differences to properly execute the vital tasks & responsibilities in both the UAC-IC 2005 and the FIDIC Yellow Book 1999?
- SQ7: How to model the Engineer as part of the UAC-IC 2005?

Methodology

This design-oriented research uses two research strategies which are used in order to answer the research question and sub-questions. First, a literature review is used to find the answers to the first three sub-questions. In this literature review, available papers on safety in the construction industry, control mechanisms, and reports of the Dutch Safety Board are used. The literature review is continued by using the general terms and conditions of the FIDIC Yellow Book 1999 edition, and the UAC-IC 2005. In this continued literature review, the theoretical part of SQ4 and SQ5 is answered. In addition to the literature review strategy, interviews are used as a second research strategy in order to find the practical oriented answers of SQ4 and SQ5. A comparison on the vital tasks & responsibility distribution is made between the FIDIC Yellow Book and the UAC-IC in order to find the differences between the two contractual models and answer SQ6. Both the information gathered in the literature review stage and the interview stage is used to make this comparison. The gathered data using the literature review and interviews, are used as argumentation whether an Engineer can enhance safety in the Dutch construction industry. If the outcome shows that a Dutch Engineer role could enhance safety in the Dutch construction industry, this research concludes with a model in which a Dutch Engineer is integrated into the UAC-IC 2005 contract (SQ7). A flowchart of the research steps can be seen in figure 2.

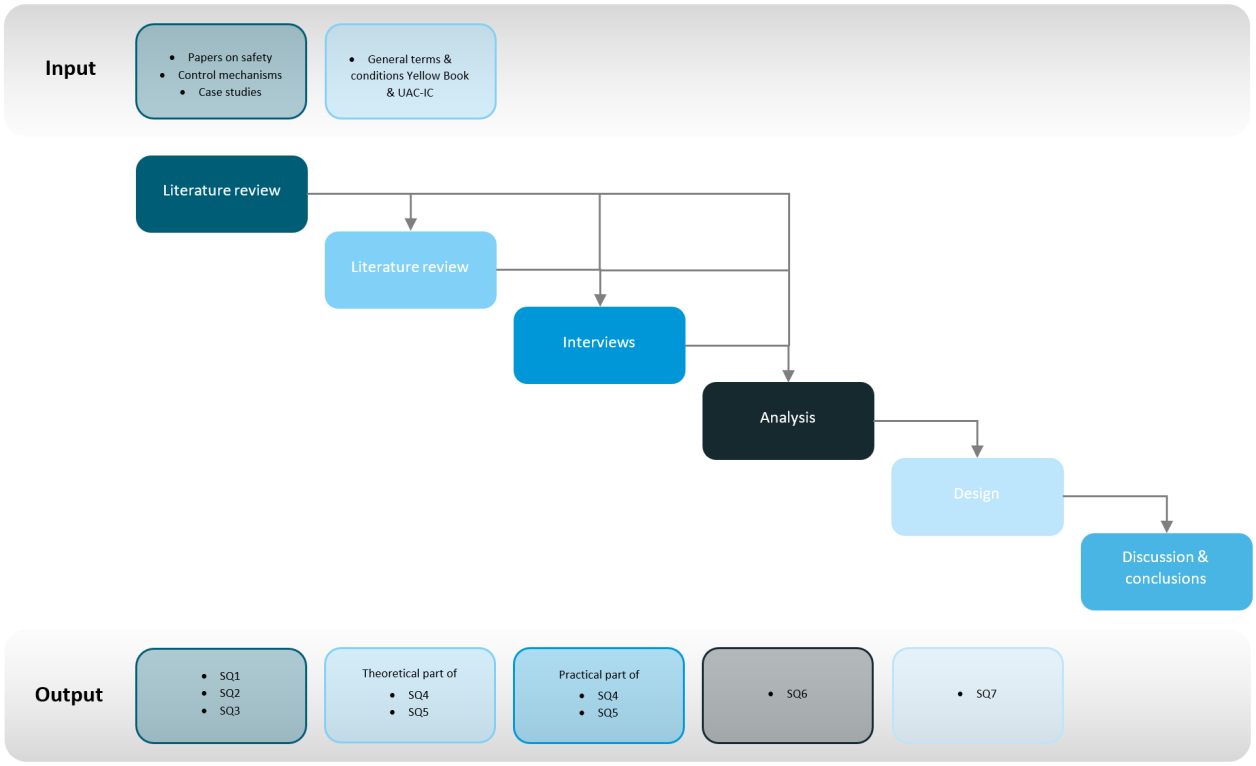

Figure 2: Flowchart of the research steps that are taken in this research, including the input and output for every step.

Literature review

A lack in structural safety is often caused by human errors (Ellingwood, 1987; Fruwald et al., 2007; Schneider & Matousek, 1976). Crucial factors that can affect the level of structural safety are communication & collaboration, control mechanisms, allocation of responsibilities, knowledge infrastructure, risk management, and the safety culture within companies which include safety on site and safety of the surrounding area (Terwel, 2014). Six case studies have been analysed using the reports of the Dutch Safety Board, which show that there are several underlying issues present in most safety related incidents. First, four contextual aspects are often present when an incident happens: competition based on price instead of quality, diffuse responsibilities & coordination,

organisational complexity, and techniques which are operated on their limit. Second, organisations are not able to close the feedback loop for structural safety since it is not clear who actually has the final responsibility to safeguard structural safety. For safety at work, the feedback loop can be closed. This is however more related to working conditions and not necessarily to safety on site and safety of the surrounding area. Third, trust is is used as a controlling intervention while this can never be a reason to neglect designated checks and inspections at crucial handover moments (Onderzoeksraad voor Veiligheid, 2018). In addition to this, quality assurance processes that are agreed on and approved in the earlier phases of a project, are not followed in practice. Some of the industry-wide issues have been first mentioned in the beginning of this century. During that period, different initiatives have been presented to try to improve the current safety situation. The last few years, the government is trying to implement a new law named 'Law safeguarding quality for building'. The law has the intention to improve the quality of buildings when handed over to the employer and increase responsibilities for the contractor. When implemented, an independent and private quality safeguarder checks whether the construction is build according to the building decree during the design and execution phase of a project (Rijksoverheid, n.d.). However, many people argue that this law is not going to provide a solution to the overall safety related problems. The Dutch Safety Board has come up with several recommendations which have the aim to safeguard the different types of safety. The main recommendation is to arrange an integrated, systematic, and continues process of risk management in order to improve safety. The first step of this recommendation mainly relates to the management of project specific and safety related risks. The second, third, and fourth step are related to the safety approach that is a result of the identified risks in the first step. These vital tasks & responsibilities include three crucial factors from literature, namely: risk management, allocation of responsibilities, and control mechanisms. All steps of the vital tasks & responsibilities are shown below (Onderzoeksraad voor Veiligheid, 2006, 2012a):

1) Potential risks must be collected to structure the safety approach. This is done by:
   (i) Exploring the context of the project.
   (ii) Risks which have the possibility to arise in this context must be collected.
   (iii) The risks must be evaluated in order to find out what risks must be managed.
   (iv) Safety measures must be coupled to the risks that must be managed.

2) Prove that the safety approach is practical and realistic. This is done by taking into account:
   (i) The applicable laws
   (ii) Available standards, best practices, and own experience.

3) The safety approach needs to be carried out and controlled. This is done by:
   (i) A description of how the safety approach is performed, showing the goals, plans, and corresponding safety measures that are used to achieve these goals.
   (ii) A transparent, clear, and accessible distribution of responsibilities for the execution of the safety plans and safety measures.
   (iii) The number of workers and level of experience required must be specified for tasks that must be performed.
   (iv) All activities related to the safety approach are coordinated by one central party.

4) The safety approach must be improved continuously whenever required. This is done at the following moments:
   (i) After risk analyses, observations on site, inspections, and audits (proactive manner)
   (ii) After incidents, or near-misses (reactive manner)

FIDIC Yellow Book and UAC-IC contracts

The Contractor is the responsible party that needs to do something with risk management in the FIDIC Yellow Book 1999 edition. Therefore, the first step of the vital tasks & responsibilities is conducted by the Contractor. The Engineer can use different Sub-Clauses to steer the risk management

system to the preferred level. The Engineer can for example make the Contractor adapt the risk management system after reviewing it under Sub-Clause 5.2 [Contractor's Documents]. The Sub-clauses in the Yellow Book, especially Sub-Clause 2.2 [Permits, Licenses or Approvals], 4.8 [Safety procedures], 6.5 [Working Hours] and 6.7 [Health and Safety], provide the information which is necessary to comply with the second step of the vital tasks & responsibilities. Step 3 (i) is the responsibility of the Contractor. This also holds for step 3 (ii). The Engineer is able to check whether the Contractor has made the responsibility distribution clear and accessible enough for every party involved, since all communication must be send to the Engineer too under Sub-Clause 1.3 [Communications]. If responsibilities are placed at subcontractors, the Engineer is able to check whether the Contractor has specified the responsibilities of each individual subcontractor in a clear and effective manner under Sub-Clause 5.2 [Contractor's Documents]. Step 3 (iii) can be facilitated by the Yellow Book if this is a requirement in the Employer's Requirements. Since the Contractor is the main party that is responsible for the execution of the Works, he is also best able to perform step 3 (iv). The fourth step is the responsibility of the Contractor. The quality assurance system entitles the Engineer to implement an external independent control mechanism by using the proactive tools mentioned under step 4 (i): the Engineer is entitled to audit the quality assurance system of the Contractor under Sub-Clause 4.9 [Quality Assurance], perform inspections during the design phase under Sub-Clause 5.2 [Contractor's Documents], perform inspections during the execution phase under Sub-Clause 7.3 [Inspections], and make the Contractor performs tests under Sub-Clause 7.4 [Testing]. When the tools are used correctly, the outcome will show whether the Contractor is continuously improving the risk management system and the corresponding safety approach, or whether the risk management system and the corresponding safety approach are not used as agreed. The continues improvement based on a reactive manner is governed by the Yellow Book in Sub-Clause 6.7 [Health and Safety] which states that after incidents, or near-misses, the Contractor must inform the Engineer. They can together improve the risk management system and corresponding safety approach accordingly. Theoretically, the vital tasks & responsibilities are completely able to be executed after the analysis of all Sub-Clauses in the Yellow Book. Most aspects are performed by the Contractor, with some guidance and control by the Engineer.

Looking at the vital tasks & responsibilities in the UAC-IC 2005 the Health and Safety dossier belongs to the responsibility of the ON. §12 [Veiligheid en gezondheid] and the Building Decree state that safety related risks must be collected, evaluated, and safety measures must be assigned to these risks. The first step of the vital tasks & responsibilities is therefore performed by the ON. The second step is not explicitly mentioned in the UAC-IC, but paragraphs such as §9 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtgever], §10 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtnemer], §11 [Wettelijke voorschriften en beschikkingen], and §48 [Toepasselijk recht] provide the boundary conditions in which the ON must prove that the safety approach is practical and realistic. Step 3 (i) is not governed by the UAC-IC, but rather by the health and safety dossier specifications from the Building Decree. The ON is responsible for this. Step 3 (ii) is not facilitated by the UAC-IC itself, but this can rather be done using the OG's requirements in a project. The same holds for step 3 (iii). A look at a project specific OG's requirements has shown that risk management should be performed by both the ON and OG. This means that there is no central party that is coordinating the corresponding safety approach, but rather indicates a shared responsibility. The safety approach related to execution risks are however the responsibility of the ON. §12 [Veiligheid en gezondheid] states that the ON must actualise and thus improve the health & safety plan if the OG specifies this. This means that there is a duty for the ON to keep the health and safety dossier, and thus the risk management system and the corresponding safety approach up-to-date. The proactive tools mentioned in step 4 (i) are facilitated in the quality assurance system which can be used by the OG to implement an external control mechanism. This quality assurance system is set out in §19 to §23, and is relatively procedural. Theoretically, the vital tasks & responsibilities cannot all be facilitated by the UAC-IC. If the Building Decree and OG's requirements are included in the analysis, the vital tasks & responsibilities are all able to be executed, mainly by the ON.

With some differences present in both contracts, they are both able to let a party perform the vital tasks & responsibilities in relation to the risk management system and corresponding safety approach from a theoretical point of view. The situation is different in practice. During the execution phase of a project, it is not uncommon that other aspects like time, or money can get "more important" for the contracting party than proper risk management processes and the corresponding safety approach. Looking at the UAC-IC, the ON's internal control mechanism gets neglected, and it is up to the OG to properly perform the external control mechanism in order to notice the negligence. The incentive present for the OG to properly perform the external control mechanism, is to eventually get his deliverable according to the contract requirements, and within the specified time. For an involved OG, this incentive would be enough to properly perform the external control mechanism. He will see that the ON is not working according the the quality plans, and will make sure that the ON is adapting the risk management processes and safety approach before any works continue. For a less involved OG, this incentive would not be sufficient to perform the external control mechanism effectively. He would argue that it is the ON's responsibility to properly perform all tasks and responsibilities as he has specified in the quality plan. Subsequently, if the ON is not working according to his quality plans, and there is no control mechanism present, risky situations can occur which will be to the detriment of safety (Terwel, 2014, p.33). Looking at the FIDIC Yellow Book, there is one essential difference which is due to the presence of the Engineer: the Yellow Book mechanisms is organised in such a manner that the Employer assumes that he can count on the Engineer with respect to all technological aspects, safety aspects, and contractual aspects. The Engineer needs to explain and justify his actions to the Employer and he therefore must be very confident to take certain actions. Due to the accountability that is assigned to the Engineer, and the uncapped amount that the Engineer can be held liable for when he is in breach with FIDIC's White Book contract, there is a significant greater incentive for the Engineer compared to the incentives in the UAC-IC. This incentive will increase the chance that the Engineer is performing his external independent control mechanism more effectively compared to the OG in the UAC-IC.

Amendment of the UAC-IC 2005

First, several adaptions to the UAC-IC must be made in order to make a Dutch Engineer perform the external independent control mechanism. The tools to do this can be found in the quality assurance system and include audits on system level, audits on process level, verification procedures, and acceptance procedures during both the design and execution phase. This external independent control mechanism must however be performed effectively in order to enhance safety. Second, the liability as stated in TNR 2011 are not extensive enough to make a Dutch Engineer perform the independent control mechanism effectively, based on FIDIC's liability. Therefore, the amount that the Engineer can be held liable for must be increased in TNR 2011. However, this might not sound interesting for Dutch engineering firms which are able to fulfil the role of the Dutch Engineer since their exposure to risk will increase. An increase in liability is however the only possibility to increase the incentives which are needed in order to make a Dutch Engineer perform the external independent control mechanism effectively. Third, it is expected that the integration of a Dutch Engineer in the UAC-IC for small and simple projects is rather costly compared to the added value. This thesis states that certain requirements must be met in order to make a Dutch Engineer mandatory in Dutch projects. These requirements are found in two technical management measures (NEN, 2021) namely, design checking and inspection during execution. These two technical management measures must already be performed by the Dutch Engineer since this is a duty in the quality assurance system when performing the external independent control mechanism. Both of the technical management measures must at least be level 2 in order to make an Engineer mandatory. However, these levels are hard to determine when a project is in the early phases. The consequence class is a something which can be determined more easy looking at the functional requirements. The design checking level, inspection during execution level, and consequence level can be coupled to each other. Therefore, when the consequence class is at least CC2, the newly created UAC-IC with an integrated Dutch

Engineer is mandatory. Eventually, this has resulted in a final figure, figure 3, in which the Dutch Engineer is integrated within the UAC-IC 2005 contract.

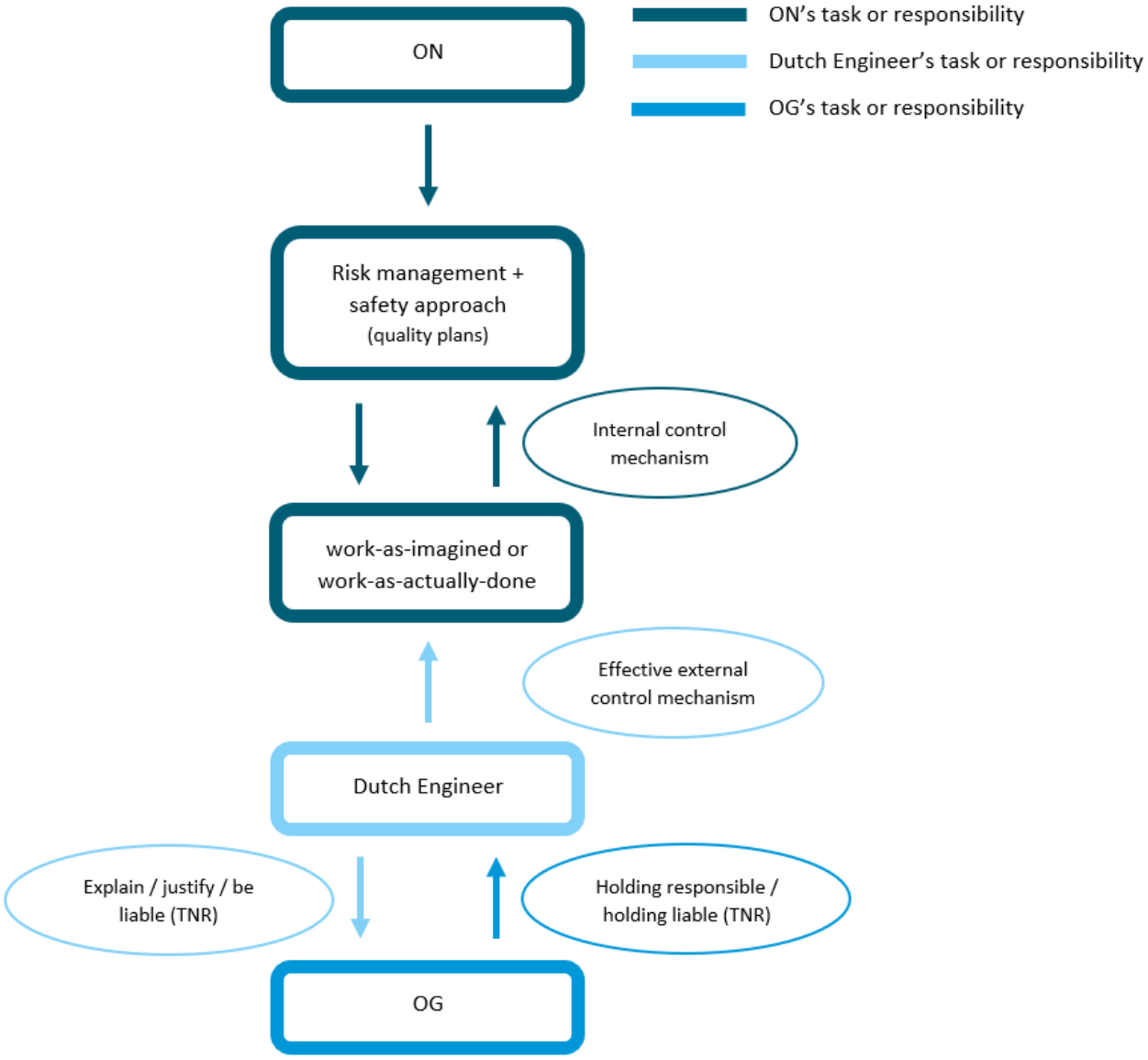

Figure 3: The new UAC-IC 2005 with the integrated role of the Dutch Engineer.

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List of Abbreviations

Table 1: List of abbreviations

Abbreviation	Meaning
CC	Consequence Class
CM	Contract manager
Contractor	Contractor in a FIDIC contract
DCL	Design Check level
DSB	Dutch Safety Board
Employer	Client in a FIDIC contract
FIDIC	Fédération Internationale des Ingénieurs-Conseils
IL	Inspection Level
Lsb	Law safeguarding quality for building
MBO	Model Basisovereenkomst
MPB	Manager projectbeheersing
OG	Client in a UAC-IC contract
OM	Omgevingsmanager
ON	Contractor in a FIDIC Contract
PDCA	Plan, Do, Check, Act
PDM	Project Delivery Model
PM	Project manager
PMP	Project Management Plan
RB	Red Book
RQ	Research question
RWS	Rijkswaterstaat
SQ	Research sub-question
TC	Toetscoordinator
TM	Technisch manager
TNR	The New Rules
UAC-IC	Uniform Administrative Conditions for Integrated Contracts
WB	White Book
YB	Yellow Book

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1. Introduction

Any industry is focusing on creating an environment that is as safe as possible for everyone that is involved. Environment in this context is an extensive concept. In the construction industry this environment mainly ranges from the protection from poisonous materials such as asbestos, to the protection from physical accidents. Accidents in any industry happen, and will most likely keep happening. A basic search at the platform 'www.Cobouw.nl' confirms that the construction industry is not accident free.

Accidents are directly related to the level of safety. In every industry, *safety at work* is an important term. Safety relates to "the protection of people from physical injury" (Hughes & Ferrett, 2011), and thus safety at work relates to the protection of workers from physical injury at work. For the construction industry, a more interesting aspect of safety is safety on site. The Dutch Labour Inspectorate (DLI) is verifying whether businesses' activities are according to various laws, such as the Dutch Working Conditions Act (in Dutch: Arbowet). The DLI frequently publishes reports which show the number of victims (workers that end up in the hospital or are permanently injured) and fatalities (workers that are killed) related to accidents at working sites in the construction industry. The number of casualties in the construction industry are visualised in figure 1.1. The reports from the Dutch Labour Inspectorate show that no downward trend in victims or fatalities is visible in the recent years. In comparison to other industries, the construction industry is placed second in the ranking of most dangerous industries with on average 133 victims per 100,000 jobs in the period from 2016 to 2020 (Cobouw, 2022a).

There can be various hazards, foreseeable and unforeseeable, which have the potential to cause harm (Cormie, 2013). The definition of hazard is defined in the Eurocode as "an unusual and severe event". Safety on site is about controlling the hazards that are present at a working site. The risk of an unwanted event can be diminished by implementing controlling interventions. By doing this, the probability or impact will be reduced and thus the risk is lowered, as can be concluded from box 1. However, not all hazards can be eliminated completely and therefore, this is done until the level of risk lies underneath a certain value. This value is a quantifiable limit and differs from situation to situation. The limit is called the As Low As Reasonably Practical (ALARP) limit (Jones-Lee & Aven, 2011). A non-zero risk value which lies under this ALARP limit means that there is residual risks left which can cause harm to people or materials. There are two elements of which one is often present when an accident happens, namely the presence of machinery or working at heights. Most incidents happen when workers are operating or cleaning machinery, or working on ladders, roofs or scaffolding.

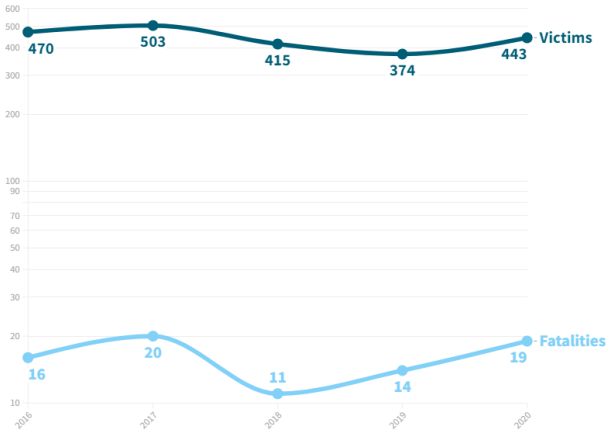


Figure 1.1: Number of casualties in the construction industry in the period 2016 - 2020, derived from Ministerie van Sociale Zaken en Werkgelegenheid (2021).

Besides safety on site, there is another aspect of safety that is critical for the construction industry in specific, namely structural safety. Structural safety refers to the deformation or destruction of on-going main or temporary structures in construction (Lin et al., 2019). Terwel (2014) combines the Eurocode definitions for *structural safety* and *reliability of structures* into one final definition: "Structural safety can be defined as the absence of unacceptable risk associated with failure of (part

Box 1: Risk

When risk is being judged, there are several different indicators that determine the level of risk such as the probability of an undesirable occurrence, the degree of seriousness, and the subsequent impact if it does occur (Zhi, 1995). In this research, Williams' definition for risk is adopted (1993) in which risk is defined as the function of probability and impact.

$$R = P \cdot I$$

In which risk R is the degree of risk, P is the probability of the risk occurring, and I is the degree of impact. Probability is quantifiable in a number between 0 and 1. Impact of often quantifiable in failure costs, or number of casualties (Janssens et al., 2012).

of) a structure". Foreseeable hazards which are relevant for structural safety can range from natural hazards to human induces hazards. A more detailed overview can be found in table 1.1. International studies and investigations on structural safety mainly focus on the different loads that were present on structures at failure, the baring capacity of the structure itself, and the poorly educated workers on site which are lacking knowledge to properly be aware of structural safety. Structural safety calculations are often based on the completed structure. This leads to a higher risk level during construction compared to the operational phase of a structure. The impact of a structural safety related event is normally greater than the impact of a safety at work related event. However, a structural safety related event can initiate a safety at work related event.

Table 1.1: Foreseeable hazards, derived from Vrouwenvelder (2014).

Normal loads	Accidental (naturel)	Accidental (manmade)	Human influences	Human errors
Self-weight	Earth-quake	Explosion	Vandalism	Design error
Imposed loads	Land slide	Fire	Demonstrations	Material error
Car park loads	Hurricane	Impact	Terrorist attack	Construction error
Traffic	Tornade	Mining subsidence		Misuse
Snow	Avalanche	Environmental attack		Lack of maintenance
Wind	Rock fall			Miscommunication
Hydraulic	High groundwater			
	Flood			
	Vulcano eruption			

During the 21st century, various severe incidents have happened at construction sites in The Netherlands in which workers and civilians were in danger, injured, or even killed. These incidents can be seen as individual incidents since they were caused by their own specific structural failure, but they show that besides safety on site & structural safety, safety of the surrounding area of the construction site is an important aspect too. The frequency of the occurrence of structural failures indicate that there are industry-wide problems which cause these constructions to be unsafe in both the execution and operational phase. Since such accidents should be prevented at all times, the Dutch Safety Board (DSB) was established in 2005. The aim of the DSB is to improve safety in The Netherlands, while focusing on situations where civilians are dependent on governmental institutions, businesses or organisations for their safety (Onderzoeksraad voor Veiligheid, n.d.). As an independent administrative body, they decide what incidents to investigate themselves. Their investigations are not only meant to determine direct causes of failures, but they also consider long-lasting safety failures and administrative processes that have an effect on safety. The DSB's recommendation for the Dutch construction industry is to integrate a third party into the contractual general terms and conditions such as the Uniform Administrative Conditions for Integral Contracts (UAC-IC) 2005. This UAC-IC is currently being revised. One of the main points of revision in the new UAC-IC is the mutual responsibility for quality management and contract management, for both the employer and contractor (CROW Ede, 2021). The construction industry is steering towards a more integrated responsibility distribution between employer and contractor in this new UAC-IC, without taking the DSB's main recommendation into account. A third party called "the Engineer" is already

standardised in the general terms and conditions of the Fédération Internationale des Ingénieurs-Conseils (FIDIC), a contract publishing organisation whose contracts are widely used internationally.

Literature offers several descriptions of FIDIC's engineer. Bunni (2005) states that "duties related to feasibility, design and supervision during construction of the project are entrusted to an independent engineer who is referred to as the 'Engineer' in the contractual arrangements between the employer and the contractor". Ndekugri et al. (2007) describe the engineer as the administration of the contract which plays a key role in unforeseeable site conditions and time management. Heaphy (2013) describes the role as "a central figure who operates and administer the contract on behalf of the employer, wielding the majority of the power under the contract and making most of the key decisions". Furthermore, Shnookal and Charrett (2010) state that the engineer has a central role in the certification process during the performance of the works. FIDIC (n.d.-c) themselves state that the engineer should put expert knowledge at the disposal of the client and serve the client, on engineering matters, as if they were his own. Based on the above stated literature it is clear that the engineer has a prominent role in managing the contract on behalf of the employer, has a central role in the certification process during construction, and has a supervisory role in the design phase and on site during construction. Furthermore this engineer is regarded as a adjudicator whenever it is needed (Bunni, 2005). These functionalities can all possibly have a positive influence on safety on site, safety of the surrounding area & structural safety. An adjusted version of FIDIC's Engineer could be integrated with the UAC-IC 2005 in order to solve the issues related to safety on site, safety of the surrounding area & structural safety.

1.1 Problem definition

The recommendation to integrate a third party is easier said than done. It is not exactly clear what this third party should actually do in practice in order to safeguard safety on site, safety of the surrounding area & structural safety in a construction project, and what responsibilities this third party should receive.

1.2 Current state of research and the research gaps

An introductory literature research showed that there is a reasonable amount of scientific and summarising literature available regarding general terms and conditions. In addition, literature regarding the role of FIDIC's engineer has also been found. The continued literate research is shown in the report. However, there are still some gaps regarding the research topic:

- First, plenty of research involving the UAC-IC is available. However, there is no research which offers an integration process of new third party into the UAC-IC.
- Second, the role of the Engineer has been analysed for various editions of the FIDIC contracts by different researchers. The research by Lina (1997) focuses on the ongoing criticism about the duality in the traditional role of the Engineer in the Red Book prior to the 1999 edition, while Ndekugri et al. (2007) focuses on the 1999 editions. Barakat et al. (2020) and Mohamed-Asem et al. (2020) analyse the changes in dispute resolution mechanisms for the 2017 editions compared to earlier editions. The Engineer's effect on the different types of safety has however not been investigated yet.
- Third, comparison studies regarding FIDIC contracts and national suitability have been performed in countries such as Sweden, United Arab Emirates, Australia, Palestine, and Qatar (Akulenka, 2013; Al-Saadi & Yas Khudhair, 2021; Besaiso et al., 2018; Mahasneh, 2020; Shnookal & Charrett, 2010). Studies regarding FIDIC which include a Dutch viewpoint have been performed by Cheung (2015), and Hasler (2014), but do not cover the role of the Engineer extensively within the Dutch legal framework.

1.3 Main objective

The objective of this research is to examine whether there is any potential to integrate a third party into the UAC-IC 2005 contract. This potential is being examined using a comparison between the UAC-IC 2005 and FIDIC Yellow Book 1999. In this comparison, the main focus points are the "vital tasks & responsibilities" that are necessary in order to safeguard safety on site, safety of the surrounding area & structural safety.

This research tries to open up the discussion regarding the obligation for a third party to be present in specific projects which use an integrated project delivery model (PDM), which is in contradiction with the philosophy of the new UAC-IC 2020. This new version of the UAC-IC is more focused on mutual coordination and responsibilities between employer and contractor, instead of a third party which takes over this role. To achieve this main objective, the research question and sub-questions which are presented in the following section need to be answered.

1.4 Research questions

The research question (RQ) and sub-questions (SQ) in this section are formulated in order to accomplish the main research objective and to assist in filling the gaps in literature.

RQ: In what way can safety on site, safety of the surrounding area & structural safety be improved by modelling a third party into the UAC-IC 2005, based on the experience of FIDIC's Engineer?

- SQ1: What are the industry-wide issues related to safety on site, safety of the surrounding area & structural safety in Dutch construction projects?
- SQ2: What is currently being done to tackle these issues?
- SQ3: What are vital tasks & responsibilities that need to be performed in order to safeguard safety on site, safety of the surrounding area & structural safety?
- SQ4: How is the vital task & responsibility distribution in the Yellow Book 1999 edition organised?
- SQ5: How is the vital task & responsibility distribution in the UAC-IC 2005 organised?
- SQ6: What are the differences to properly execute the vital tasks & responsibilities in both the UAC-IC 2005 and the FIDIC Yellow Book 1999?
- SQ7: How to model the Engineer as part of the UAC-IC 2005?

In the "Compodium Aanpak Constructieve Veiligheid", the following phases in the building process are distinguished (Spekkink, 2011, p. 81): the initial phase / initiation phase, design phase, execution phase, and the use phase. During this thesis research, the focus is on the design and execution phase. The initial phase and the use phase are excluded. The reason for this can be found in section 2.1.

1.5 Methodology

Verschuren and Doorewaard's *intervention cycle* is used in order to reach a solution related to practical oriented problems (2010). The intervention cycle contains five steps: the problem analysis, diagnosis, design, intervention, and evaluation. The problem analysis can be summarised as the agenda setting of a problem which makes stakeholders aware that there actually is a problem. In the diagnosis step, the causes of the problem are identified. In the design step, a plan can be developed in order to find a solution for the problem. In the intervention step, the actual design step is integrated. The evaluation step is there to verify whether the implementation of the plan has

actually solved the problem. Stakeholders are aware that there is a fundamental problem related to safety in the construction industry. This is concluded using the numerous articles and reports which have been published by different parties such as the DSB, Cobouw, and the Dutch Institution of Construction Law. The problem analysis step has therefore been finished. The underlying issues of these safety related problems have been investigated by the DSB. In this research, it is assumed that all underlying issues have been found in order to go to the next step in the intervention cycle. This research most closely resembles the third step of the intervention cycle and therefore is a design-oriented research.

Within this design-oriented research, there are two main research strategies. The first research strategy that is used is *desk research*. Verschuren and Doorewaard (2010) has defined desk research as a strategy in which the researcher does not gather empirical data herself or himself, but uses material produced by others. The 'material produced by others' that is meant here, is knowledge produced by others. The variant of desk research that is used here, is a literature review. This research strategy is used to find the the underlying issues that cause a lack of safety in the Dutch construction industry (SQ1). To identify these underlying issues, an analysis of available papers on safety in the construction industry is performed first. Second, an analysis of the investigations that have been conducted by the DSB is performed. These investigations can be seen as case studies, which have the following characteristics: a major safety related accidents has happened at a construction site, workers or civilians have been in danger due to this accident, and the accident took place in The Netherlands. The case studies are listed below:

- Falling facade plates throughout The Netherlands (Onderzoeksraad voor Veiligheid, 2006)
- Collapsed concrete floor at the B-Tower in Rotterdam (Onderzoeksraad voor Veiligheid, 2012b)
- Partially collapsed roof of soccer stadium Grolsch Veste in Enschede (Onderzoeksraad voor Veiligheid, 2012a)
- Collapsed cranes on pontoons in Alphen aan den Rijn (Onderzoeksraad voor Veiligheid, 2016)
- Partially collapsed parking garage in Eindhoven (Onderzoeksraad voor Veiligheid, 2018)
- Partially collapsed roof of soccer stadium AZ in Alkmaar (Onderzoeksraad voor Veiligheid, 2020)

Furthermore, this literature review strategy is used to find out what has already been done and tried to enhance safety (SQ2), and to find the vital tasks & responsibilities that must be performed in order to enhance safety (SQ3).

During the next step of this research, the same literature review strategy is used in order to find the tasks and responsibility distribution in the FIDIC Yellow Book 1999 contracts (SQ4), and to analyse the task and responsibility distribution in the UAC-IC 2005 (SQ5). Information sources that are used in this literature review are the internet, scientific articles, books, and most importantly: contract documents and the general terms and conditions of both the FIDIC Yellow Book 1999 edition and the UAC-IC 2005. The General Conditions of FIDIC are used in order to analyse a set of general terms and conditions in which a third party is already integrated. This Yellow Book 1999 edition is able to govern multiple integrated project delivery models, just as the UAC-IC 2005 is able to. Therefore, the Yellow Book is most comparable to the UAC-IC. The more recent Yellow Book 2017 edition is not used since there is more expertise available for the Yellow Book 1999 edition.

In addition to the literature review strategy, interviews are used as a second research strategy. Answers on sub-questions 4 and 5 using only the literature review strategy would end up very theoretical, with own interpretation of the practical situation. The interviews provide insights in a more realistic point of view from experts, and they help to answer both sub-questions 4 and 5. The type of interview that is used in this thesis, is the semi-structured interview. An important advantage of semi-structured interviews is that it is found to be successful in achieving a certain level of interaction between the interviewer and interviewee (Galletta & Cross, 2013), which enables the

interviewer to improvise follow-up questions based on the response of the interviewee (Hardon et al., 2004). The interviews are taped with consent of the interviewee. The method of recording relates to the location of the interview. If the interview is conducted via MS Teams, the meeting is taped with audio and video. If the interview is conducted in person, only the audio of the interview is recorded via a voice recorder application. At a later moment in time, the interviews is transcribed in a verbatim manner which can be found in appendices C.5 to C.8. The data is accordingly extracted in the form of quotes. These quotes are all coded, consisting of the word "QUOTE", a number which is traceable to one of the interviewees as can be seen in C.1, and the quote number which can be found in ascending order in the transcribed interviews. The aim of the semi-structured interviews is to get the interviewees perspective on the practical situation.

Having answered the first five sub-questions using a literature review and conducting interviews, a comparison on the vital tasks & responsibility distribution is made between the FIDIC Yellow Book and the UAC-IC in order to find the differences between the two contractual models. These differences are not only based on the textual clauses of both contracts, bot also on certain motives that the involved parties have to properly execute the vital tasks & responsibilities (SQ6). Both the information gathered in the literature review stage and the interview stage is used to make this comparison. The gathered data using the literature review and interviews, are used as argumentation whether an Engineer can enhance safety in the Dutch construction industry. If the outcome shows that a Dutch Engineer role could enhance safety in the Dutch construction industry, this research concludes with a model in which a Dutch Engineer is integrated into the UAC-IC 2005 contract (SQ7). A flowchart of the research steps can be seen in figure 1.2.

This research can be categorised as a qualitative and exploratory research. The expected result of this research is a new model of the UAC-IC in which an third party is integrated. Furthermore, tasks and responsibilities are described in this model. In the end, all sub questions are of help in answering the main research question. This research is accompanied by Witteveen+Bos, which will be of help providing certain literature, expert knowledge and insides, and are of help by providing professionals for the interviews.

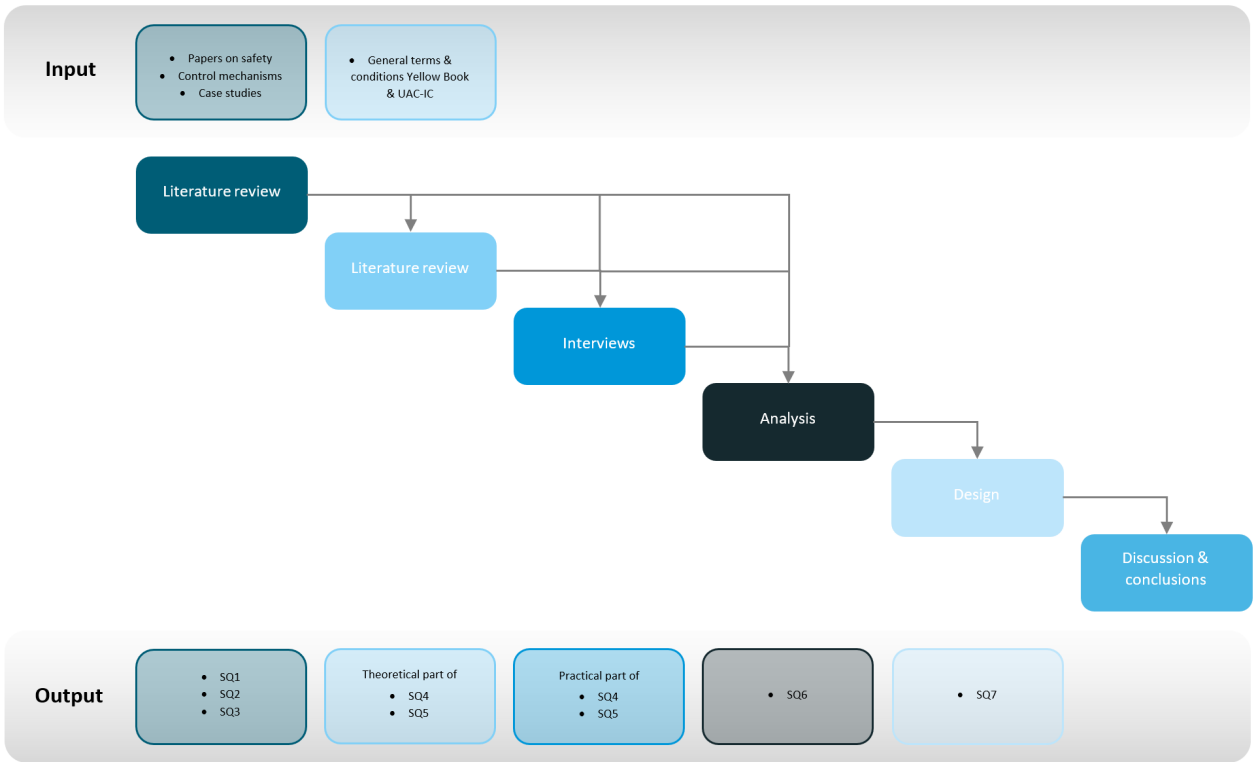


Figure 1.2: Flowchart of the research steps that are taken in this research, including the input and output for every step.

2. State of the art - Literature review

In this chapter, a state of the art literature review is conducted regarding safety on site, safety of the surrounding area & structural safety. First, a literature review regarding previously identified safety related issues is conducted in section 2.1. Section 2.2 focuses on one of the most important safety related issue, namely the different control mechanisms. In section 2.3, six cases are analysed after which their underlying and mutual issues are assessed in section 2.4. Section 2.5 highlights the Law safeguarding quality for building, the latest development in the Dutch construction industry which should tackle the lack of quality and safety. The chapter ends with a summarising and concluding section. In this section, it is first checked whether the previously identified issues from section 2.1 are the same as the underlying issues in the case studies as shown in section 2.4. Furthermore, a suggestion regarding vital tasks and responsibilities is given. These vital tasks and responsibilities are the direct result of the underlying issues identified in literature and the case studies, and can therefore affect the safety on site, safety of the surrounding area & structural safety level in a positive way. This chapter answers the first three sub-questions.

2.1 Safety related issues identified in literature

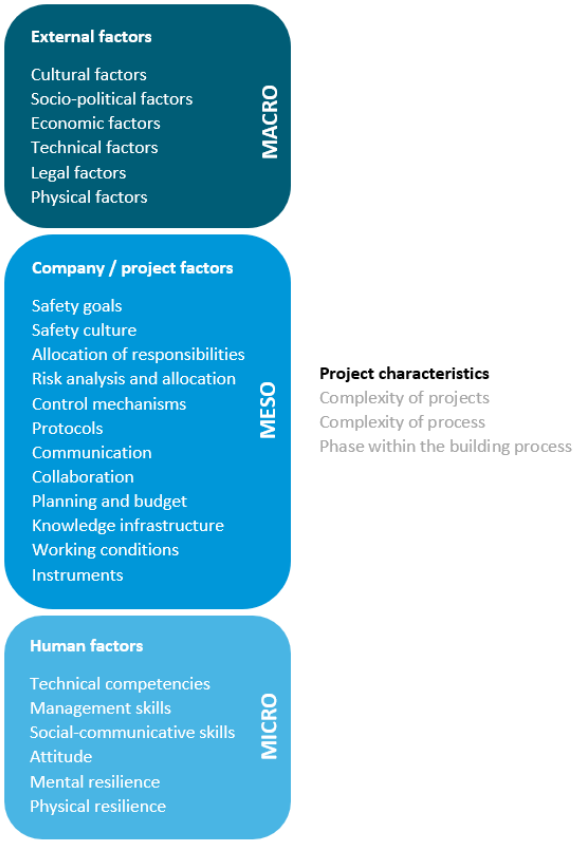
Research (for example Ellingwood (1987), Fruwald et al. (2007), and Schneider and Matousek (1976)) has concluded that the majority of structural failures is caused by human errors. Terwel (2014) has analysed three databases which include structural failures with a total of 741 events. His analysis shows that:

- 85% (non-weighted average) of structural failures occur at buildings.
- Concrete, steel or reinforcement is involved in 68% (non-weighted average) of the structural failures.
- 85% (weighted average) of the failures occurs in the design or execution phase.
- approximately 90% (weighted average) of structural failures are caused by human errors.

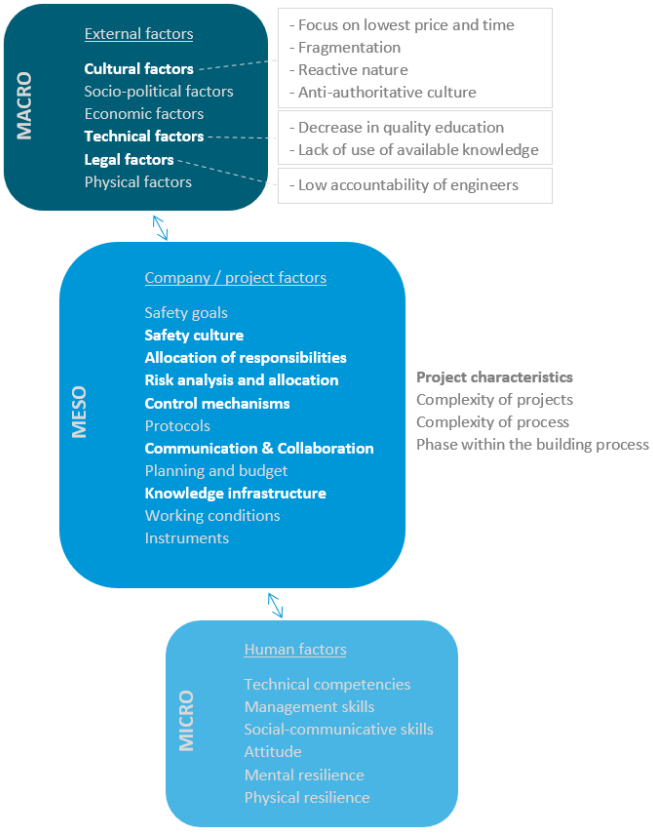
Examples of human errors during the design and execution phase are listed below (Terwel, 2014):

- Design errors:
  - Incorrect modelling or calculation error
  - Incorrect dimensions on drawings
  - Conflicting drawing and calculation
  - Absence of drawing and/or calculation
  - Other design errors
- Execution errors:
  - Insufficient quality of materials applied
  - Incorrect assembling of elements on the building site
  - Insufficient amount of material used
  - Erroneous measurements on the building site
  - Other execution errors

Research (for example Vrouwenvelder (2014)) has shown that there are underlying factors that influence human errors. Van Duin (1992) has suggested to arrange these factors in three levels: country or sector factors (macro level), organisational factors (meso level), and human factors (micro level). Factors available in literature were selected and filtered by Terwel and Vambersky (2013), and finally organised into a framework which can be seen in figure 2.1a. At the macro level, external factors are listed which are related to the context in which a project is situated. These factors are usually hardly influenceable by project parties. At the meso level, a distinction is made between company factors, projects factors, and project characteristics. Company factors take into consideration that each company brings along its own culture, habits, and working conditions. Project factors relate to the collaboration of the different parties within a project. Project characteristics relate to the level of complexity, project type, and the phase a project is in. At the micro level, underlying human factors are mentioned.



(a) Framework of possible underlying factors on macro, meso, and micro level, derived from Terwel and Vambersky (2013).



(b) The most crucial factors which can influence structural safety according to Terwel (2014). These factors are highlighted in white. The arrows indicate that factors on a specific level can influence other levels.

Figure 2.1: All possible underlying factors, and the most important ones which can affect structural safety in the construction industry found in literature.

Terwel performed an extensive literature review on the factors which could influence structural safety at the macro level. The outcome of this review shows that cultural factors, technical factors, and legal factors can have a negative influence on structural safety. He calls these factors "threats" for structural safety. Focus on lowest price and tightest schedule, fragmentation, a reactive nature, and an anti-authoritative culture are the most important cultural factors which establish the cultural threats. A declining educational quality and the lack of use of available knowledge within the sector are the most important technical factors which establish the technical threats. A low level of accountability for advisors such as engineers, is considered the main threat for the legal factors.

Furthermore, Terwel used a questionnaire to find the most crucial factors which affect structural

safety during a construction project at meso and micro level. In the questionnaire, Terwel used the delta approach and direct judgement method to identify the most crucial factors. The outcome of both approaches for the meso level factors can be found in table A.1. The factors at the micro level were not taken into account in the direct judgement approach. The delta approach showed that the factors at meso level are more statistically significant compared to the micro level factors. Terwel highlights that factors at the micro level could however influence factors at the meso level, and vise versa. This also holds for factors at macro and meso level. The factors at meso level that are the most crucial factors according to the questionnaire are:

- Communication & collaboration
- Control mechanisms
- Allocation of responsibilities
- Risk management
- Safety culture
- Knowledge infrastructure

The most crucial factors at the three levels, are highlighted in white in figure 2.1b. The magnitude of contribution to safety for the various factors have not been determined. In section 2.5 this thesis will conclude whether these factors are also present in the analysed case studies from section 2.3.

2.2 Control mechanisms

One of the most crucial factors which is able to influence safety, as identified in section 2.1, are control mechanisms. As stated in section 1, this thesis focuses on the general terms and conditions of the UAC-IC 2005 and the FIDIC Yellow Book. These general terms and conditions are able to facilitate different integrated project delivery methods in which a contractor is responsible for the design and execution of the works. Controlling the works of the Contractor helps to improve safety (Terwel, 2014, p.145). The primary processes are essential to fulfil in order to build a structure. The control mechanism are not essential to eventually build a structure. With competing goals present such as time, budget, and quality, it is easy to omit a control mechanism. Leaving out a control mechanism will however be to the detriment of safety (Terwel, 2014, p.33). There are four types of control mechanisms which are different based on who is actually performing the control mechanism, namely:

- Internal self control (Stewart & Melchers, 1989)
- Internal overview control (Stewart & Melchers, 1989)
- External independent control (Terwel, 2014)
- External authority control (Terwel, 2014)

An internal control mechanism means that the party who is responsible for the works, is also the party which is responsible for the control mechanism of the works. Internal self control holds that the person who is working on a task, is responsible for the immediate monitoring and correction of his deliverable. This self-checking process is considered as something which every designer, engineer, or contractor applies in practice (Stewart & Melchers, 1989). Internal overview control holds that a senior colleague is responsible for the monitoring and correction of a deliverable. This senior colleague must have sufficient available time (Stewart & Melchers, 1989). External independent control holds that an independent party is responsible for the needed checks of the works. An example of external independent control is a Technical Inspection Service (TIS) (Terwel, 2014). External

control can also be the responsibility of the municipality. In this case, this is named external authority control (Terwel, 2014). Control mechanisms go further than either internal or external control. When applied both, an internal control mechanism prior to an external control mechanism, a double assurance is in place which provides a control mechanism for a control mechanism (Terwel, 2014; Vambersky & Terwel, 2009).

What is even more important than a control mechanisms, is an effective control mechanism. Effective in this context is twofold: the right things must be checked in the right way. Terwel states that risks analysis are best to be used in order to point out the situations that need special attention, i.e. find the right things that must be checked. To perform a control mechanism in the right way, one should first make a proper choice of which control mechanism to use. For the simplest job possible, no external authority control or double assurance is needed. Second, an incentive or stimulus must be present. This incentive can mean a shift in accountability, e.g. in terms of magnitude of liability (Terwel, 2014, p.147).

2.3 Case studies

The five cases described in section 1.5 have been reason for the DSB to start investigating safety on site & structural safety in the Dutch construction industry. The outcome of these investigations not only showed the importance of safety on site, but also highlighted a industry-wide problem related to structural safety during the design, execution, and operational phase. Sections 2.3.1 to 2.3.6 give an analysis of the cases.

2.3.1 Falling facade plates across The Netherlands (2005)

This paragraph is based on an investigation report by the Onderzoeksraad voor Veiligheid (2006).

At four locations, glass and stone facade plates fell off onto crowded pedestrian paths, resulting in life threatening situations for civilians. One person was injured during those four incidents, but the outcome could have been worse. Four more incidents were reported prior to 2005. The report shows that mistakes were made during the design, execution and operational phase of the projects.

- During the design phase, not enough effort was put into the verification of requirements from the building decree, and there was a lack of communication between different designers which worked on the same interface between facade and the building. When permits needed to be granted by municipalities in order to start building, the designers themselves did not check the designs which they handed over to the municipality, i.e. the internal control mechanism was not present. Quality control was in fact only done by the municipalities, which were often not able to do this properly due to a lack of resources. Therefore, the external control mechanism was lacking.

- During the execution phase, there was a lack of supervision by the employer on the quality of support structures. The actual quality of the workers and their performed work was insufficient. According to a interviewee, a contractor which has a build-in quality assurance system set up with an internal control mechanism present in the design phase, is no reason for the employer to neglect quality control and his external control mechanism during the execution phase.

- During the operational phase, the owner of the deliverable, who is responsible for the overall structure in this phase, only conducted visual inspections of the facade plates which could not result in an accurate representation of the state of the facade supporting structure. At the time, there were no specific guidelines on how to inspect facade plates and its support structure.

Besides the causes identified above, the DSB states more problems during the overall processes: risks were not documented in a structured manner and they were not documented enough; employers and

contractors were not aware of the responsibility they had related to structural safety; there is a lack of communication between parties during the design and execution phase; municipalities are not capable (enough) to check complex designs and therefore to grant permits; there is a lack of supervision and control during the design and execution phase; and post-incident investigations are too often focused on incident-related causes instead of industry-wide causes.

2.3.2 Collapsed concrete floor B-Tower Rotterdam (2010)

This paragraph is based on an investigation report by the Onderzoeksraad voor Veiligheid (2012b).

While cast-in-situ concrete was being poured on the third floor of the B-tower on the 21st of October, approximately 300 square meters of floor collapsed and came down 11 meters below. Five workers were severely injured in the incident. The DSB identified that the temporary scaffolding that should have supported the cast-in-situ floor collapsed. This could happen because of several factors.

- The risks related to a failing scaffolding structure were misjudged during all phases of the project. The risk of a failing support structure was briefly mentioned during a start-up meeting and in safety documents. However, no efforts to mitigate the risks were taken in practice.
- The team of workers that was hired by the sub-contractor to build the scaffolding structure, was not certified to do this. As a result of this and their overall incompetence, they only installed 4 crossbracings instead of the 59 which should have been present according to the design. When the scaffolding designer came on site, he noticed that crossbracings were missing. The designer phoned the main contractor, but it is not sure until what extend his message became clear. The main contractor did not make sure that the remaining crossbracings were installed, and the scaffolding designer did not perform any follow-up checks to inspect whether they were installed later. The lack of crossbracings led to an unstable scaffolding system which was not able to support the weight of the concrete floor.
- There was a lack of inspections regarding the quality of the scaffolding works. The designer of the scaffolding should have instructed the team of workers that were building the scaffolding system. This designer should also have performed regular inspections regarding the quality of the scaffolding system. However, these instructions and inspections were only conducted once a week. Furthermore, no final check of the scaffolding was performed by the scaffolding designer and main contractor before it was handed over to the main contractor to pour the cast-in-situ concrete.
- The sense of responsibility for the quality of the scaffolding structure was lacking by all parties. The main contractor neglected his responsibility of the support structure on which they were pouring concrete, since he did not check the design and quality of the scaffolding at any stage. The main contractor assumed that the sub-contractor was responsible for this. The sub-contractor was in fact responsible for the scaffolding, but did not act like this because it hired a scaffolding designer, and a team that was able to built the support structure. The sub-contractor only wanted to be informed about the process and assumed that the designer would inspect the structure. However, the designer and sub-contractor did never agree on any formal inspections. Therefore, the designer did not feel any responsibility regarding the overall structure and neglected the inspections on which he verbally agreed.

2.3.3 Collapsed roof Grolsch Veste stadium (2011)

This paragraph is based on an investigation report by the Onderzoeksraad voor Veiligheid (2012a).

During the extension of the grandstand on the 7th of July, the steel structure of the roof came down. Two workers died, and nine workers were severely injured during the incident. The DSB identified three direct causes which led to the incident. First, essential parts of the steel structure were not in place yet. Second, the steel structure did not fit on the concrete sub-structure and therefore the

steel structure was deformed using force which led to a reduction in resistance capacity. Third, the unfinished steel structure was already loaded with finishing materials, maintenance structures, and workers. When a temporary stability element was finally removed, an unstable situation led to the failure of the roof. The collapse could eventually happen due to several other factors.

- During the design phase, the feasibility of the construction planning was not checked. This led to clashes between different interfaces during the execution phase, e.g. between construction of the staircases and construction of the steel roof elements, or between the steel roof elements and roof finishing.
- Due to a tight schedule, the main contractor decided to use the unfinished steel structure to start applying roof finishing. The main contractor argued that if the steel structure would not have been safe, the sub-contractor which was responsible for constructing the steel structure would have told him before his workers would enter the structure. This reasoning was influenced by trust in the sub-contractor, due to previous experiences. When the main contractor entered the structure and started working, the sub-contractor however thought otherwise. The sub-contractor thought that the main contractor made stability calculations of the unfinished steel structure before he would let his workers enter the structure.
- The main contractor neglected his obligation to coordinate and perform inspection on the steel structure. the Dutch Labour Inspectorate and municipality trusted the workers based on previous successful projects, and did not perform any inspections.

Furthermore the DSB concludes that: problems were solved by sub-contractors without interference of the main contractor; the employer did not perform intermediate inspections but only planned one final inspection after the construction would be completed; responsibilities regarding structural safety were clear in the contract phase however, no-one acted responsible in practice; the main contractor did not inspect the concrete sub-structure before the sub-contractor started construction of the steel roof structure, there was no clear handover moment; regular inspections were not conducted because parties trusted each other; responsibilities between interfaces were not clear; and risk identification was seen as an administrative task instead of a measure to ensure safety.

2.3.4 Collapsed cranes on pontoon Alpen aan den Rijn (2015)

This paragraph is based on an investigation report by the Onderzoeksraad voor Veiligheid (2016).

A crane operation in Alpen aan den Rijn became a disaster when two cranes and the part of a bridge they were lifting became uncontrollable. As a result of this, both cranes fell of their pontoons on which they were placed, destroying several houses. One person was rescued from underneath the debris. Miraculously, no one was injured during the event. The DSB states that the main direct cause of the incident can be found in the combinations of cranes and pontoons which led to an unstable situation during the lift of the bridge piece. Indirect causes are found earlier in the process.

- The crane lifting and pontoon sub-contractors misjudged the risks related to stability and safety in their lift-approach-plan and underestimated to overall complexity. As a result, there was zero margin for negative external effects such as wind or deflection of the cranes during the lift procedure.
  - No safety margins were included in the stability calculations.
  - The cranes were loaded to their full loading capacity to optimise costs.
  - Cranes and pontoons would have to manoeuvre outside of their safety zone.
  - No ballast plan was made for the pontoons, even after it was noticed that there was no ballast plan.
  - Both parties were focused on their individual tasks instead of an integral approach towards the job.

  - Both parties based their actions on trust instead of agreements.

- The individual sub-contractor's project leaders were experienced and had a huge amount of influence during the project. Because of their experience and routine, their work was not checked frequently. Even after some project engineers identified some safety issues regarding stability documents, the project leaders stated that it would all be resolved during the execution phase.

- Within the main contractor, which was a combination of two parties which were respectively responsible for 20% and 80% of the overall activities, decisions were taken without informing each other which led to an increase of frustration towards each other. This also made responsibilities of individual parties within the main contractor more unclear. As a result of the vague and diffuse responsibilities, the lift-approach-plan was approved by the main contractor without undergoing a thorough check.

- Every involved party had their individual safety documents and activities like V&G and TRA, but there were no integrated plans or activities which were spoken through together. This also holds for risk identification documents which were extensive on an individual level in the first phase of the project. However, there were no integrated documents and in practice, no-one acted based on these risk documents.

The DSB also classifies the role of the municipality as distant. The municipality trusted the main contractor, and did not perform any checks during the design phase. The municipality also failed to identify risks related to societal safety for residents close to the renovation activities. Furthermore they did not ask for any safety assurance plans when the contractor asked for permits.

2.3.5 Collapsed parking garage Eindhoven (2017)

This paragraph is based on an investigation report by the Onderzoeksraad voor Veiligheid (2018).

One month before a parking garage near Eindhoven Airport would be finished, it partially collapsed on the 27th of May. Debris came down outside of the enclosed area. No one got injured in the incident, partly because of the absence of any workers at the time of failure. The DSB identified that the incident was due to the lack of appropriate reinforcement between floor elements. There were several indirect causes which induced the lack of reinforcement.

- The financial opportunity that was created by the employer was strict due to a restricted amount of money a contractor could bid in order to do a valid tender submission, and the inclusion of a penalty clause for not fulfilling all requirements in their tender. One of these requirements was a thin floor design in order to be as environmental friendly as possible. During the first round of procurement, one contractor expressed his concerns regarding the risks related to the contractual maximum floor thickness, in combination with the budget cap and penalty clause. In the second round of procurement, the same contractor stated his concerns again, even though the employer increased the maximum floor thickness requirement. Due to this repeated concerns, the employer asked other parties involved in the procurement procedure if they shared the same concerns. No other party stated any concerns related to the limited contractual floor thickness. From that point onward, the employer did not show any concerns regarding the maximum floor thickness requirement in any phase of the project.

- The main contractor which was awarded the project, lowered its price rate to be competitive in the procurement procedure. However, already in the beginning of the execution phase the project predictions indicated an overall loss for the main contractor.

- The contractual agreement between employer and main contractor was based on the UAC 2012, in which the employer was responsible for the design of the parking garage. The main contractor agreed on making a more detailed design of the floors which would fit within the prescribed dimension requirements. The employer therefore assumed that the overall design

responsibility was transferred to the main contractor. However, only the design responsibility of the floors was transferred to the main contractor. During the execution phase, the employer's agent did only perform one inspection, since they expected the main contractor to do this themselves. The main contractor was not aware that the employer assigned any responsibility to them since the overall construction was based on a UAC contract.

- The employer's agent needed to perform checks regarding the constructive coherence of the overall deliverable. At the same time, they themselves were partly responsible for the design of the foundations and columns. Their own designs were never checked by anyone.

- The main contractor had their own procurement process to find a party which could design the floors. The eventual designer decided to deviate from the typical design due to the large span width. As a result of this, the floor elements were rotated 45 degrees which furthermore led to a cheaper design compared to a typical design. No party realised that the rotation of the slabs led to a vulnerable design. Constructive calculations were not shared by the designer because of competitive reasons during the tender procedure. The main contractor trusted the floor designer because of good experiences in the past.

- The quality assurance system between employer and main contractor, was not used in practice as agreed on by the main contractor. As a result of this, signals which were indicating a constructively poor design were neglected.

2.3.6 Collapsed roof AZ stadium (2019)

This paragraph is based on an investigation report by the Onderzoeksraad voor Veiligheid (2020).

After being in operation for 13 years, a part of the roof of the AZ soccer stadium collapsed on the 10th of August. At the time, there was no crowd present. No one got injured during the incident. The DSB identified that four welding joints in the steel support structure failed. Since the stadium was already delivered a long time ago at the time of the collapse, it was harsh to identify any indirect causes related to the involved parties during the overall construction process. However, the DSB identified several possible underlying causes.

- The steel roof structure was connected to the steel grandstand structure. The node which connected the two had an unusual design. As a result, the stresses that acted on this node in practice were different than thought during the design phase. In addition, the wind load that was taken into account during the design phase was not appropriate for the actual construction. The designer, engineer, contractor, and municipality did not analyse whether the steel structure was designed according to the NEN-norm. In practice, the node did not comply with these standards, partly because of the complex design and inappropriate wind loads. The parties involved failed to verify this during the process.

- During the execution phase, the sub-contractor that was responsible for the construction of the steel structure, had limited availability of information regarding the welding joints. Important information related to minimum welding joint thickness, and material that should be used was not specified. The dimensions of the used profiles in the connecting node led to a limitation of the maximum thickness of the welding joints. Profiles needed to be deformed in order to achieve the desired thickness. However, which of the two profiles needed to be deformed was not specified. This led to the threat that any sub-contractor could construct the steel structure using his own interpretation. No inspection on the quality of the welding joints was performed during construction because the main contractor trusted his sub-contractor based on previous experiences. During post-incident inspections, the DSB identified that welding joints were executed too thin, and welding joints were missing at important places.

- The DSB also hypothesize that a high-intensity wind event induced a crack in the welding joint that failed first. During the years after, the crack started to corrode and grew bigger. The

amount of corrosion indicated that the process until failure took approximately ten years. Four years before the roof collapsed, the failed welding joints were painted. The painter decided to not remove the corrosion but just painted over it. When the corrosion would have been removed, a crack might have been identified. The painter did not pointed out the corrosion to the stadium manager. No one succeeded to identify the danger during the operational period.

2.4 Underlying issues in case studies

The cases in sections 2.3.1 to 2.3.6 highlight that there are structural issues related to safety on site, safety of the surrounding area & structural safety in the construction industry. Every now and then an incident keeps happening, and the recent NEC stadium incident in 2021 in which a grandstand fully loaded with crowd partly collapsed, does not prove otherwise. The direct causes found in the previous sections can all be seen as individual, and unrelated issues since they all happened at different projects. However, a lot of similarities in the cases can be found in the indirect causes of the incidents. Contextual aspects will be discussed in section 2.4.1, the obstacles in policy of different parties in section 2.4.2, and the influence of trust in section 2.4.3.

The underlying issues which are described below, are the result of several investigation of the DSB. *Section 2.4 is a brief summary based on the parking garage Eindhoven report (Onderzoeksraad voor Veiligheid, 2018, p.57-75).*

2.4.1 Contextual aspects

The cases show that safety on site & structural safety cannot be safeguarded because parties are acting in an environment that involves four main contextual aspects. These four main aspects enlarge the risks for incidents to happen.

Competition based on price instead of quality

The tender phase is the most important phase of a project to agree on a realistic price that is in proportion to the project scope, quality, and risks. In practice, price is the most important aspect on which contractors can compete with others. Even when EMVI-criteria (in Dutch: Economisch Meest Voordelige Inschrijving) are being used, which are meant to award theoretical discounts regarding criteria which the employer pursues, price can have the most heavy weighting. When no party can distinguish themselves based on quality, a lower price will automatically give an advantage to win the bid (Onderzoeksraad voor Veiligheid, 2018, p.57-59).

Diffuse responsibilities & coordination

The contractual agreement is the most important part where responsibilities can be determined in order to safeguard structural safety. When a mixture of a traditional PDM and an integrated PDM is used during the project, the risk that the responsibility distribution is not clear for involved parties, increases (Onderzoeksraad voor Veiligheid, 2018, p.59-60). The needed checks will therefore not be performed, and the responsibility will not be fulfilled in practice. Attitude and behaviour also need to be in accordance with the contractual responsibility of a party. If not, tasks and responsibilities, especially within interfaces, will not be conducted according to plan. Additionally, parties only feel responsible for their own part of the work. The earlier mentioned interfaces are neglected. Since these interfaces are neglected, there is a lack of communication between parties that share the same interface. It is very interesting to note that parties often do not even read the contract at all (Cobouw, 2022b). Responsibilities cannot be clear for a party when they have not taken a look at the contractual obligations they have.

Organisational complexity

Besides the employer and main contractor which are always involved in a construction project, many advisors, sub-contractors and suppliers are involved too. The construction industry is characterised more and more by fragmentation (Onderzoeksraad voor Veiligheid, 2018, p.61-63). This leads to organisational complex projects. The reason for this fragmentation is threefold. First, due to complex requirements and goals it is unreasonable to think that one party could be able to accomplish them all. Therefore, knowledge needs to be bought by hiring other parties. Second, resources are time and place bound. For logistic reasons, it is sometimes better to hire material and people close to the project location instead of importing them from one's own location to the project site. Third, the construction industry is sensitive to fluctuations of the economy. Economic downturn could result in overcapacity of workers if they would be permanently employed at a contractor or employer. Therefore, parties hire external personal in order to achieve the needed flexibility. The advantages of outsourcing do however not always make up for the disadvantages of organisational complexity.

Techniques are operated on their limit

Employers are increasingly focusing on environmental friendly, and aesthetically requirements. This leads to the need to innovate for contractors. Techniques need to be operated more and more on the limit of their technical capabilities in order to achieve the goals, making as little costs as possible. This unfortunately happens at the expense of built-in safety margins (Onderzoeksraad voor Veiligheid, 2018, p.63-64).

2.4.2 Obstacles in organisations

The cases highlight that the policy of involved parties is one of the components that influences the ability to safeguard safety at work & structural safety during a construction project. In this section, the policy of contractors, employers, and asset owners is described.

Contractor's organisation

Safety goals are established by the organisational management, and these aspirations are named in official documents such as annual reports. The "tone at the top" is most important for this establishment. Safety at work & structural safety are organised in different ways in the contractor's management structure. There are two levels of policy making that can be distinguished: the business policy level and a project policy level. At the business policy level, it is a continues process of achieving goals during the lifetime of the entire business. In opposition, the project policy level is time bound to the duration of a project. In order to find out whether the intended safety goals are also met in practice, the PDCA-cycle can be used for both policy levels.

Box 2: PDCA-cycle

The PDCA-cycle in based on the principle that one needs to check whether intended goals are actually achieved in practice. There are four stages in this cycle (Managementmodellensite, n.d.):

First, a strategy needs to be made in order to achieve the desired goal (**Plan**). Second, this strategy needs to be executed in practice (**Do**). Third, verification is needed to monitor whether the strategy actually has been executed in practice (**Check**). Fourth, if the outcome of this verification shows that there is a difference between the strategy and the actual execution of that

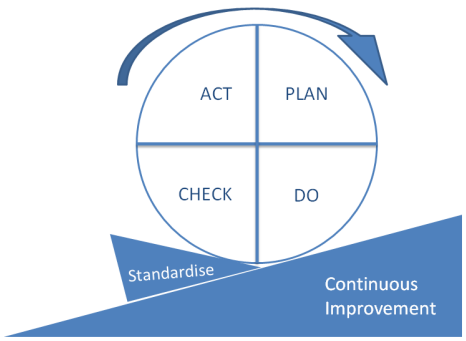


Figure 2.2: PDCA-cycle by W.E. Deming (CURIS, n.d.)

strategy, one has to make the decision to improve (**Act**). The four steps are visualised in a cycle (figure 2.2) because the decision for improvement will result in a revision of the strategy, and so on. By iterating the cycle, the process will eventually improve continuously. This only holds when the process is standardised within an organisation.

Safety at work (in Dutch: arbeidsveiligheid) is organised at a business policy level (Onderzoeksraad voor Veiligheid, 2018, p.65). Contractors are obligated to organise a safe work environment for their workers (plan-phase). Safety at work is not seen as project specific, but needs to be present at all times and at all places in the organisation. Contractors have organised this in a department which is called the Health & Safety department, or QHSE department which includes quality and environmental aspects. In this department, safety at work is looked after centrally at a business policy level (do-phase). This department provides guidelines which need to be followed at the project policy level. When something happens in practice (project policy level) that was not foreseen, a feedback loop between business policy level and project policy level makes sure that this risk is anticipated on in future projects (check-phase & act-phase). Because safety at work is organised at a business policy level, and the feedback loop between business policy level and project policy level is closed, the organisation is able to learn from accidents.

structural safety is organised at a project policy level (Onderzoeksraad voor Veiligheid, 2018, p.66). Contractors are approaching every project as unique with its own particular requirements: a project is approached as a prototype. structural safety, which is a requirement for every deliverable, is therefore project specific. Contractors have organised this at a project policy level using engineering and design departments which can offer support on specific subjects depending on the project needs and type of contract. Structural risks are identified in the early phases of a project (plan-phase). Since this is done at a project policy level, only the people involved in the project can identify the risks that might arise. Whenever an unidentified risk occurs which was not present in the plan-phase and has never happened before (using the experience of the people working on the project), the check-phase from the PDCA-cycle is not realisable. Therefore, the risk is not added to the risk management system, or other risks are not adjusted. No one considers structural safety at a business policy level because the feedback loop between the two levels is not closed. Because of this lack of considerations at a business policy level, there is a lack of guidelines which should support the project policy level in their plan-phase, and therefore should be of assistance for the check-phase. Since the PDCA-cycle and the feedback loop between the two policy levels are not closed, this does not lead to continues improvement of structural safety. The construction industry is not learning from accidents.

For both safety at work & structural safety, the PDCA-cycle of the two policy levels, and the feedback loop between the two policy levels are visualised in figure 2.3. One of the reasons for the contractor's management structure to be as it is, is due to governing law. The Dutch Working Conditions Act clause 2.35 causes the contractor to be obligated to take measures in order to safeguard safety at work (Arbeidsomstandighedenbesluit, 1997b). They have therefore managed this at the business policy level. structural safety does not has a constitutional stimulus such as safety at work, and therefore the contractor does not feel the need to manage this in an integrated manner at a business policy level. Safety on site however, continues to be a problem, even though it is an essential part of safety at work.

Employer's organisation

The employer is responsible for the identification of safety at work related risks, the evaluation of these risks, and they need to take measures for project specific risks according to the Dutch Working Conditions Act (in Dutch: Arbowet) article 2.28 clause 1 (Arbeidsomstandighedenbesluit, 1997a). The employer is the central entity that is responsible for governing safety at work. The contractual agreements that are made in the contract are the starting point for a responsible realisation of the project related to structural safety. The employer's attitude is crucial for the safeguarding of structural safety (VROM-inspectie, 2008). Whenever the employer does not focus on structural

safety, it does not automatically lead to a process where structural safety is safeguarded by other involved parties.

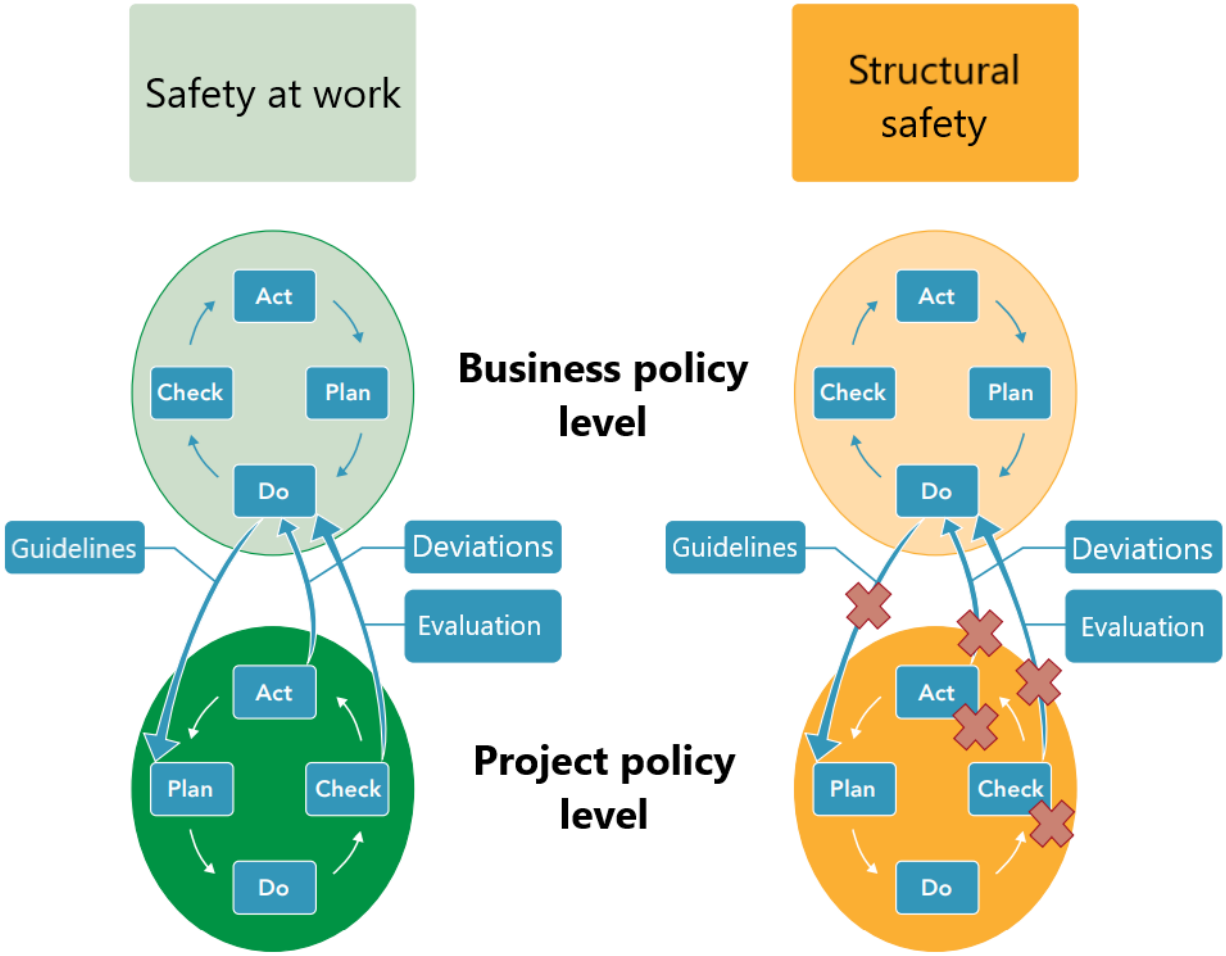


Figure 2.3: Policy processes for safety at work & structural safety, based on Onderzoeksraad voor Veiligheid (2018).

Asset owner's organisation

Structural safety related risks can not only occur during the execution phase of a project. Years later, during the operational phase, risks can still happen which could cause casualties. According to the Dutch Housing Act (in Dutch: Woningwet) Article 1a clause 1, the owner of an asset is responsible for the condition of the asset during the operational phase. Involved parties in the design, execution, and operational phase, including the asset owner, do not realise that the risks related to structural safety continue to be present when the deliverable has been constructed and is operated by the asset owner (Onderzoeksraad voor Veiligheid, 2018).

2.4.3 Trust

Since we are dealing with an increasing amount of parties present in the construction process, interorganisational trust is getting more attention than before. Interorganisational trust is defined as the extent to which members of one organisation hold a collective trust orientation towards another organisation (Zaheer et al., 1998, p.143). Related to this definition of interorganisational trust, Currall and Inkpen (2002) point out that collective trust within a firm towards another firm is established by a shared history. In the construction industry, parties are organised in occasional and temporary partnerships which are rarely the same in different projects. They often vary in specific parties involved, number of participating parties, and hierarchy between the parties. In a project

specific configuration, parties have not gathered a collective history together, and so the foundation for trust is not completely present (Onderzoeksraad voor Veiligheid, 2018).

During a construction project, parties are depending on each other since there are activities that can only start when a predecessor activity has been finished. The party that is responsible for the successor activity needs to be aware whether the predecessor activity has been conducted in a proper way within the quality standards. If this party is not aware of the quality of the predecessor activity, vulnerable situation could occur. Because vulnerable situations need to be prevented at all times, it is expected that quality checks are performed with the implemented control mechanisms, and risk related knowledge is transferred to the next party at handover moments. Trust cannot be used as a control mechanism to verify quality of performed activities. The cases show that when trust is used as a controlling intervention, parties are not aware of the responsibilities other parties are assigning to them. Therefore, trust can never be a reason to ignore designated checks and inspections at handover moments (Onderzoeksraad voor Veiligheid, 2018). In addition, quality assurance processes that are agreed on and approved in the early phases of a project, are not complied with in practice. Hence, these documents are neither a reason to ignore checks and inspections at handover moments.

2.5 Law safeguarding quality for building

The Law safeguarding quality for building (Lsb) (in Dutch: Wet kwaliteitsborging voor het bouwen (Wkb)) is currently being introduced in construction projects with consequence class (CC) 1. When successful, the law will also become mandatory for construction projects with CC2 & CC3. The law has the intention to improve the quality of buildings when handed over to the employer and increase responsibilities for the contractor. The main point that is relevant for this research is as follows (Rijksoverheid, n.d.):

- An independent and private quality safeguarders (in Dutch: kwaliteitsborgers) check whether the construction is build according to the building decree during the design and execution phase of a project.

The law obligates an employer or a contractor to hire an independent quality safeguarder (in Dutch: kwaliteitsborger) which checks whether the construction is build according to the building decree during the design and execution phase of a project. When the quality safeguarder has a 'reasonable' feeling that the building is being build according to the building decree, he signs his documents which the municipality needs in order to approve that the building is ready for the operational phase afterwards. The municipality can admit permits on the bases of the quality safeguarder's signature of approval. This law replaces the process in which the municipality needs to check the design of the construction to admit permits prior to the start of construction. With the implementation of this new law, responsibilities are increasingly located at the private construction sector and municipalities can reduce their structural knowledge even more.

This law has been the reason for ongoing discussion in the construction industry. Tjibbe Joustra, former chairman of the DSB, argues that the industry is not ready for an increasing amount of privatisation and thus an increasing amount of responsibility (van Belzen, 2018b). Bob Gieskens, director of the association of constructors (in Dutch: VNconstructeurs), states that the law does not provide a solution for the overall problem, since it is very limited to supervision and checks, but neglects tasks and their corresponding responsibilities during the building process (van Belzen, 2018a). According to Evelien Bruggeman, director of the Institution of Construction Law (in Dutch: Instituur voor Bouwrecht (IBR)), the law only increases the main problem in the construction industry, namely fragmentation by adding a quality safeguarder and three other bodies (van Belzen & Verweij, 2020). Evelien Bruggeman has furthermore stated that it is still unclear what this quality safeguarder is going to do exactly. Several articles in the Cobouw journal argue that the will be an increase in liability discussions due to the extra complexity introduced by this fragmentation, and

due to the municipality that keeps involved during the process of construction.

More initiatives have come up in the past to try to improve the current safety situation in the construction industry. These initiatives are for example 'Plan van Aanpak Constructieve Veiligheid', 'Compendium Aanpak Constructieve Veilgheid', 'Gedragscode Constructieve Veiligheid', and 'Governance Code Veiligheid in de Bouw'.

Closing words of chapter 2

Project phase

While some incidents related to safety occur during the operational phase of a structure, most incidents still occur during the execution phase of a project. From the six studied cases, four accidents happened in the execution phase of the project, while two happened at the operational phase. From literature it can be concluded that most of the accidents are related to human errors in the design and execution phase. Therefore, this thesis focuses on the design and execution phases, while it excludes the initiation and operational phase.

Safety

Every company is responsible for their own workers' safety at work. This is controlled at a business policy level which should enables continues improvements. However, we can conclude that safety on site is still not achieved at all times. Structural safety is controlled at a project policy level. Structural safety is not always controlled since the responsibilities are distributed diffuse. Since it is not clear who actually has the final responsibility to safeguard structural safety, organisations are not able to close the feedback loop and structural safety cannot be improved in future projects. Since safety at work is already governed by law, the to be integrated third party should mainly focus on the safeguarding process for structural safety, safety on site, and the safety of the surrounding area. Since structural safety is controlled at project policy level, the to be integrated third party should focus on controlling the meso project factors which have been identified in literature.

Control mechanisms

Control mechanisms are often neglected when other competing goals come into play. However, omitting a single or multiple control mechanisms can lead to a loss in level of safety. The control mechanisms that are found in literature are:

- Internal self control (Stewart & Melchers, 1989)
- Internal overview control (Stewart & Melchers, 1989)
- External independent control (Terwel, 2014)
- External authority control (Terwel, 2014)

Using both an internal and external control mechanism leads to a double assurance in terms of control mechanisms. The implementation of an effective control mechanism is even more important. Therefore, the right things must be checked in the right way. To achieve an effective control mechanisms, risks analysis is best to use in order to point out the situations that need special attention, the proper control mechanisms must be used, and an incentive must be present for the controlling party or persons.

Underlying factors in literature and case studies

Looking at the threats on macro level, the cultural factors which relate to the focus on lowest price and fragmentation are present in the cases. These factors are usually hard to influence by any

participant in a project (Terwel, 2014, p.72). The parties involved in a construction project, are able to affect the safety level in a project by prioritising the crucial factors at the meso level. The crucial meso level factors found in literature can be found in most of the cases. The essence of the Dutch construction industry is as followed:

- Neither structural safety, safety on site, nor safety of the surrounding area is safeguarded.
- There is a lack of integrated control of safety related risks between parties.
- There is a lack of coordination between parties that share the same interfaces.
- Responsibilities are diffusely distributed.
- Involved parties often lack a feeling of responsibility for the overall process, they only look at 'their' part of the work.
- Inspections of performed work are neglected at crucial moments during all stages of a project. This holds for inspections on the own work performed, or inspections by external parties. Perceived trust is an important reason for this.

Therefore, the to be integrated third party needs to keep these six points into mind when focusing on the crucial project factors at meso level.

Vital tasks & responsibilities

The reports of the DSB highlight a number of recommendations which are repeated several times throughout the reports. These recommendations have the aim to safeguard the different types of safety. These recommendations lead to a set of vital tasks and responsibilities which are presented below.

Responsibilities of a party are set in the Contractual agreement. However, after the Contract is established during the tender phase, project participants tend to cover up the contract until something goes wrong (Cobouw, 2022b) (no scientific source). Fragmentation increases the chance of negligence of the contract by one or more parties. More attention for the safeguarding of the responsibilities during the design and execution phase is needed. Therefore, there should be one party that coordinates the responsibilities described in the Contract during the design and execution phase. This party is then also able to safeguard all responsibilities set in the contract.

The enhancement of safety can be achieved by a clear distribution of responsibilities and clear communication between parties. Miscommunications must be prevented at all times. The different types of safety that need to be safeguarded are safety on site, safety for the surrounding area, and structural safety. In order to achieve a more clear and covering responsibility distribution, and to make sure that risks related to safety are really controlled, the parties involved in a construction project need to be guided. More precisely, this can be done by the appointment of one party that is responsible for the process of an integrated, systematic and continues process of risk management (Onderzoeksraad voor Veiligheid, 2018, p.76-82). The party responsible for this process, should be able to obligate the other involved parties to participate in this integrated, systematic and continues process of risk management. The steps that need to be performed in order to arrange an integrated, systematic, and continues process of risk management are described below in box 3 (Onderzoeksraad voor Veiligheid, 2006, 2012a).

Box 3: Vital tasks & responsibilities

1) Potential risks must be collected to structure the safety approach. This is done by:
   (i) Exploring the context of the project.
   (ii) Risks which have the possibility to arise in this context must be collected.

(iii) The risks must be evaluated in order to find out what risks must be managed.
(iv) Safety measures must be coupled to the risks that must be managed.

2) Prove that the safety approach is practical and realistic. This is done by taking into account:
   (i) The applicable laws
   (ii) Available standards, best practices, and own experience.

3) The safety approach needs to be carried out and controlled. This is done by:
   (i) A description of how the safety approach is performed, showing the goals, plans, and corresponding safety measures that are used to achieve these goals.
   (ii) A transparent, clear, and accessible distribution of responsibilities for the execution of the safety plans and safety measures.
   (iii) The number of workers and level of experience required must be specified for tasks that must be performed.
   (iv) All activities related to the safety approach are coordinated by one central party.

4) The safety approach must be improved continuously whenever required. This is done at the following moments:
   (i) After risk analyses, observations on site, inspections, and audits (proactive manner)
   (ii) After incidents, or near-misses (reactive manner)

There is one final step, which focuses on top management involvement of the project parties. This factor can be categorised as a company factor on meso level. As stated before, the parties involved on a project level are not able to influence these company factors and therefore, this step is not included in the stepwise process to implement an integrated, systematic, and continues process of risk management.

Law safeguarding quality for building

The most relevant process that has been going the past years is the Law safeguarding quality for building. This law is trying to improve the overall quality in the construction industry in the future. However, the law fails to arrange the system in such a manner that all vital tasks and responsibilities are fulfilled. This is one of the reasons that there is a lot of critique regarding the introduction of the law. The third party developed in this thesis should fulfil all vital tasks and responsibilities as described above, and is preferred to be integrated into the contractual agreements in order to be standardised.

3. Contract analyses

This chapter starts with the literature review of the FIDIC Yellow book 1999 edition general conditions in section 3.1, and the UAC-IC 2005 general conditions in section 3.2. After this literature review, an analysis regarding the differences in both contracts is performed in section 3.3. This chapter provides the answer on sub-question 4, 5 and 6.

3.1 FIDIC Yellow Book 1999 Edition

FIDIC is the global representative body for national associations of consulting engineers. Founded in 1913, it is now represented in more than 100 countries (FIDIC, n.d.-a). A FIDIC contract is a contract between two entities namely, the Employer and the Contractor. A third party who acts as a certifier named the 'Engineer' is involved. This Engineer is however not a party in the contract itself. The philosophy holds that the Employer and Contractor in the contract agree that certain rights and obligations only exist under the condition that the Engineer exercises his power (Jaeger & Hök, 2010). These powers holds for example that payment is only due if the Engineer has evaluated it and has certified the relevant amount, or that a claim is given if the Engineer has determined it. The engineer is supposed to be a fair decision-maker. The Engineer should use his skill in the endeavour to good results, instead of only in the role of the Employer's agent. The Engineer shall ensure best practice for money (Jaeger & Hök, 2010). A basic overview of the relation between the Employer, Contractor, and Engineer can be found in figure 3.1.

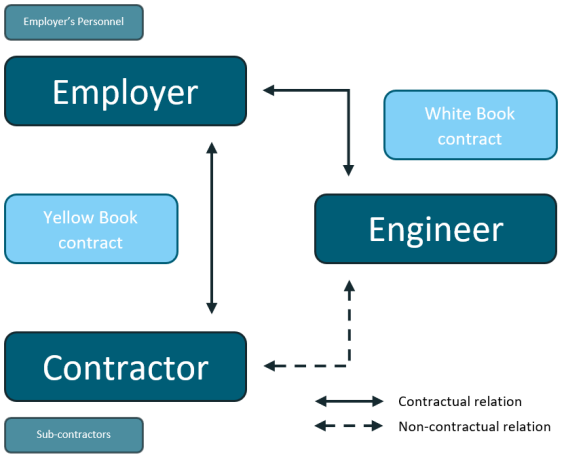


Figure 3.1: The relations between the named parties in the FIDIC Yellow Book.

The first contract published by FIDIC, was the Red Book First Edition in 1957. The first edition of the Yellow Book was published in 1963, with subsequent editions in 1980 and 1987 (White & Case, n.d.). In 1994, both the Red Book and Yellow Book were handed over to a Task Force within FIDIC to renew the latest editions. The motivation for this Task Force to update the most recent versions was twofold (Bunni, 2005). On one side, the role of the engineer was criticised. Users of the contracts preferred the engineer to be a more impartial figure. Users furthermore argued that it was contradictory for the engineer to act impartially whilst he was being employed by the employer. On the other side, there was a need for standardisation. The Task Force eventually introduced the 1999 Yellow Book, among with the 1999 Red Book, and Silver Book. These contracts are known as the 'Rainbow Suite'. In 2017, FIDIC published second version of the Rainbow Suite contracts. An overview of the Yellow Book's history can be found in figure 3.2.

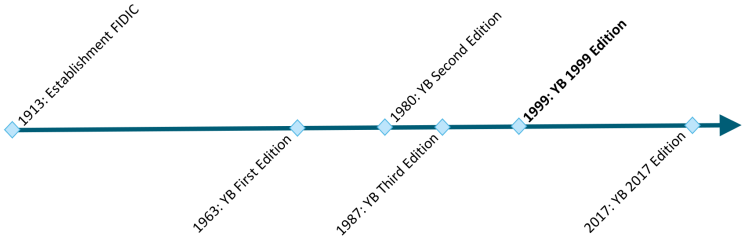


Figure 3.2: History of the Yellow Book, showing the scope of this thesis in bold text.

3.1.1 Definitions

Table 3.1: Definitions of terms used in FIDIC, based on FIDIC (1999, p.1-5) unless stated otherwise.

"Term"	Definition in FIDIC
"Letter of Tender"	The document entitled letter of tender, which was completed by the Contractor and includes the signed offer to the Employer for the Works.
"Letter of Acceptance"	The letter of formal acceptance, signed by the Employer, of the Letter of Tender, including any annexed memoranda comprising agreements between and signed by both Parties. If there is no such letter of acceptance, the expression “Letter of Acceptance" means the Contract Agreement and the date of issuing or receiving the Letter of Acceptance means the date of signing the Contract Agreement.
"Employer’s Requirements"	The document entitled employer’s requirements, as included in the Contract, and any additions and modifications to such document in accordance with the Contract. Such document specifies the purpose, scope, and/or design and/or other technical criteria, for the Works.
"Contractor’s Documents"	The calculations, computer programs and other software, drawings, manuals, models and other documents of a technical nature (if any) supplied by the Contractor under the Contract; as described in Sub-Clause 5.2 [Contractor’s Documents].
"Works"	The Permanent Works and the Temporary Works, or either of them as appropriate.
"Base Date"	The date 28 days prior to the latest date for submission of the Tender.
"Commencement Date"	The date that contractually is the starting point of the time needed to complete the project.
“Time for Completion"	The time for completing the Works or a Section (as the case may be) under Sub-Clause 8.2 [Time for Completion], as stated in the Appendix to Tender (with any extension under Sub-Clause 8.4 [Extension of Time for Completion]), calculated from the Commencement Date.
“Defects Notification Period”	The period for notifying defects in the Works or a Section (as the case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects], as stated in the Appendix to Tender (with any extension under Sub-Clause 11.3 [Extension of Defects Notification Period]), calculated from the date on which the Works or Section is completed as certified under Sub-Clause 10.1 [Taking Over of the Works and Sections].
"Contract Price"	The price defined in Sub-Clause 14.1 [The Contract Price], and includes adjustments in accordance with the Contract.
"Accepted Contract Amount"	The amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.
"Variation”	Any change to the Employer’s Requirements or the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].
"Claim"	A request or assertion by one of the parties to a contract to the other party for an entitlement or relief under any clause of the conditions or otherwise in connection with, or arising out of, the contract or the execution of the works (Drynkorn, 2018).
"Instruction”	A written record issued by the Engineer, which the Contractor must comply to.
"Notice"	A written remark or comment issued by one party to another, which often causes the start of a certain procedure under a Sub-Clause.

3.1.2 Structure

The structure of the Yellow Book: Conditions of Contract for Plant and Design-Build 1999 Edition, is well organised, just like the other contracts of FIDIC. The contractual documents in order of precedence are as follows (Jaeger & Hök, 2010):

- Contract agreement
- Letter of Acceptance
- Letter of Tender
- Particular Conditions
- **General Conditions**
- Employer's Requirements
- Schedules
- Contractor's Proposal and any other documents forming part of the Contract

The General Conditions are 20 fixed clauses which are based on a fair and balanced risk and reward allocation between the Employer and Contractor. These clauses can be found in table A.2. An Employer is able to make additions and adjustments to the General Conditions, by using the Particular Conditions. These Particular Conditions are used because every project can be seen as unique project. This thesis however, focuses on the part of the contract that is standardised for every project: the General Conditions.

3.1.3 Philosophy

FIDIC represents fair, balanced and well recognised construction and engineering contracts. A FIDIC Contract has real commercial value to both the Employer and the Contractor, at the tendering and execution stage. FIDIC states that they are observing a trend in which the Particular Conditions are used more intensively to replace, change or omitting parts of the General Conditions. The replacements and changes introduced have lately been found to be substantial and of such extent, that the final Contract no longer represents the FIDIC principles, and thus are jeopardising the FIDIC brand. The Golden Principles have been developed in order to identify which contractual principles are considered to be "inviolable and sacrosanct".

The philosophy of FIDIC and its Yellow Book is shown by these 'Golden Principles' (FIDIC, n.d.-b). These Golden Principles have been developed by FIDIC in 2019, but are still applicable to the Yellow Book 1999 edition. The Golden Principles are as follows:

- The duties, rights, obligations, roles and responsibilities of all the Contract Participants must be generally as implied in the General Conditions, and appropriate to the requirements of the project.
- The Particular Conditions must be drafted clearly and unambiguously.
- The Particular Conditions must not change the balance of risk/reward allocation provided for in the General Conditions.
- All time periods specified in the Contract for Contract Participants to perform their obligations must be of reasonable duration.
- Unless there is a conflict with the governing law of the Contract, all formal disputes must be referred to a Dispute Avoidance/Adjudication Board (or a Dispute Adjudication Board, if applicable) for a provisionally binding decision as a condition precedent to arbitration.

As the last Golden Principle mentions, the governing law that is specified in the Contract is always guiding. This does not only hold for any dispute that may arise, but for every Sub-Clause that is in the YB. The governing law usually will be the law of the Employer's country at which the Site will probably be located (Seppala, 2003, p.5).

3.1.4 Setup tasks & responsibilities

The tasks and responsibilities of the different parties involved in a construction project are extensively set out in a FIDIC contract. In this section, the tasks and responsibilities of the Employer, Contractor and Engineer are analysed. Since the main focus of this research is the role of the Engineer, all tasks and responsibilities of the Engineer are covered in this section. For the same reason, only the most noteworthy Clauses which indicate any task or responsibility for the Employer or Contractor are highlighted in the corresponding sections. This selection of Clauses is chosen because they highlight the general philosophy of the YB 1999 edition, or possibly have the largest effect on safety.

The following sections have the same structure: first, a Sub-Clause is cited from the YB 1999 edition (FIDIC, 1999). This Sub-clause is cited in a blue box which indicates the number of the Sub-Clause, the title of the Sub-Clause, and the content of the Sub-Clause. If some part of a Sub-Clause is left out of the citation, it is indicated with the '(...)' symbol. Below the blue box, an analysis or comment regarding the Sub-Clause is given. There is no reasoning behind the specific order in which the Sub-Clauses are given in the following sections. An example of the structure described above, can be seen below:

Sub-Clause "No. of Sub-Clause": "Title of Sub-Clause"

"Content of Sub-Clause." (FIDIC, 1999).

"Analysis or comments of/on Sub-Clause."

3.1.5 Employer's tasks & responsibilities

Sub-Clause 2.1: Right of Access to the Site

The Employer shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the Appendix to Tender. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Employer shall do so in the time and manner stated in the Employer's Requirements. However, the Employer may withhold any such right or possession until the Performance Security has been received.

(...)

According to Sub-Clause 2.1, the Employer is obligated to give "possession" of the Site to the Contractor. This term "possession" describes the Contractors right to enter the Site, which differs from project to project. There are several types of possession which can be distinguished (Jaeger & Hök, 2010, p.182). The first kind of possession is where the Contractor is granted non exclusive possession. The second kind is where the Contractor has exclusive possession. The third kind is where the Contractor requires partial possession of the Site, for example to perform tests. Whenever the Employer fails to give possession to the Contractor on time the Contractor is entitled to an extension of time if completion is delayed, and payment of costs plus reasonable profit.

Sub-Clause 2.2: Permits, Licences or Approvals

The Employer shall (where he is in a position to do so) provide reasonable assistance to the Contractor at the request of the Contractor:

(a) by obtaining copies of the Laws of the Country which are relevant to the Contract but are not readily available, and;
(b) for the Contractor's applications for any permits, licences or approvals required by the Laws of the Country:
  (i) which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws];
  (ii) for the delivery of Goods including clearance through customs, and;
  (iii) for the export of Contractor's Equipment when it is removed from the Site.

According to Sub-Clause 1.13(a) ("the Employer shall have obtained (or shall obtain) the planning, zoning or similar permission for the Permanent Works, and any other permissions described in the Employer's Requirements as having been (or being) obtained by the Employer; and the Employer shall indemnify and hold the Contractor harmless against and from the consequences of any failure to do so"), the Employer is responsible for obtaining the planning, zoning or similar permissions for the permanents Works. The contractor is responsible for obtaining other permissions which correspond to the design, execution, and completion of the Works. Appuhn and Eggine, p.9, state that the General Conditions fail to specify which kind of permits are needed to be obtained by the Employer and Contractor due to the term "similar permission". They conclude that permits that are required to allow the project to be developed at the site of the works should be obtained by the Employer and therefore, belong to the responsibility of the Employer. According to Sub-Clause 2.2, the Employer needs to assist the Contractor with any permissions the Contractor needs to obtain, whenever the Employer is in a position to do so.

Sub-Clause 2.4: Employer's Financial Arrangements

The Employer shall submit, 28 days after receiving any request from the Contractor, reasonable evidence that financial arrangements have been made and are being maintained which will enable the Employer to pay the Contract Price (as estimated at that time) in accordance with Clause 1.4 [Contract Price and Payment], If the Employer intends to make any material change to his financial arrangements, the Employer shall give notice to the Contractor with detailed particulars.

According to Sub-Clause 2.4, the Employer needs to submit "reasonable evidence" for the financial arrangements made, which enables the Employer to pay the Contractor the Contract Price. Neither Sub-Clause 2.4 nor FIDIC defines "reasonable evidence". There is much debate regarding this term, especially because there are severe consequences whenever the Employer does not comply with the submission of "reasonable evidence": this could eventually lead to the right of suspension or termination by the Contractor under Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work] and Sub-Clause 16.2 [Termination by Contractor] (Mayer Brown, 2017, p.5). Jaeger and Hök, p.183 states that Employers and Contractors would wish to have a more precise guideline on this matter.

Sub-Clause 14.7: Payment

The Employer shall pay the Contractor:

(a) the first instalment of the advance payment within 42 days after issuing the Letter of

Acceptance or within 21 days after receiving the documents in accordance with Sub-Clause 4.2 [Performance Security] ans Sub-Clause 14.2 [Advance Payment], whichever is later;

(b) the amount certified in each Interim Payment Certificate within 56 days after the Engineer receives the Statement and supporting documents; and

(c) the amount certified in the Final Payment Certificate within 56 days after the Employer receives the Payment Certificate.

(...)

According to Sub-Clause 14.7, it is the obligation of the Employer to pay the Contract Price to the Contractor. Whenever the Contractor argues that that he should be paid, he submits a Statement to the Engineer. The Engineer has to approve this statement, and needs to issue a Payment Certificate. A timeline of this procedure can be found in the beginning pages of the YB. The Contract Price consists of 1) the Accepted Contract Amount (which is the lump sum amount that the Contractor offered in the tender), plus 2) any adjustments in accordance with the Contract (for example under Sub-Clause 13.5 [Provisional Sums], 13.7 [Adjustments for Changes in Legislation], or 13.8 [Adjustments for Changes in Costs]).

Sub-Clause 4.10: Site Data

The Employer shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in the Employer's possession on sub-surface and hydrological conditions at the Site, including environmental aspects. The Employer shall similarly make available to the Contractor all such data which come into the Employer's possession after the Base Date. The contractor shall be responsible for interpreting all such data.

To the extent which was practicable (taking account of cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Words. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, its surroundings, the above data and other available information, and to have been satisfied before submitting the Tender as to all relevant matters, including (without limitation):

(a) the form and nature of the Site, including sub-surface conditions;

(b) the hydrological and climatic conditions;

(c) the extent and nature of the work and Goods necessary for the execution and completion of the Works and the remedying of any defects;

(d) the Laws, procedures and labour practices of the Country, and;

(e) the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.

Sub-Clause 4.10 gives a good overview of the risk allocation between Employer and Contractor. The Employer needs to provide the Contractor with "all relevant data in the Employer's possession". Data is this context, consists of factual material and does not include opinions or conclusions which consultants or experts have derived from that data in the past. Since it is the responsibility of the Contractor to interpret this data, opinions and conclusion of such investigations are not required to be shared by the Employer (Corbett et al., 2020).

Furthermore, the Employer could possibly be a huge entity such as a governmental organisation. Data which is not available in one department, might be available in another department. It is therefore important to specify in what part of the organisation the data needs to be in possession

in order to be shared with the Contractor.

The obligations of the Contractor are not limited to interpreting the information provided by the Employer, but the Contractor should also gather relevant data himself which could have any influence on the Works. When no data concerning for example soil condition is available, the Contractor should examine the site in order to obtain this data.

As a last comment in this section, we want to highlight the duty to compensate. The Employer has the duty to compensate the Contractor whenever he does not comply with for example Sub-Clauses 2.1 [Right of Access to the Site], 4.10 [Site Data], 7.4 [Testing], 8.4a [Extension of Time for Completion], 8.4e, and others. This compensation according to Sub-Clause 20.1 [Contractor's Claims] holds:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost, which shall be included in the Contract Price.

3.1.6 Contractor's tasks & responsibilities

As can be seen in table A.2, Clause 4 is about the Contractor. This Clause has the most Sub-Clauses in the FIDIC Yellow Book, giving an indication of the Contractor's amount of tasks and responsibilities.

Before the Contractor and the Employer enter into a FIDIC agreement, the contractor has several pre-contractual duties. An example of this can be found in Sub-Clause 4.10 [Site Data] which states that the contractor has to inspect the site before submitting his tender. Another example can be found in Sub-Clause 5.1 [General Design Obligations] which states that the Contractor shall be deemed to have scrutinised the Employer's Requirements.

Sub-Clause 5.1: General Design Obligations

The Contractor shall carry out, and be responsible for, the design of the Works. Design shall be prepared by qualified designers who are engineers or other professionals who comply with the criteria (if any) stated in the Employer's Requirements. Unless otherwise stated in the Contract, the Contractor shall submit to the Engineer for consent the name and particulars of each proposed designer and design Subcontractor.

The Contractor warrants that he, his designers and design Subcontractors have the experience and capability necessary for the design. The Contractor undertakes that the designers shall be available to attend discussions with the Engineer at all reasonable times, until the expiry date of the relevant Defects Notification Period.

Upon receiving notice under Sub-Clause 8.1 [Commencement of Works], the Contractor shall scrutinise the Employer's Requirements (including design criteria and calculations, if any) and the items of reference mentioned in Sub-Clause 4.7 [Setting Out]. Within the period stated in the Appendix to Tender, calculated from the Commencement Date, the Contractor shall give notice to the Engineer of any error, fault or other defect found in the Employer's Requirements or these items of reference.

After receiving this notice, the Engineer shall determine whether Clause 13 [Variations and Adjustments] shall be applied, and shall give notice to the Contractor accordingly. If and to the extent that (taking account of cost and time) an experienced contractor exercising due care would have discovered the error, fault or other defect when examining the Site and the

Employer's Requirements before submitting the Tender, the Time for Completion shall not be extended and the Contract Price shall not be adjusted.

As specified in Sub-Clause 5.1, the YB is characterised by the Contractor's design responsibility for the Works. This is in contrast to the Red Book in which the Employer is responsible for the design of the Works. When finished, the Works need to be fit for purpose for which the Works are intended, in accordance with the Contract under Sub-Clause 4.1 [Contractor's General Obligations], and in accordance with the Employer's Requirements. Sub-Clause 5.8 [Design Error] makes the Contractor's design responsibility and liability even more clear by stating: "If errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the Contractor's Documents, they and the Works shall be corrected at the Contractor's cost, notwithstanding any consent or approval under this Clause". Sub-Clause 5.8 means that whenever the Works do not comply with the Employer's Requirements or is not fit for purpose, the Contractor's needs to remedy the defect at his own costs.

Sub-Clause 5.1 further specifies that everyone involved in the design of the Works, needs to have the necessary experience and capabilities. The Contractor himself has a duty to warn/to give notice to the Engineer whenever he discovers a defect in the Employer's Requirements. It is important for the Contractor to carefully analyse the Employer's Requirements before submitting his Tender documents, otherwise he might not have fulfilled this duty to warn/to give notice, which can lead to non-entitlement to an Extension of Time for Completion or compensation later on in the project.

Sub-Clause 4.4: Subcontractors

The Contractor shall not subcontract the whole of the Works.

The Contractor shall be responsible for the acts or defaults of any Subcontractor, his agents or employees, as if they were the acts or defaults of the Contractor. Unless otherwise stated in the Particular Conditions:

(a) the Contractor shall not be required to obtain consent to suppliers of Materials, or to a subcontract for which the Subcontractor is named in the Contract;
(b) the prior consent of the Engineer shall be obtained to other proposed Subcontractors; and
(c) the Contractor shall give the Engineer not less than 28 days' notice of the intended date of the commencement of each Subcontractor's work, and of the commencement of such work on the Site.

According to Sub-Clause 4.4, the Contractor needs to execute some part of the Works himself since he is not permitted to sub-contract the Works in its entirety. The Contractor has unlimited responsibility for all acts and defaults of any sub-contractor, regardless whether the sub-contractor was proposed by the Employer. The Contractor is therefore also liable for all acts and defaults of any sub-contractor. This liability leads to the prohibition from submitting any claims which were caused by any sub-contractor.

By naming a (potential) sub-contractor in the Particular Conditions, the Contractor does not need any consent of the Engineer to make uses of the services of this sub-contractor. Logically, when a sub-contractor is not pre-approved in the Particular Conditions, the Engineer has the rights to raise objection to this sub-contractor unless this sub-contractor solely is used for the supplies of materials (Corbett et al., 2020).

Sub-Clause 4.8: Safety Procedures

The Contractor shall:

(a) comply with all applicable safety regulations,
(b) take care for the safety of all persons entitled to be on the Site,
(c) use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons,
(d) provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [Employer's Taking Over], and
(e) provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.

Sub-Clause 4.8 describes what safety procedures the Contractor shall abide by. Sub-clause 4.8(a) refers to the "applicable" safety regulations, which can be different from project to project depending on the governing law. Sub-Clause 4.8(b) and (c) relate to the safety of people that are entitled to be on Site. As described earlier under Sub-Clause 2.1 [Right of Access to the Site], there are different types of possession for the Contractor. Depending on whether the possession entails exclusive, non-exclusive, or partial possession, entitled personnel shall not only include Contractor's personnel, but could also hold Employer's personnel or the Engineer. The type of possession under Sub-Clause 2.1 also has consequences for the area which is defined as the "Site". FIDIC defines "Site" in Sub-Clause 1.1.6.7 as "the places where the Permanent Works are to be executed and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site". If the Site holds only a small part of the construction site, the Contractor is only responsible for the safety of entitled people at this part of the construction site. It is not completely clear whether Sub-Clause 4.8(b) and (c) only concern safety on Site, or also considers structural safety. Sub-Clause 4.8(d) deals with security of the Site instead of safety. Safety of the surrounding area is mentioned in Sub-Clause 4.8(e), which deals with the safety of the public and the surrounding area by providing Temporary protection Works. It does state the safety measure "provide Temporary Works", but does not state any other strategy related to the management of risks in the surrounding area.

Sub-Claus 4.8 is not the only Sub-Clause in the YB that deals with safety. There are more Sub-Clauses namely, 4.18 [Protection of the Environment], 4.22 [Security of the Site], 6.4 [Labour Laws] 6.7 [Health and Safety], which deal with some kind of safety or security. Sub-Clause 6.4 literally names "safety at work" as something that the Contractor needs to require his employees to obey.

Sub-Clause 4.9: Quality Assurance

The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract. The Engineer shall be entitled to audit any aspect of the system.

Details of all procedures and compliance documents shall be submitted to the Engineer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval by the Contractor himself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

Many of the Sub-Clauses that can be found in Clause 4 of the YB are included in the Quality Assurance system under Sub-Clause 4.9 (Corbett et al., 2020). The Contractor needs to put the Quality Assurance system in place in order to demonstrate its compliance with the Contract requirements. The implementation of this system does however not mean that the Contractor has automatically

complied with the Contract requirements. The Contractor is able to organise the Quality Assurance system in whatever manner he wants, as long as the Contractor's Contract compliance is demonstrated to the Employer.

The Engineer is authorized to audit the Quality Assurance system. The Engineer can however not issue an instruction as a result of the audit (Corbett et al., 2020). The instruction of the Engineer is dealt with in Sub-Clause 3.3 [Instructions of the Engineer] which states that "the Engineer may issue to the Contractor (at any time) instructions which may be necessary for the execution of the Works and the remedying of any defects, all in accordance with the Contract". The Engineer's instruction is a written interpretation of the Contract which the Contractor has to comply to. This means that the Engineer can give a Notice regarding the Quality Assurance system, but this does not mean that the Contractor is mandatory to make any changes to the system.

Sub-Clause 4.21: Progress Reports

Unless otherwise stated in the Particular Conditions, monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

Each report shall include:

(a) charts and detailed descriptions of progress, including each stage of design, Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection, testing, commissioning and trial operation;
(b) photographs showing the status of manufacture and of progress on the Site;
(c) for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:
  (i) commencement of manufacture,
  (ii) Contractor's inspections,
  (iii) tests, and
  (iv) shipment and arrival at the Site;
(d) the details described in Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment],
(e) copies of quality assurance documents, test results and certificates of Materials;
(f) list of Variations, notices given under Sub-Clause 2.5 [Employer's Claims] and notices given under Sub-Clause 20.1 [Contractor's Claims],
(g) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
(h) comparisons of actual and planned progress, with details of any events or circumstances which may jeopardise the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

The use of the Progress Reports in Sub-Clause 4.21 is considered to be an essential part of competent project management (Corbett et al., 2020). The Progress Reports shall include a lot of information, which can be found in Sub-Clause 4.21(a) to (h). The Progress Report is submitted to the Engineer. However, the Engineer cannot approve or deny the report. Whenever the Employer, Contractor or

Engineer want to discuss an item from the progress report, a progress meeting should be scheduled. During these meetings, possible claims can be discussed since they will probably rely on information and items from the Progress Reports. When discussing claims in advance, this may reduce the number of disputes in the end.

Sub-Clause 6.7: Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.

Sub-Clause 6.7 deals with the requirement for the Contractor to deal with safety at work and the safety of its personnel. The Contractor furthermore needs to assign an accident prevention officer which should prevent accidents to occur. It is not mentioned whether this officer needs to be present at all times, and on Site only. However, by stating "Throughout the execution of the Works (...)", it is assumed that this officer is present on Site during the execution phase of a project. Measures that could be taken are (Corbett et al., 2020): the development of safety policies and plans, safety training, and the review of accidents. Therefore, this accident prevention officer can play a role in the enhancement of safety on site.

Sub-Clause 8.2: Time for Completion

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including:

(a) achieving the passing of the Tests on Completion, and
(b) completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections].

According to Sub-Clause 8.2, it is the Contractor's responsibility to complete the Works within the specified number of Days from the start of the Commencement Date. The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claim] to an extension of the Time of Completion whenever one of the various causes from Sub-Clause 8.4 [Extension of Time for Completion] holds. These causes vary from Variations and delay attributable to the Employer, to exceptionally adverse climatic conditions.

Sub-Clause 8.3: Programme

The Contractor shall submit a detailed time programme to the Engineer within 28 days after receiving the notice under Sub-Clause 8.1 [Commencement of Works], The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. (...)

(...) The Contractor shall proceed in accordance with the programme, subject to his other obligations under the Contract. The Employer's Personnel shall be entitled to rely upon the programme when planning their activities.

The Contractor shall promptly give notice to the Engineer of specific probable future events or circumstances which may adversely affect the work, increase the Contract Price or delay the execution of the Works. The Engineer may require the Contractor to submit an estimate of the anticipated effect of the future event or circumstances, and/or a proposal under Sub-Clause 13.3 [Variation Procedure],

If, at any time, the Engineer gives notice to the Contractor that a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised programme to the Engineer in accordance with this Sub-Clause

Sub-Clause 8.3 highlights the obligation for the Contractor to be responsible for a consistent and accurate Programme which is up-to-date at any moment in time. The first Programme that is submitted by the Contractor, is often called the baseline Programme (Hewitt, 2018). The baseline Programme should be the best estimate that the Contractor can give regarding order and timing of how the Contractor intends to carry out the Works at the time of submission. Whenever the Engineer gives notice to the Contractor that the baseline Programme does not comply with the Contract, or the Contractor is entitled to an extension of Time for Completion, the Contractor should revise the baseline Programme. The latest revision of the Programme is the leading Programme. An update of the Programme is not a revision of the baseline programme, but it rather shows the actual progress compared to the baseline to forecast the Time for Completion. Both the revision and the update of the Programme are important because the Employer's Personnel need to be able to rely on the Programme.

Sub-Clause 8.3 also highlights an early warning duty for the Contractor for any probable event which could cause any delay of the Works, or an increase in Contract Price.

3.1.7 Engineer's tasks & responsibilities

In order to find out all tasks and responsibilities FIDIC's Engineer has in the Yellow Book 1999 Edition, Abdul-Malak and El Masri (2016)'s paper "Understanding the Engineer's role in administering the construction contract" is used as a starting point. The objective of Abdul-Malak and El Masri's research is to examine and highlight the major roles expected of the Engineer, and to investigate a method that can help more rigorously classify them. This method, which comes down to a classification matrix, allows practitioners to differentiate between the 'deduced main roles' (agreeing, determining, consenting, approving, certifying, assessing, evaluating, giving notice, etc.), the 'nature of the role' (proactive, reactive or passive), the 'role type' (administrative, technical or managerial), and 'role fulfillment capacity' (Employer's agent or independent). The work in Abdul-Malak and El Masri's research consists of scrutinizing all the roles given to FIDIC's Engineer through a Sub-Clause by Sub-Clause reading of the FIDIC Red Book 1999 Edition General Conditions. A description of the terminology used in the classification matrix is shown in table 3.2

Table 3.2: System for classifying the Engineer's roles, according to Abdul-Malak and El Masri (2016).

Classification Parameter	Parameter Attributes	Underlying Rationale for Assigning Attributes
Deduced Main Roles	Agreeing / Determining / Consenting / Inspecting / etc.	Descriptive and adopted from the exact wording used in the examined FIDIC Clauses
Role Nature	Proactive	Taking the initiative in the role
	Reactive	The required role is the answer to an act or request by the others (the Employer or the Contractor)
	Passive	The nature of a role where no reaction is necessarily required from the Engineer and where basically the Engineer is only informed in the process
Role Type	Administrative	Defines an automated role in a defined process / paperwork related
	Technical	Required specialty or expertise in the matter
	Managerial	Includes some decision making within a specific frame of time
Role FulfillmentCapacity	Employer's Agent	Where the Engineer is supposed to act on behalf of the Employer
	Independent	Where the Engineer is supposed to act in a professional objective manner

The scope of their work, other than this thesis, entails the Red Book 1999 Edition. This means that an adapted version of the raw data needs to be made in order to make it correspond to the Yellow Book 1999 Edition. However, the raw Sub-Clause by Sub-Clause data is not present in Abdul-Malak and El Masri's paper. Therefore, Farah Y. El Masri has been contacted in order to receive this data. Since Bunni (2005, p.637-741) provides a side by side comparison of all Sub-Clauses in the RB and YB, all textual differences between both contracts are able to be identified. Whenever a textual difference also induces a change in the Engineer's role, Abdul-Malak and El Masri's data is adapted to make it correspond to the YB. Yellow Book Sub-Clauses with different roles for the Engineer compared to the RB are Sub-Clause: 1.9, 4.5, 5.1, 5.2, 5.4, 5.6, 5.7, 12.2, 12.4 & 13.3. Besides these Sub-Clauses in which the Engineer has a different role, there are Sub-Clauses in which the Engineer does not have a role. These Sub-Clauses are deleted from the database. Furthermore, some adaptions to the database are made in order to make it more consistent. The newly created database for the YB can be found in Figures B.1 to B.5 and shows that:

- There are a total of 217 roles for the Engineer, found in 90 Sub-Clauses.
  - Out of these 217 roles, there are 45 unique roles.
  - The roles with the highest frequent are "determining" (35), "agreeing" (27), "instructing" (24), "requiring" (21), and "giving notice" (17).
  - The Sub-Clauses with most Engineering roles in it are Sub-Clause 20.1 [Contractor's Claims] (9), 4.12 [Unforeseeable Physical Conditions] (6), 7.3 [Inspection] (6), 7.4 [Testing] (6), and 13.3 [Variation Procedure] (6).
- The nature of the roles are 24% proactive, 69% reactive, and 7% passive, indicating a slight difference compared to the RB (in which 70% of the tasks is reactive).
- 69% of the roles is classified as technical, which indicates that the Engineer as an entity needs to hold sufficient knowledge regarding the different matters.
- In 69% of the roles, the Engineer needs to act independent.

We argue that the method which is used by Abdul-Malak and El Masri has several limitations. One of these limitations holds that the way the FIDIC Books are scrutinized has the consequence that one and the same role could be interpreted as multiple and different roles. To highlight this, the following example is provided: Sub-Clause 4.7 [Setting Out] states that "After receiving the notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extend". Sub-Clause 7.4 [Testing] states that "After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters". Both Sub-Clauses refer to

Sub-Clause 3.5 [Determinations] in which the role "agreeing" and "determining" are already named. As a consequence of this, the roles "agreeing" and "determining" are added to the database three times while in fact, both roles only exist under Sub-Clause 3.5 [Determinations]. Therefore, the number of unique roles is more relevant than the total number of roles in the database.

Another limitation is related to the terminology "independent". The Yellow Book 1999 Edition states that "except as otherwise stated in these [Particular] Conditions: (a) whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall be deemed to act for the Employer". Since this thesis does not focus on the Particular Conditions and only takes the General Conditions into consideration, the Engineer shall in essence act as an agent of the Employer. Looking at the "independent" percentage of the tasks in the database, we can see that this 69% seems rather significant for a party that should in principle act as an Employer's Agent. Ndekugri et al. (2007) even states that the term "independent" is not applicable in the 1999 Editions anymore. We have to mention that the scope of Ndekugri et al.'s research is limited to the Red Book Fourth Edition and the Red Book 1999 Edition. Despite that the RB 1999 Edition is not the scope of this thesis, all 1999 Editions are textually comparable. This means that the same terminology is used in the RB 1999 Edition and the YB 1999 Edition (this is checked using the side by side comparison of the RB and YB 1999 Edition in Bunni (2005, p.637-741)). Continuing on Ndekugri et al.'s research, the General Conditions prior to the FIDIC 1999 Editions contain the requirement for the engineer to act "impartially", and thus be independent. The 1999 versions however contain the duty to, at predetermined moments, make "fair determinations". Terms as "independent" or "impartially" do not occur in the FIDIC YB 1999 version. When we look at the two most frequently occurring tasks (determining and agreeing), we can observe that these tasks are named simultaneously with a reference to Sub-Clause 3.5 [Determinations] in which the Engineer shall make "fair determinations". Thus, the high percentage for the "independent" Role Fulfillment Capacity can be explained when Abdul-Malak and El Masri have not made a distinction between being "independent" and being "fair".

Furthermore we would like to mention that if, a role is quantitative less present in the General Conditions this does not mean that it is less relevant or important. A role that is only named once could for example be highly time consuming and relevant to safeguard any type of safety.

As in sections sections 3.1.5 and 3.1.6, the tasks and responsibilities of the Engineer are explained below in a more structured and detailed manner as described in section 3.1.4.

Sub-Clause 1.3: Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices and requests, these communications shall be:

(a) in writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Appendix to Tender; and

(...)

When a notice is issued to a Party, by the other Party or the Engineer, a copy shall be sent to the Engineer or the other Party, as the case may be.

According to Sub-Clause 1.3, the communication of all actions under the Contract need to be send in "writing". Writing is defined in Sub-Clause 1.2 as "hand-written, type-written, printed or electronically made, and resulting in a permanent record". Whenever some kind of communication is made, this piece of communication is traceable at all times in the predefined system which prohibits

information to get lost in the process.

Because the Engineer is receiving copies of every piece of communication between the Contractor and Employer, and is receiving all other information directly, he has a central role in the process of communication and information. The Engineer is therefore up-to-date on all matter, and can be seen as the central party between the Employer and Contractor.

Sub-Clause 3.1: Engineer's Duties and Authority

The Employer shall appoint the Engineer who shall carry out the duties assigned to him in the Contract. The Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.

The Engineer shall have no authority to amend the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. If the Engineer is required to obtain the approval of the Employer before exercising a specified authority, the requirements shall be as stated in the Particular Conditions. The Employer undertakes not to impose further constraints on the Engineer's authority, except as agreed with the Contractor.

However, whenever the Engineer exercises a specified authority for which the Employer's approval is required, then (for the purposes of the Contract) the Employer shall be deemed to have given approval.

Except as otherwise stated in these Conditions:

(a) whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall be deemed to act for the Employer;
(b) the Engineer has no authority to relieve either Party of any duties, obligations or responsibilities under the Contract; and
(c) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances.

As stated in Sub-Clause 3.1, the Engineer is appointed and this chosen by the Employer. The Contractor does not have any input in this procedure. The requirement for the Engineer to have included "suitable qualified engineers and other professionals who are competent to carry out these duties" appears to indicate that the Engineer is an organisation with multiple people.

There are some limitations to the powers of the Engineer. He cannot amend the Contract, and in some cases he needs to obtain approval of the Employer in order to do something. This "something" should be stated in the Particular Conditions. Corbett et al. (2020) give some examples for which the Engineer usually needs to obtain approval of the Employer. Approval is normally required for: instructing a Variation, issuing approval to the Contractor, and issuing any instruction that relieves the Contractor from any of its obligations under the Contract. These things have a direct effect on the Contract and therefore, the Employer prefers to have influence in these processes.

Sub-Clause 3.1 (a) is one of the most important parts of this Sub-Clause, since it states that the Engineer is deemed to act for the Employer unless stated otherwise. The Engineer, based on this statement, is an agent of the Employer.

Sub-Clause 3.3: Instructions of the Engineer

The Engineer may issue to the Contractor (at any time) instructions which may be necessary for the execution of the Works and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer, or from an assistant to whom the appropriate authority has been delegated under this Clause. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

The Contractor shall comply with the instructions given by the Engineer or delegated assistant, on any matter related to the Contract. These instructions shall be given in writing.

The Engineer is entitled to submit an order to the Contractor which is mandatory for the Contractor to perform. This mandatory order is called an instruction. Whenever this instruction holds something that is not specified in the Contract, it is called a Variation. This Variation procedure is specified in Clause 13 [Variations and Adjustments]. The Contractor must execute the Variation, unless he is able to specify (by sending notice to the Engineer) why he cannot perform the Variation, using the three point mentioned in Sub-Clause 13.1 [Right to Vary]. The Engineer shall, after receiving the notice, determine whether the Instruction is cancelled or keeps valid.

Sub-Clause 3.5: Determinations

Whenever these Conditions provide that the Engineer shall proceed in accordance with this Sub-Clause 3.5 to agree or determine any matter, the Engineer shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

The Engineer shall give notice to both Parties of each agreement or determination, with supporting particulars. Each Party shall give effect to each agreement or determination unless and until revised under Clause 20 [Claims, Disputes and Arbitration].

One of the most important tasks for the Engineer holds that he needs to agree or determine Employer's Claims and Contractor's Claims respectively related to Sub-Clause 2.5 and 20.1. A reference to this Sub-Clause is made in Sub-Clauses: 1.9 [Errors in the Employer's Requirements], 2.1 [Right of Access to the Site], 2.5 [Employer's Claims], 3.2 [Delegation by the Engineer], 4.7 [Setting Out], 4.12 [Unforeseeable Physical Conditions], 4.19 [Electricity, Water and Gas], 4.20 [Employer's Equipment and Free-Issue Material], 4.24 [Fossils], 7.4 [Testing], 8.9 [Consequences of Suspension], 9.4 [Failure to Pass Tests on Completion], 10.2 [Taking Over of Parts of the Works], 10.3 [Interference with Tests on Completion], 11.4 [Failure to Remedy Defects], 11.8 [Contractor to Search], 12.2 [Delayed Tests], 12.4 [Failure to Pass Tests after Completion], 13.3 [Variation Procedure], 13.7 [Adjustments for Changes in Legislation], 14.4 [Schedule of Payments], 14.15 [Currencies of Payment], 15.3 [Valuation at Date of Termination], 16.1 [Contractor;s Entitlement to Suspend Work], 17.4 [Consequences of Employer's Risks], 19.4 [Consequences of Force Majeure], and 20.1 [Contractor's Claims].

The first step under this Sub-Clause is to reach agreement. The Engineer must act as a mediator to try to facilitate an agreement (Corbett et al., 2020). The form of consultation is not specified in the General Conditions and can therefore be chosen by the Engineer. Corbett et al. states that this consultation does however needs to take place with both parties, in individual or shared sessions, in order to come to a valid and enforceable agreement. If both parties cannot come to an agreement, the Engineer must determine the matter fairly in accordance with the Contract.

But what does "fair" actually mean? Cambridge Dictionary comes up with "treating a group of people equally and not allowing personal opinions to influence your judgement", "reasonable", and

"according to the rules". Bunni (2005) defines fair as "just, unbiased, equitable in accordance with the rules". Therefore, we can say that the Engineer must act without bias and impartially when making the fair determination, notwithstanding his role as the Employer's agent (Corbett et al., 2020). The determination that is made by the Engineer is binding (Nisja, 2004), until one of the parties refers the matter to the Dispute Adjudication Board under Sub-Clause 20.4 [Obtaining Dispute Adjudication Board's Decision].

The position of the Engineer can be very complicated due to the fair determination he has to made, and being the Employer's agent as stated in Sub-Clause 3.1 at the same time. It can be even more complicated when the Engineer needs to obtain approval for an agreement or determination. What if the Employer does not agree with the determination the Engineer made? The Employer could simply refuse to give approval, no determination can be made accordingly, and the matter is referred to the Dispute Adjudication Board.

Sub-Clause 5.2: Contractor's Documents

The Contractor's Documents shall comprise the technical documents specified in the Employer's Requirements, documents required to satisfy all regulatory approvals, and the documents described in Sub-Clause 5.6 [As-Built Documents] and Sub-Clause 5.7 [Operation and Maintenance Manuals], Unless otherwise stated in the Employer's Requirements, the Contractor's Documents shall be written in the language for communications defined in Sub-Clause 1.4 [Law and Language].

The Contractor shall prepare all Contractor's Documents, and shall also prepare any other documents necessary to instruct the Contractor's Personnel. The Employer's Personnel shall have the right to inspect the preparation of all these documents, wherever they are being prepared.

If the Employer's Requirements describe the Contractor's Documents which are to be submitted to the Engineer for review and/or for approval, they shall be submitted accordingly, together with a notice as described below. In the following provisions of this Sub-Clause, (i) "review period" means the period required by the Engineer for review and (if so specified) for approval, and (ii) "Contractor's Documents" exclude any documents which are not specified as being required to be submitted for review and/or for approval.

Unless otherwise stated in the Employer's Requirements, each review period shall not exceed 21 days, calculated from the date on which the Engineer receives a Contractor's Document and the Contractor's notice. This notice shall state that the Contractor's Document is considered ready, both for review (and approval, if so specified) in accordance with this Sub-Clause and for use. The notice shall also state that the Contractor's Document complies with the Contract, or the extent to which it does not comply.

The Engineer may, within the review period, give notice to the Contractor that a Contractor's Document fails (to the extent stated) to comply with the Contract. If a Contractor's Document so fails to comply, it shall be rectified, resubmitted and reviewed (and, if specified, approved) in accordance with this Sub-Clause, at the Contractor's cost.

For each part of the Works, and except to the extent that the prior approval or consent of the Engineer shall have been obtained:

(a) in the case of a Contractor's Document which has (as specified) been submitted for the Engineer's approval:

(i) the Engineer shall give notice to the Contractor that the Contractor's Document is approved, with or without comments, or that it fails (to the extent stated) to comply with the Contract;
(ii) execution of such part of the Works shall not commence until the Engineer has approved the Contractor's Document; and
(iii) the Engineer shall be deemed to have approved the Contractor's Document upon the expiry of the review periods for all the Contractor's Documents which are relevant to the design and execution of such part, unless the Engineer has previously notified otherwise in accordance with sub-paragraph (i);

(b) of such part of the Works shall not commence prior to the expiry of the review periods for all the Contractor's Documents which are relevant to its design and execution;
(c) execution of such part of the Works shall be in accordance with these reviewed (and, if specified, approved) Contractor's Documents; and
(d) if the Contractor wishes to modify any design or document which has previously been submitted for review (and, if specified, approval), the Contractor shall immediately give notice to the Engineer. Thereafter, the Contractor shall submit revised documents to the Engineer in accordance with the above procedure.

If the Engineer instructs that further Contractor's Documents are required, the Contractor shall prepare them promptly.

Any such approval or consent, or any review (under this Sub-Clause or otherwise), shall not relieve the Contractor from any obligation or responsibility.

The Contractor's Documents shall be specified in the Particular Conditions. Since these Conditions do not belong in our scope, we take over the standard provided definition which can be found in table 3.1, including As-Built Documents under Sub-Clause 5.6 [As-Built Documents]. Since the Engineer is part of the Employer's personnel, the Engineer is entitled to inspect the Contractor's Documents while they are still in preparation. This means that the Engineer is able to inspect the design of the Works during the entire design phase of a project. If the design is finished, the Engineer needs to review or approve the document. By having the right to access the documents in an early stage, the Engineer is able to correct any errors prior to the moment of submission to the Engineer. Thus, the Engineer has the possibility to review the design at multiple moments in the design phase. If the Engineer is not able to give notice to the Contractor whether a specific document is approved or not within the review period, the document shall be deemed approved. Therefore, the Engineer has 21 days to review the relevant Contractor's Documents which have been submitted to the Engineer.

Sub-Clause 5.2 (d) gives the Engineer the opportunity to review a revised design or other document again, according to the same procedure as described in Sub-Clause 5.2.

Sub-Clause 6.5: Working Hours

No work shall be carried out on the Site on locally recognised days of rest, or outside the normal working hours stated in the Appendix to Tender, unless:

(a) otherwise stated in the Contract,
(b) the Engineer gives consent, or
(c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer.

Safety at work includes the number of working hours, and the times at which workers are performing activities. Sub-Clause 6.5 makes an additional statement to the locally (or as stated in the Appendix to Tender) binding safety at work rules. The Engineer is entitled to consent for adapted working

times under this Sub-Clause. However, this does not mean that the Engineer can act in such a manner that is not in line with the governing law.

Sub-Clause 6.9: Contractor's Personnel

The Contractor's Personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative if applicable, who:

(a) persists in any misconduct or lack of care,
(b) carries out duties incompetently or negligently,
(c) fails to conform with any provisions of the Contract, or
(d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment.

If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

The Engineer is entitled to (indirectly) remove Contractor's Personnel from the project. This can be done by requiring the Contractor to remove certain personnel. Contractor's Personnel does also hold sub-contractors. This can only be done with one if the reasons from Sub-Clause 6.9 (a) to (d).

Sub-Clause 7.3: Inspection

The Employer's Personnel shall at all reasonable times:

(a) have full access to all parts of the Site and to all places from which natural Materials are being obtained, and
(b) during production, manufacture and construction (at the Site and elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of Materials.

The Contractor shall give the Employer's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility.

The Contractor shall give notice to the Engineer whenever any work is ready and before it is covered up, put out of sight, or packaged for storage or transport. The Engineer shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Engineer does not require to do so. If the Contractor fails to give the notice, he shall, if and when required by the Engineer, uncover the work and thereafter reinstate and make good, all at the Contractor's cost.

According to Sub-Clause 7.3, the Employer's Personnel is entitled to examine, inspect, measure and test the the materials and workmanship at all reasonable times. This gives the Engineer the opportunity to inspect the Works while being in the construction phase. However, these not-specified inspections are not mandatory. Whenever the Contractor notifies to the Engineer that some part of the Works is ready, the Engineer is entitled to inspect the part of the Works before it is covered up. An example of this could be reinforcement bars prior to the moment in which they are covered in concrete. This inspection before cover up is mandatory for the Engineer under Sub-Clause 7.3 (Corbett et al., 2020). However, the Sub-Clause includes an exception for non-inspection by stating that the Engineer shall carry out the inspection "or promptly give notice to the Contractor that the Engineer does not require to do so".

Sub-Clause 7.4: Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

The Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. The Contractor shall agree, with the Engineer, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Engineer may, under Clause 13 [Variations and Adjustments], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Engineer shall give the Contractor not less than 24 hours' notice of the Engineer's intention to attend the tests. If the Engineer does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, and the tests shall then be deemed to have been made in the Engineer's presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which the Employer is responsible, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) payment of any such Cost plus reasonable profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall promptly forward to the Engineer duly certified reports of the tests. When the specified tests have been passed, the Engineer shall endorse the Contractor's test certificate, or issue a certificate to him, to that effect. If the Engineer has not attended the tests, he shall be deemed to have accepted the readings as accurate.

The definition of "test" or "testing" in Sub-Clause 7.4 is quite vague. Corbett et al. (2020) states that "There is no limitation on the meaning of the term "tests" used here and it will be necessary to refer to the Specifications. There is no reason why the "tests" under a particular contract should not be something more than is normally understood by the term – for example they may include inspections, or verification of quantity as well as assessment of quality". It is assumed that a "test" is one of the actions named in Sub-Clause 7.3 [Inspection]: an examination, an inspection, or a measurement.

Sub-Clause 7.4 relates to predetermined tests which are described in the Contract. In contrast to the tests that are specified in Sub-Clause 7.3 [Inspection], the tests under Sub-Clause 7.4 are conducted by the Contractor himself on behalf of the Engineer. The Contractor needs to perform these tests in order to show the Engineer that the Works are in accordance with the Contract and the Employer's Requirements. If any Tests does not show compliance with the Contract, the Engineer is entitled to reject the results of the Tests under Sub-Clause 7.5 [Rejection]. When the Tests on completion

under Clause 9 [Tests on Completion] are completed and approved by the Engineer, the Contractor may apply by notice to the Engineer for a Taking-Over Certificate under Sub-Clause 10.1 [Taking Over of the Works and Sections]. The Engineer shall issue the Taking-Over Certificate, or reject the application by giving reasons and specifying the work required to be done bu the Contractor to enable the Taking-Over Certificate to be issued.

Sub-Clause 7.6: Remedial Work

Notwithstanding any previous test or certification, the Engineer may instruct the Contractor to:

(a) remove from the Site and replace any Plant or Materials which is not in accordance with the Contract,
(b) remove and re-execute any other work which is not in accordance with the Contract, and
(c) execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

The Contractor shall comply with the instruction within a reasonable time, which shall be the time (if any) specified in the instruction, or immediately if urgency is specified under sub-paragraph (c).

If the Contractor fails to comply with the instruction, the Employer shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer all costs arising from this failure.

Sub-Clause 7.6 (c) relates to any issue that is related to the safety of the Works. Works, as defined in table 3.1, includes the terms "Permanent Works" and "Temporary Works". Permanent Works is defined as the permanent works to be executed by the Contractor under the Contract. Temporary Works is defined as all temporary works of every kind (other than Contractor's Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects. Safety at work is not included in the term "Works". The type of safety that however is relevant under this Sub-Clause is constructive safety.

If the Engineer argues that, for whatever reason, the constructive safety of the Permanent Works or Temporary Works is in danger, he can instruct the Contractor to urgently resolve the issue.

Sub-Clause 8.8: Suspension of Work

The Engineer may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

The Engineer may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub Clauses 8.9, 8.10 and 8.1 1 shall not apply.

According to Sub-Clause 8.8, the Engineer is entitled to suspend the progress of the Works, for whatever reason. At the moment of the Engineer's instruction, the Contractor must protect the Works against deterioration and damage. The Engineer is not obliged to mention the reason for suspension. However, the reason is actually given in practice in order to clarify the applicability of other Sub-Clauses (such as Sub-Clause 8.9 [Consequences of Suspension, 8.10 [Payment for Plant and Materials in Event of Suspension], 8.11 [Prolonged Suspension], and 8.12 [Resumption of Work])

to the Contractor (Corbett et al., 2020). If the Engineer instructs the Contractor to suspend the Works, he is acting as the Employers Agent as suggested in Sub-Clause 3.1 [Engineer's Duties and Authority].

Sub-Clause 11.9: Performance Certificate

Performance of the Contractor's obligations shall not be considered to have been completed until the Engineer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract.

The Engineer shall issue the Performance Certificate within 28 days after the latest of the expiry dates of the Defects Notification Periods, or as soon thereafter as the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any defects. A copy of the Performance Certificate shall be issued to the Employer.

Only the Performance Certificate shall be deemed to constitute acceptance of the Works.

After all Tests on Completion under Clause 9 [Tests on Completion] have been approved by the Engineer, the Taking-Over Certificates have been issued by the Engineer under Sub-Clause 10.1 [Taking Over of the Works and Sections], the Defects Notification Period under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] has expired, and all defects are remedied during this Defects Notification Period, the Engineer shall issue the Performance Certificate under Sub-Clause 11.9. At the time of issuing the Performance Certificate, the Contractor has completed all obligations under the Contract and this certificate is a written confirmation of this.

If any defects are not remedied after the Defects Notification Period, or an extended Defects Notification Period under Sub-Clause 11.3 [Extension of Defects Notification Period], the Employer can resolve the defect under Sub-Clause 11.4 [Failure to Remedy Defects] by carrying out the work himself at the Contractor's cost, requiring the Engineer to determine a reasonable reduction in the Contract Price under Sub-Clause 3.5 [Determinations], or terminate the Contract as a whole (if the defect deprives the Employer of substantially the whole benefit of the Works).

Sub-Clause 13.1: Right to Vary

Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal. A Variation shall not comprise the omission of any work which is to be carried out by others.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, (ii) it will reduce the safety or suitability of the Works, or (iii) it will have an adverse impact on the achievement of the Schedule of Guarantees. Upon receiving this notice, the Engineer shall cancel, confirm or vary the instruction.

As already mentioned at the analysis of Sub-Clause 3.3 [Instructions of the Engineer], a Variation is a change of something in the Contract. This Variation could either be issued by an Instruction of the Engineer, or by request for the Contractor to submit a proposal to the Engineer. This "request" can be perceived to be a requirement. Variations may include things like (Corbett et al., 2020): changes in quantities; changes to quality or other characteristics; changes to levels, positions, or dimensions; omission of work unless it is to be carried out by others; any additional work, Plant, Materials, or services necessary for the Permanent Works including tests; or changes to the sequence or timing of

the Works. The contractor is obliged to carry out any Variation, unless he is able to identify why he cannot carry out the Variation with the three points mentioned in the Sub-Clause.

Corbett et al. (2020) furthermore state that it is not uncommon for this Sub-Clause to be the cause of a dispute. Often, the Engineer and Contractor have a different opinion whether the Instruction given by the Engineer is an Instruction or Variation. The Contractor will therefore make an application for an extra payment under Sub-Clause 20.1 [Contractor's Claims]. The Engineer will however, since he does not agree with the Contractor, deny his request. The issue will then be escalated to the Dispute Adjudication Board.

Besides the cited Sub-Clauses above, there are some more processes in which the Engineer is involved. The Engineer is entitled to audit the Contractor's Quality Assurance System under Sub-Clause 4.9 [Quality Assurance], which is cited in section 3.1.6. The Engineer is entitled to discuss matters with designers at all reasonable times under Sub-Clause 5.1 [General Design Obligations], which is cited in section 3.1.6. Furthermore, the Engineer is involved in the payment procedures under Sub-Clause 14.2 [Advanced Payment], Sub-Clause 14.6 [Issue of Interim Payment Certificates], and Sub-Clause 14.13 [Issue of Final Payment Certificate].

3.1.8 Vital tasks & responsibilities in the Yellow Book 1999 Edition

After the analysis of the FIDIC Yellow Book 1999 Edition General Conditions, this research is are able to verify whether FIDIC succeeds to fulfil the vital tasks & responsibilities as recommended by the DSB and described in section 2.5. This research also looks at the role of the Engineer in this integrated, systematic, and continues process of risk management. The analysis can however only be made on a theoretical level since only the theoretical framework of the General Conditions is used. To not only approach this analysis from the theoretical side, practical data must be gathered. This is done using interviews with two FIDIC experts which can be found in appendices C.5 and C.6. The connection between the interviews and the practical data is given using a coded num
In this section, the theoretical information and the practical data is combined in order to provide the answer to SQ4, but also find the parts of the vital tasks & responsibilities that are not covered by the Yellow Book and its Engineer.

The General Conditions do not literally provide Sub-Clauses regarding risk management or the control of risks during the design and execution phases of a project. Therefore, the Engineer is not necessarily designated to be the party that is responsible for the risk management system itself. Using different Sub-Clauses, the Engineer is however in the power to influence the process of an integrated, systematic, and continues process of risk management.

According to Sub-Clause 4.1 [Contractor's General Obligations], the Contractor must do anything which is necessary to satisfy the Employer's Requirements, and necessary for stability or the completion, or safe and proper operation, of the Works. If the Employer's Requirements state that the Contractor is obliged to keep up-to-date a risk management system, the Contractor is required to do so. The more detailed the requirement, the more the Employer is able to steer this risk management system. The Contractor must comply with the Engineer's instructions under Sub-Clause 3.3 [Instructions of the Engineer]. If there is no specific requirement about risk control or management in the Employer's Requirement, the Engineer is entitled to instruct the Contractor to implement a risk management system. This risk management system can be as broad as the Engineer requires. This instruction could possibly be in fact a Variation under Clause 13 [Variations and Adjustments] which can induce an increase to the Contract Price. This would however require approval of the Employer since this matter affects the Contract Price [QUOTE1F1, QUOTE1F3, QUOTE2F1]. Thus, the Contractor can be made responsible for a risk management approach using the Employer's Requirements in the first place, or by the Engineer's instructions in the second place. The latter would be very controversial, since the Engineer would normally only act according to the Contract [QUOTE1F2]. Since the Contractor is already obligated to comply with all applicable safety reg-

ulations under Sub-Clause 4.8 [Safety Procedures], risk management system is something that fits to this obligation. From this point onward, the Contractor is deemed to be responsible for the risk management system during a project. This is confirmed by both the interviewees [QUOTE1F6, QUOTE2F14]. The General Conditions and the interviewees show that the Engineer is able to support the Contractor with the process of risk management [QUOTE1F7, QUOTE2F16].

Looking at the steps in section 2.5 that need to be performed in order to arrange an integrated, systematic, and continues process of risk management, step 1 (i) until 1 (iv) can be assigned as a duty to perform by the Contractor, since he is the party that is responsible for the risk management system itself. Step 1 forms the origin of this system in the context of a construction project. The Contractor is best able to perform this step, since the Contractor must co-ordinate his own activities with those of his subcontractors under Sub-Clause 4.6 [Co-ordinate]. As a result, the Contractor must be aware of any activity that is being performed during the design and execution phase. Being aware of all activities at any moment in time and the context that the project is situated, the Contractor is able to identify all interfaces between the different activities of different subcontractors and the corresponding risks related to those interfaces. The Contractor is best able to manage risks related to a lack of feeling responsible in an interface, because it is the party that is most involved in this interface.

The risk management system is part of the Contractor's documents which must be drafted by the Contractor. During the preparation of the risk management system, for example during step 1 (ii), the Engineer is entitled to inspect the risk management system while it is in still in preparation under Sub-Clause 5.2 [Contractor's Documents]. Under the same Sub-Clause, the Engineer is able to inspect and review the design during the design phase, and is thus able to identify potential risks in an early phase. Risk sessions can also be held in the presence of the Employer, Engineer, and Contractor to gather potential risks [QUOTE2F15]. The Engineer is entitled to send instructions to the Contractor indicating an adaption of the risk management system. This could for example be the addition of risks which the contractor did not anticipated on himself, or a change in safety measures which have to be applied under step 1 (iv). If the Engineer would not use this situation to inspect the risk management system while it is still in preparation, the Engineer is entitled to inspect the risk management system at a later moment in time, namely when the Contractor submit the risk management system for review or approval under Sub-Clause 5.2 [Contractor's Documents]. At this stage, the Engineer is still able to make adaptions to the risk management system since commencements of the Works cannot start prior to the Engineer's approval under Sub-Clause 5.2 (a)(ii) [Contractor's Documents].

In the second step of the integrated, systematic, and continues process of risk management, the applicable laws and standards have to be indicated in order to show that the safety approach is practical and realistic for the context in which the project is situated. The FIDIC Yellow Book provides several Sub-Clauses which already indicate which laws or regulations to use during the project. These Sub-Clauses are shown below. The Employer must provide to the Contractor reasonable assistance with obtaining the applicable laws of the country which are relevant to the Contract under Sub-Clause 2.2 [Permits, Licenses or Approvals]. This Sub-Clause indicates that the applicable law of the project can be chosen freely, but most likely these laws are the ones in which the project is being built. The Contractor must comply with all applicable safety regulations under Sub-Clause 4.8 [Safety Procedures], these regulations include safety on Site and safety of the surrounding area. It is not completely clear whether this Sub-Clause also includes structural related safety regulations. As stated in Sub-Clause 6.5 [Working Hours], the work has to take place withing certain working hours. Furthermore, the Contractor's must take reasonable precautions to maintain the health and safety of the Contractor's Personnel under Sub-Clause 6.7 [Health and Safety]. The Engineer can use his own experience to verify whether the Contractor's safety approach is indeed deemed to be practical and realistic. If not, he can instruct the Contractor's to adapt the safety approach accordingly.

The third step of the safety approach relates to the actual execution of the safety plans and safety measures. This step might be the step which deserves the most of attention, since the cases highlight that this step is often neglected in practice. Step 3 (i) is, as discussed earlier, the responsibility of the Contractor. However, the Engineer has the tools available to influence the safety approach. Step 3 (ii) relates to a transparent, clear, and accessible distribution of responsibilities to actually execute the safety plans and safety measures. The management of risks needs to be allocated at the party which is best able to manage the risk. This might be the Contractor himself, but could also be a subcontractor or supplier of materials. To make it as transparent, and accessible as possible, all communication between parties is transmitted using an agreed system of electronic transmission under Sub-Clause 1.3 [Communications]. This means that all involved parties receive the same (amount of) information. Whenever communication is not directly send to the Engineer, he must receive a copy of the communication. This means that the Engineer is at least informed about everything that happens under the Contract. The Contractor must prepare documents to instruct the Contractor's Personnel, and thus the subcontractors, under Sub-Clause 5.2 [Contractor's Documents]. These documents need to be reviewed or approved by the Engineer under the same Sub-Clause. When the Engineer reviews these documents, he is able to see whether the Contractor is specifying the responsibilities of each individual subcontractor in a clear and effective manner. If the Engineer is not convinced that the documents makes the responsibilities clear for each subcontractor, he can instruct the Contractor to revise the documents in such a way that the responsibilities will become more clear. By doing so, the Engineer can assume that the project manager of the subcontractor has the responsibilities of his organisation secured on project policy level. On his turn, the subcontractor's project manager is responsible for making the tasks and responsibilities clear to his personnel that is actually executing the Works. It is not one of the Engineer's duties to control this on a subcontractor level. He can however tell the Contractor to keep an eye on his subcontractors [QUOTE2F20]. Since the Contractor is the main party that is responsible for the execution of the Works, he is also best able to be the central party that coordinates the safety approach during these Works (step 3 (iv)). However, the Contractor should execute this role under supervision of the Engineer. The Engineer is controlling the Contractor's safety approach by constantly asking him if he mitigating certain risks, if he should not take more mitigating interventions to control a risk, and so on [QUOTE2F17]. Without the Engineer that is stimulating the Contractor to work on his risk management system and safety approach, both would be neglected more [QUOTE2F18].

The fourth step of the safety approach relates to the continues improvement of these plans and the corresponding safety measures. The Engineer has different tools available to do this. First, the Engineer is entitled to audit any part of the Quality Assurance system under Sub-Clause 4.9 [Quality Assurance]. This Quality Assurance system includes the risk management system and safety approach. Sub-Clause 4.9 [Quality Assurance] states that evidence of the prior approval by the Contractor himself shall be apparent on the document itself, when any document of a technical nature is issued to the Engineer. This explicitly means that an internal control mechanism must be present within the Contractor's organisation. The audit of the Quality Assurance system which can be conducted by the Engineer, can be categorised as an external independent control mechanism since the Engineer is often described as an independent party. Second, the Contractor must keep the Engineer up-to-date using progress reports under Sub-Clause 4.21 [Progress Reports]. The Engineer is able to see the implementation of the safety approach and corresponding safety measures using these progress reports, and is also able to identify any crucial moment in the construction process. The Engineer can decide to go to the Site himself and perform an inspection, which leads to the third point. The Engineer is able to inspect the Works at multiple moments in time. As already mentioned, the Engineer is able to inspect the design while the design is being prepared under Sub-Clause 5.2 [Contractor's Documents]. These designs include drawings and calculations of the Temporary and Permanent Works. This entitlement does not mean that the Engineer is obliged to inspect the designs while they are being prepared. However, this entitlement does enable the Engineer to inspect these documents during the preparation phase of the documents. When the design is finished according to the Contractor, the Contractor must submit the design to the

Engineer under Sub-Clause 5.2 [Contractor's Documents]. The Engineer is obliged to review (and approve if specified in the Particular Conditions) the design. Therefore, the Engineer is enabled to have another opportunity for an inspection of the design documents and also to improve the safety approach if needed. During the actual execution phase, the Engineer is entitled to examine, inspect, measure and test the Works at all reasonable times under Sub-Clause 7.3 [Inspection]. These inspections are also used in practice [QUOTE2F11]. The inspections in Sub-Clause 7.3 which the Engineer can perform as described above are however a bit contrary to the philosophy of an integrated contract in which the Contractor must show that the Works are constructed according to the Contract [QUOTE2F10, QUOTE2F26]. Therefore, the use of Sub-Clause 7.4 [Testing] is more appropriate. Besides the Engineer performing inspections and tests, the Contractor can be obligated to perform tests himself using the Particular Conditions under Sub-Clause 7.4 [Testing] and 9.1 [Contractor's Obligations]. The Engineer is deemed to be present at these tests. Both the tests performed by the Engineer himself under Sub-Clause 7.3 [Inspection], and the tests performed by the Contractor under Sub-Clause 7.4 [Testing], should be sufficient for the Engineer to judge whether the Works are approved or rejected under Sub-Clause 7.5 [Rejection]. If the Works are rejected, for example if the implemented safety measure does not cover the corresponding risk, the Works can be retested under Sub-Clause 7.5 [Rejection] and 9.3 [Retesting]. The Engineer is even entitled to suspend the progress of the Works under Sub-Clause 8.8 [Suspension of Work] if e.g. tests keep failing. If the Engineer does not classify himself as enough qualified to perform tests or inspections, the Engineer is able to hire independent inspectors to perform any test under Sub-Clause 3.2 [Delegation by the Engineer]. However, this does not mean that the Engineer is not allowed to perform inspections himself [QUOTE2F10, QUOTE2F25].

The continues improvement of the safety approach cannot only be reached using instructions to the Contractor which might come out of the blue. The Engineer is also able to make the Contractor attend discussions until the end of the Defects Notification Period under Sub-Clause 5.1 [General Design Obligations]. These discussions can make the Contractor aware of any possible incoming instruction. The above mentioned tools are all proactive tools. Under Sub-Clause 6.7 [Health and Safety], the Engineer receives any information regarding any accident. The Engineer can act on an accident and make the Contractor adapt the safety approach. This however, is an adaption in a reactive manner which is not ideal.

Cobouw (2022b) (no scientific source) states that the contract is not being read by project parties during the design and execution phase, taking the Dutch construction industry as a context. The responsibilities set in the Contract are therefore not clear during these phases. FIDIC's Engineer, as the Contract administrator, is able to help make the responsibilities more clear for all parties during all phases. The DSB's main recommendation, an integrated, systematic, and continues process of risk management, is partly facilitated by FIDIC. The first step is conducted by the Contractor, in close collaboration with the Engineer which is able to steer to process using several tools. The second step is facilitated by FIDIC by indicating what laws to use in the General Conditions. The third, and most important step, could be safeguarded when the Engineer is present on site. The fourth step is mainly safeguarded by the Engineer's proactive tools.

It gets more interesting when time and money are an issue for the Contractor, i.e. he is in debt or does not make the planned schedule. The Contractor will look for all possible ways to save money. This could mean that the risk management gets neglected [QUOTE2F21], or even that safety becomes an issue for some Contractors [QUOTE2F25]. This also means that the Contractor's internal control mechanisms, stated in Sub-Clause 4.9 [Quality Assurance] is neglected. The Engineer, being the party that performs the external independent control mechanism, checks whether the risk management process is performed according to the initial plans of the Contractor [QUOTE2F3, QUOTE2F17]. Therefore, the Engineer must detect that the Contractor is not performing risk management as agreed. Using the external independent control mechanism, the Engineer is actually able to influence the activities of the Contractor at this rather critical stage. There are many types of

Engineers, but interviewee 2F sketched two extreme types of Engineers which would act in different ways. The first type of Engineer would choose to agree with the Contractor on a change in the risk management approach, and therefore possibly the implementation of different safety measures [QUOTE2F12, QUOTE2F22]. The Employer must be asked for approval if this situation would occur, because this can be seen as a Variation under the Contract. The other type of Engineer would stick with his main task: make sure that the activities are performed according to the Contract [QUOTE2F13, QUOTE2F23]. This would then also hold for the risk management and the implementation of the corresponding safety approach. Being the Engineer in a project, one really should think about how to act at these critical moments, and what attitude is best for both project performance and safety [QUOTE2F24].

3.1.9 Engineer's incentive

As stated above, an external independent control mechanism is implemented in order to acquire a double assurance in terms of checks. To properly perform these checks, the Engineer must have certain incentives to perform these checks in the right way. These incentives can be found in the contract between the Engineer and the Employer: FIDIC's Client/ Consultant Model Services Agreement, also known as the FIDIC White Book contract. To find these incentives, the 5th edition of the White book is used. Different from the analysis of the FIDIC Yellow Book, the analysis is not made Sub-Clause by Sub-Clause but rather based on the different incentives that are present in the FIDIC White Book. The main incentive is found in the liability of the Engineer.

Liability

While the function of the Engineer in the Yellow Book is to make sure that the activities are performed according to the Contract, the White Book describes the function in Sub-Clause 3.1.1 [Scope of Services]: "The Consultant [Engineer] shall perform the Services as stated in Appendix 1 [Scope of Service]" (FIDIC, 2017). This Appendix 1 [Scope of Service] is different from project to project and can therefore not be used directly. However, we assume that Appendix 1 [Scope of Service] states the it is the Engineer's function to make sure that the activities are performed according to the Contract.

Sub-Clause 3.3.1 [Standard of Care] states: "Notwithstanding any term or condition to the contrary in the Agreement or any related document or any legal requirement of the Country or any other relevant jurisdiction (...), in the performance of the Services the Consultant [Engineer] shall have no other responsibility than to exercise the reasonable skill, care and diligence to be expected from a consultant [Engineer] experienced in the provision of such services for projects of similar size, nature and complexity". This Sub-Clause shows the aim of the White book: protect the Engineer as long as he has exercised reasonable skill, care and diligence.

Sub-Clause 3.9.4 [Construction Administration] states: "The Consultant [Engineer] shall not be liable to the Client [Employer] for the performance of the Works Contract by the Contractor. In the discharge of its duties under the Works Contract, the Consultant [Engineer] shall only be liable to the Client [Employer] if the Consultant [Engineer] commits a breach of the Agreement". The consecutive Sub-Clause 3.9.5 states: "The Consultant [Engineer] Shall not be liable to the Client [Employer] or the Contractor for the means, techniques, methods or sequencing of any aspects of the Works Contract or for the safety or adequacy of any of the Contractor's operation". These Sub-Clauses point out that when something that relates to safety occurs on the Site, the Engineer cannot be held liable direct. However, indirectly, if the Engineer has not exercised reasonable skill, care or diligence related to his own Scope of Services, the Engineer can be held liable. This corresponds to Sub-Clause 8.1.1 [Liability of Breach]: "The Consultant [Engineer] shall be liable to the Client [Employer] for any breach by the Consultant [Engineer] of any provision of the Agreement". The extend to which the Engineer is liable, is stated under Sub-Clause 8.1.3 (a) & (b): "If either Party is liable to the other, damages shall be payable only on the following terms: (a) such damages shall be limited to the amount of reasonable foreseeable loss and damage suffered as a direct result of

such breach; (b) in any event, the amount of such damages shall be limited to the amount stated in Sub-Clause 8.3.1 [Limit of Liability]". To find out to what exact amount the Engineer can be held liable, one must look at Sub-Clause 8.3.1 [Limit of Liability]: "The maximum amount of damages payable by either Party to the other in respect of any and all liability, including liability arising from negligence, under or in connection with the Agreement shall not exceed the amount stated in the Particular Conditions. (...)". Since this amount can be found in the Particular Conditions, it can be as much as the Client [Employer] and Engineer have agreed on in a specific project. Therefore, there is no capped liability based on the White Book. The only fixed limit of liability that is present in Sub-Clause 8.3.3 which states that neither party can be held liable for indirect damages or losses.

Sub-Clause 8.2.1 [Duration of Liability] states: "(...), neither the Client [Employer] nor the Consultant [Engineer] shall be considered liable for any loss or damage resulting from any occurrence unless a claim is formally made on one Party by the other Party before the expiry of the relevant period stated in the Particular Conditions, such period to commence upon completion of the Services or termination of the Agreement (whichever is earlier). (...)". This Sub-clause states that (assuming that the contract is not terminated) the duration of liability is also given in the Particular Conditions. It seems that this period can therefore be as long as agreed. This is however not realistic, since deliverables deteriorate over time. This is also not realistic since Croft (2017) states that this Sub-Clause tries to override lengthy limitation periods, such as that where the principle of decennial liability applies.

To conclude, the magnitude of liability and the duration of liability are not capped in the FIDIC White Book. The magnitude of liability, i.e. the monetary value that an Engineer is exposed to, is set in the Particular Conditions and can be as large as agreed. This also holds for the duration of liability. However, the White Book tries to nullify very long periods of liability. Especially the magnitude of liability can be a big risk for an Engineer when participating in a project. Therefore, the stimulus or incentives for the Engineer to properly perform his work are huge.

3.2 UAC-IC 2005

A study in 1996 by CROW regarding the different Project delivery methods resulted in the need for an legal framework for projects with an integrated responsibility for design and execution (CROW, n.d.). A task force was established to create this legal framework during the period between 1998 and 2000. This task force created the "Model Basisovereenkomst" (MBO) and the UAC-IC 2000. After a trial period of 4 years, the needed adaptions were made to the framework resulting in the UAC-IC 2005. Dutch standardised general terms and conditions such as the "Standaardvoorwaarden 1997 Rechtsverhouding" (SR 1997), "Regeling van de Verhouding tussen Opdrachtgever en adviserend Ingenieursbureau 2001" (SVOI 2001), and "De Nieuwe Regeling 2005" (DNR 2005) have a long tradition. This is not different for the UAC-IC 2005. The UAC-IC has been developed by involving multiple parties into the process, which represented clients, contractors, knowledge institutes and lawyers (Bleeker, 2014; M. Chao-Duivis, 2015). The involvement of these parties have led to a set terms and conditions which is known for its fair balance.

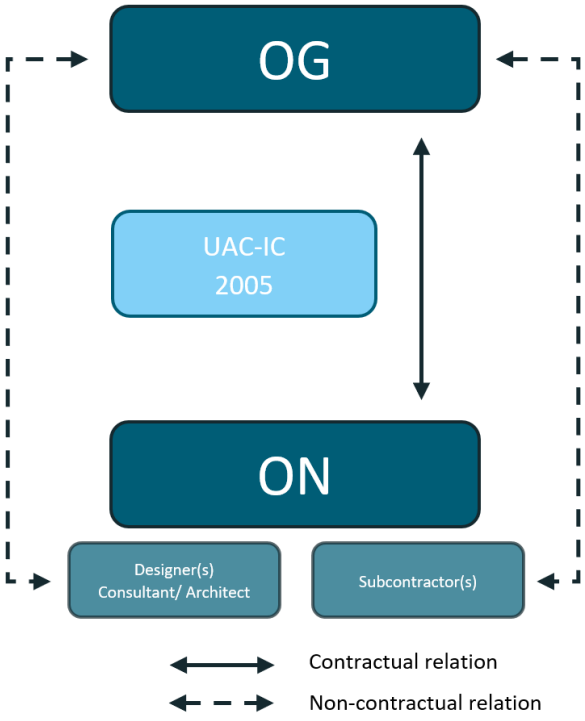


Figure 3.3: The relations between the parties in the UAC-IC 2005.

The MBO and UAC-IC have been developed in such a way that the contract can facilitate different project delivery methods. Examples of these project delivery methods are Turnkey, Design & Construct, and Engineer & Construct. In these different project delivery methods, the responsibility distribution looks different from each other as can be seen from figure 3.4. Not only the responsibility of the ON (i.e. client, more details in section 3.2.3) is different in each project delivery method, but also the passive involvement of the OG (i.e. contractor, more details in section 3.2.3) during the design and execution phases. Within the UAC-IC, different optional clauses can be selected in the contract in order to reach the desired level of responsibility for both the ON and OG.

The UAC-IC 2005 mainly relates to the contractual relation between the OG and ON. Incidental, "independent auxiliary persons" are mentions which relate to subcontractors. A basic overview of the relation between the ON, OG subcontractors, and consultants can be found in figure 3.3.

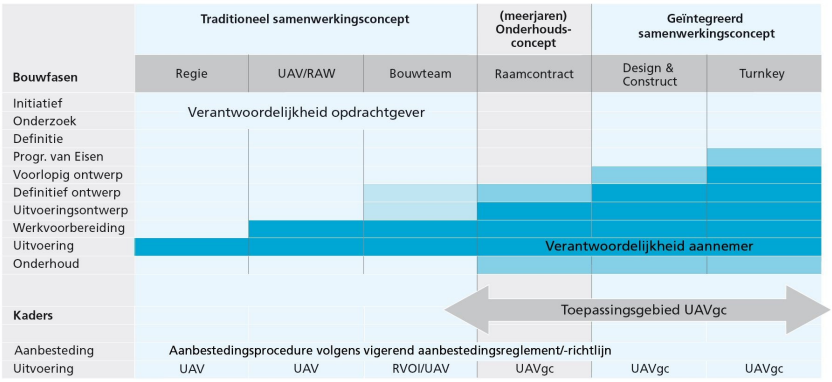


Figure 3.4: The range of project delivery methods in which the UAC-IC (in Dutch: UAV-GC) can be used (Aarsen, 2020).

3.2.1 Definitions

The most important terms uesd in the UAC-IC 2005 are given in table 3.3. These terms are stated and explained in Dutch. The reason for this is to keep the legal slang in its original state.

Table 3.3: Definitions of terms used in the UAC-IC.

"Term"	**Definition in the UAC-IC 2005**
"Aanbieding"	contractdocument waarmee de Opdrachtnemer te kennen heeft gegeven het Werk en, eventueel, het Meerjarig Onderhoud te willen realiseren conform het bepaalde in de Overeenkomst tegen betaling van de in de Basisovereenkomst vastgelegde prijs. (CROW, 2020)
"Acceptatie"	Schriftelijke aan de Opdrachtnemer gerichte mededeling waarin de Opdrachtgever verklaart geen bezwaar te hebben tegen door de Opdrachtnemer ter Acceptatie voorgelegde Documenten, zelfstandige hulppersonen, Werkzaamheden, resultaten van Werkzaamheden of Wijzigingen in de zin van § 15 lid 3. (CROW, 2020)
"Bekwame spoed"	Enige tijd mag genomen worden voor een ractie, bijvoorbeeld omdat onderzoek gepleegd moet worden (M. Chao-Duivis, 2015)
"Binnen bekwame tijd"	Enig onderzoek of beraad is geoorloofd (M. Chao-Duivis, 2015)
"Documenten"	Alle informatie door of namens de Opdrachtnemer geproduceerd in het kader van de Werkzaamheden, ongeacht de aard van de informatiedrager waarop of waarin deze informatie is vastgelegd. (CROW, 2020)
"Onverwijld"	Zo spoedig mogelijk (M. Chao-Duivis, 2015) / zonder vertraging (CROW, n.d.)
"Opdrachtgever"	In de Basisovereenkomst genoemde natuurlijke of rechtspersoon die de Opdrachtnemer opdraagt het Werk en, indien overeengekomen, het Meerjarig Onderhoud te realiseren. (CROW, 2020)
"Opdrachtnemer"	In de Basisovereenkomst genoemde natuurlijke of rechtspersoon aan wie de realisatie van het Werk en, indien overeengekomen, het Meerjarig Onderhoud is opgedragen. (CROW, 2020)
"Vraagspecificatie"	Het als zodanig in de Basisovereenkomst aangemerkte contractdocument dat door of namens de Opdrachtgever is vervaardigd, op basis waarvan de Opdrachtnemer zijn Aanbieding heeft opgesteld en ingediend. (CROW, 2020)
"Werk"	Het in de Basisovereenkomst omschreven werk dat de Opdrachtnemer op basis van de Vraagspecificatie en de Aanbieding door middel van Ontwerp- en Uitvoeringswerkzaamheden dient te realiseren. (CROW, 2020)

3.2.2 Structure

An UAC-IC 2005 contract does not only hold the standardised terms and conditions, but many more documents that set out the contract. The order of precedence of all these documents is as follows (CROW, 2020):

- Model Basisovereenkomst
- Vraagspecificatie
- Annex Vraagspecificatie
- **UAC-IC 2005**
- Aanbieding
- Documents under §1 UAC-IC 2005

The UAC-IC 2005 has 18 chapters including a total of §48 clauses. A list of all chapters can be found in table A.3. Using the Model Basisovereenkomst, every contract can be made project specific. This thesis focuses on the part of the contract that is standardised for every project: the UAC-IC 2005. If needed for extra context, the Model Basisovereenkomst is cited as well.

3.2.3 Setup tasks & responsibilities

In order to make a clear deviations between FIDIC's Sub-Clauses compared to UAC-IC's clauses, the sign "§" is introduced. Clauses of the UAC-IC 2005 are indicated with this sign. The employer in the UAC-IC is from this point onward called the OG (in Dutch: opdrachtgever), while the contractor is called the ON (in Dutch: opdrachtnemer).

The following sections have the same structure: first, a § is cited from the UAC-IC 2005 (CROW, 2020). This § is cited in a blue box which indicates the number of the §, the title of the §, and the content of that §. The citation is given in Dutch to keep it as authentic as possible. If some part of a § is left out of the citation, it is indicated with the '(...)' symbol. Below the blue box, an analysis or comment regarding the § is given. This analysis is given in English. There is no reasoning behind the specific order in which the § are given in the following sections. An example of the structure described above, can be seen below:

§"No. of §": "Title of §"

"Content of §." (CROW, 2020)

"Analysis or comments of/on §."

3.2.4 OG's tasks & responsibilities

§3: Verplichtingen van de Opdrachtgever

3-1 De Opdrachtgever zorgt er voor dat de Opdrachtnemer tijdig beschikt over:

(a) alle informatie waarover de Opdrachtgever beschikt, voorzover het ter beschikking stellen daarvan noodzakelijk is om de Opdrachtnemer in staat te stellen het Werk en het Meerjarig Onderhoud conform de Overeenkomst te realiseren;

(b) het in de Vraagspecificatie omschreven terrein en/of het water waarop, waarin en/of waaronder het Werk en het Meerjarig Onderhoud moet worden gerealiseerd;

(c) alle goederen waarvan in de Basisovereenkomst uitdrukkelijk is bepaald dat deze door of namens de Opdrachtgever aan de Opdrachtnemer ter beschikking zullen

worden gesteld.

3-2 De Opdrachtgever is verantwoordelijk voor de inhoud van alle informatie die door hem aan de Opdrachtnemer ter beschikking is gesteld, alsmede voor de goederen die krachtens lid 1 sub c aan de Opdrachtnemer ter beschikking zijn gesteld.

(...)

3-9 De Opdrachtgever zal aan de Opdrachtnemer voldoen hetgeen hem volgens de Overeenkomst toekomt. Het ingevolge de Overeenkomst aan de Opdrachtnemer toekomende bedrag is het saldo, gevormd door de in de Basisovereenkomst vastgelegde prijs, verhoogd dan wel verlaagd met hetgeen overigens aan of door de Opdrachtnemer ter zake van de Overeenkomst verschuldigd is.

According to §3, the OG has the obligation to provide the ON with information if this lies within the power of the OG. If the ON has the power in whatever way to get the information himself, without the help of the OG, the obligation to provide the ON with information cancels for the OG. Some information might be provided to the ON in the procurement phase in order to do a proper "aanbieding". Furthermore the OG is obligated to pay to the ON the amount that is specified in the contract.

§9: Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtgever

9-1 De Opdrachtgever zorgt er voor dat op de in een bij de Vraagspecificatie gevoegdeannex genoemde tijdstippen de vergunningen, ontheffingen, beschikkingen of toestemmingen die vermeld staan in die annex, beschikbaar zijn. De Opdrachtnemer is verplicht, voorzover dat in zijn vermogen ligt, de Opdrachtgever de medewerking te verlenen die noodzakelijk is voor het verkrijgen van die vergunningen, ontheffingen, beschikkingen of toestemmingen.

9-2 Voorzover de in lid 1 bedoelde annex geen melding maakt van vergunningen, ontheffingen, beschik-kingen of toestemmingen wordt de Opdrachtgever geacht zich niet te hebben verplicht daarvoor te zorgen.

9-3 Indien de Opdrachtgever tekortschiet in de nakoming van zijn verplichting uit hoofde van lid 1, kan de Opdrachtnemer met inachtneming van het daaromtrent in de wet bepaalde de hem krachtens de wet toekomende rechtsvorderingen instellen, behoudens het bepaalde in de leden 4 tot en met 8.

(...)

According to §9, the OG has the obligation to get in his possession the necessary permits which are specified in the requirements of the contract. Permits that are not mentioned in this requirements document, do not have to be obtained by the OG. If permits are not obtained on time, there are different consequences possible for the OG.

§20: Toetsing van Ontwerpwerkzaamheden

20-1 De Opdrachtgever is bevoegd om te toetsen of:

(a) de kwalificaties van hulppersonen die de Opdrachtnemer wil inschakelen voor de Ontwerpwerkzaamheden, en

(b) de uit Ontwerpwerkzaamheden voortkomende Ontwerpdocumenten,

voldoen aan de eisen die voortvloeien uit de Overeenkomst. Deze toetsing vindt plaats op basis van het toetsingsplan Ontwerpwerkzaamheden. De Opdrachtgever is slechts

bevoegd tot toetsing van de in deze paragraaf bedoelde kwalificaties van hulppersonen en Ontwerpdocumenten, voorzover het toetsingsplan daarin uitdrukkelijk voorziet, behoudens het bepaalde in lid 2.

20-2 De Opdrachtgever is bevoegd te toetsen of de kwaliteitsborging van de Ontwerpwerkzaamheden plaatsvindt overeenkomstig het eventuele kwaliteitsplan, eventuele deelkwaliteitsplannen en de overige eisen die gelet op de aard en de inhoud van de Overeenkomst aan die kwaliteitsborging kunnen worden gesteld.

20-3 De Opdrachtgever dient bij het uitoefenen van zijn toetsingsbevoegdheid uit hoofde van deze paragraaf de Werkzaamheden zo weinig mogelijk te verstoren.

20-4 De Opdrachtgever is niet verplicht gebruik te maken van zijn toetsingsbevoegdheid uit hoofde van deze paragraaf. Het is aan hem te bepalen of en hoe hij die toetsingsbevoegdheid gedurende de Ontwerpwerkzaamheden uitoefent. Niettemin rust op de Opdrachtgever de verplichting de Opdrachtnemer schriftelijk en binnen bekwame tijd te informeren, indien hij een tekortkoming van de Opdrachtnemer daadwerkelijk heeft opgemerkt.

In order to start the analysis §20, the context of the Dutch word "toetsen" has to be explained. The verification procedure contains the following characteristics (M. Chao-Duivis, 2015):

- It is an activity performed by the OG to verify whether the ON has performed the works according to the requirements in the contract.
- The OG is not obligated to inform the ON about the results.
- However, the OG is obliged to inform the ON about any defect in relation to the contract.
- The OG is not obligated to use his entitlement to verify.

The verification procedure during the design phase is explained in more detail in §20. It states that this procedure must take place according to the predefined aspects set in the so called verification plan of the design work. The OG cannot determine what he exactly likes to verify at any moment in time, but has to predefine this in the same verification plan.

§21: Toetsing van Uitvoeringswerkzaamheden

21-1 Indien en voorzover dat in het acceptatieplan is vastgelegd, legt de Opdrachtnemer een keuringsplan Uitvoeringswerkzaamheden en een keuringsplan Onderhoudswerkzaamheden ter Acceptatie voor aan de Opdrachtgever. Het bepaalde in § 23 is van toepassing.

21-2 Met de resultaten van keuringen waarin de in lid 1 bedoelde keuringsplannen voorzien en die hij moet uitvoeren, dient de Opdrachtnemer aan te tonen dat Uitvoerings- en Onderhoudswerkzaamheden en resultaten daarvan voldoen aan de eisen die voortvloeien uit de Overeenkomst.

21-3 De Opdrachtnemer maakt met bekwame spoed na de uitvoering van een in een keuringsplan voorziene keuring, de resultaten daarvan schriftelijk kenbaar aan de Opdrachtgever, tenzij in overleg tussen partijen een termijn is overeengekomen. Daarbij dient de Opdrachtnemer te vermelden:

(a) op welk onderdeel van de Uitvoerings- of Onderhoudswerkzaamheden de keuring betrekking heeft, onder verwijzing naar het relevante keuringsplan,

(b) wie de keuring heeft uitgevoerd,

(c) de datum en het tijdstip waarop de keuring is uitgevoerd, en

(d) of het resultaat van de uitgevoerde keuring beantwoordt aan de eisen die krachtens de Overeenkomst aan de Uitvoerings- of Onderhoudswerkzaamheden zijn gesteld.

21-4 De Opdrachtgever is bevoegd om, uiterlijk op het moment waarop Acceptatie van een keuringsplan plaatsvindt, in dat keuringsplan stop- en bijwoonpunten te vermelden. In dat geval geeft de Opdrachtgever voor elk afzonderlijk stoppunt aan:

(a) de geobjectiveerde criteria waaraan de resultaten van de relevante, in het keuringsplan voorziene keuringen moeten voldoen, om voor Acceptatie in aanmerking te komen, en

(b) de termijn waarbinnen de Opdrachtgever aan de Opdrachtnemer zowel mondeling als schriftelijk moet mededelen of die resultaten als geaccepteerd worden beschouwd.

21-5 De Opdrachtnemer stelt de Opdrachtgever tevoren schriftelijk in kennis van het tijdstip waarop een stop- of bijwoonpunt wordt bereikt, tenzij in overleg tussen partijen een termijn is overeen-gekomen.

21-6 Bij het bereiken van een stoppunt legt de Opdrachtnemer ter Acceptatie aan de Opdrachtgever voor:

(a) de in het keuringsplan genoemde Uitvoerings- of Onderhoudswerkzaamheden en/of de resultaten van die Werkzaamheden, ten aanzien waarvan de Opdrachtgever een stoppunt heeft vermeld, en

(b) de resultaten van de in het keuringsplan voorziene keuring van die Werkzaamheden, overeen-komstig het bepaalde in lid 3.

Het bepaalde in § 23, leden 4 tot en met 15 is van overeenkomstige toepassing, met dien verstande dat daar waar wordt gesproken van 'acceptatieplan', gelezen moet worden 'keuringsplan Uitvoeringswerkzaamheden' of 'keuringsplan Onderhoudswerkzaamheden'.

21-7 Bij het bereiken van een bijwoonpunt houdt de Opdrachtnemer voor toetsing door de Opdrachtgever beschikbaar:

(a) de in het keuringsplan genoemde Uitvoerings- of Onderhoudswerkzaamheden en/of de resultaten van die Werkzaamheden, ten aanzien waarvan de Opdrachtgever een bijwoonpunt heeft vermeld, en

(b) de resultaten van de in het keuringsplan voorziene keuringen van die Werkzaamheden, overeenkomstig het bepaalde in lid 3.

De Opdrachtnemer is gerechtigd de Uitvoerings- of Onderhoudswerkzaamheden voort te zetten, indien de Opdrachtgever na het bereiken van een bijwoonpunt de beschikbaar gehouden Werkzaamheden, resultaten van Werkzaamheden en de resultaten van de in het keuringsplan voorziene keuringen van die Werkzaamheden niet toetst.

21-8 De Opdrachtgever is bevoegd te toetsen of de kwaliteitsborging van de Uitvoerings- en Onderhoudswerkzaamheden plaatsvindt overeenkomstig het eventuele kwaliteitssysteem van de Opdrachtnemer, het eventuele kwaliteitsplan, eventuele deelkwaliteitsplannen, de keuringsplannen en de overige eisen die gelet op de aard en de inhoud van de Overeenkomst aan die kwaliteitsborging kunnen worden gesteld.

21-9 De Opdrachtgever dient bij het uitoefenen van zijn toetsingsbevoegdheid uit hoofde van deze paragraaf de Werkzaamheden zo weinig mogelijk te verstoren.

21-10 De Opdrachtgever is niet verplicht gebruik te maken van zijn toetsingsbevoegdheid uit hoofde van deze paragraaf. Het is aan hem te bepalen of en hoe hij die toetsingsbevoegdheid gedurende de Uitvoerings- en Onderhoudswerkzaamheden uitoefent. Niettemin rust op de Opdrachtgever de verplichting de Opdrachtnemer schriftelijk en binnen bekwame tijd te informeren, indien hij een tekortkoming van de Opdrachtnemer daadwerkelijk heeft opgemerkt.

In order to start the analysis §21, the context of the Dutch words "acceptatie", and "keuren" has to be explained.

Acceptance contains the following characteristics (M. Chao-Duivis, 2015):

- It is an activity which entails a clear go or no-go decision by the OG. If a document is not accepted, the works cannot continue.
- The entitlement to accept (parts of) the works is only valid if it is predetermined in the acceptation plan.
- The acceptation procedure is dealt with in §23, and is most relevant for essential parts of the works.
- If the acceptation procedure takes place, the OG is always entitled to perform the verification procedure first.

Inspection contains the following characteristics (M. Chao-Duivis, 2015):

- It is an activity performed by the ON to show the OG that the works are performed according to the requirements in the contract.
- The inspection plan must be submitted to the OG if that is predetermined in the acceptation plan.
- The OG has the right to implement stop and attendance points. A stop moment means that the OG can start the acceptance procedure on the inspection plan. An attendance point means the OG can start the verification procedure on the inspection plan.

According to §21, the OG is entitled to inspect the results of the execution phase. This is done by the so called inspection plan. In these plans, the ON specifies the method which he uses to validate the quality of the results in relation to the requirements in the contract. The OG has the right to verify or accept the results of the inspection plan. The entitlement to inspect means that the OG cannot inspect the quality of the works himself. The ON is rather the party that provides the OG with reports regarding the quality of the results. The OG can however be present at the inspection procedure.

The acceptance procedure does not mean that the OG has approved the to be accepted documents. Acceptance does just mean that the OG does not have any objection in relation to any requirement in the contract. Responsibilities do not change or shift after acceptance.

§33: Betaling

33-1 Betaling van de in de Basisovereenkomst vastgelegde prijs geschiedt op basis can een door de Opdrachtnemer opgestelde termijnstaat.

(...)

According to §33, the OG is obliged to pay a predefined amount to the ON. This amount can vary depending on different scenarios during the project phases.

3.2.5 ON's tasks & responsibilities

§2: Vertegenwoordiging van partijen

2-1 De Opdrachtgever is gerechtigd een of meer vertegenwoordigers aan te wijzen om als zijn gemachtigde op te treden in zaken het Werk en het Meerjarig Onderhoud betreffende, dan wel de als zodanig aangewezen persoon of personen door anderen te vervangen.

(...)

2-7 De Opdrachtnemer is verplicht om bij door de Opdrachtgever te accepteren volmacht een vertegenwoordiger aan te wijzen om als zijn gemachtigde op te treden in zaken het Werk en het Meerjarig Onderhoud betreffende. De acceptatieprocedure omschreven in § 23 is van toepassing.

Since the OG and ON cannot be always on site themselves, it can be helpful to appoint representatives for both parties. According to §2-1, the OG is allowed to appoint one or more representatives, but its points out that this is not mandatory. In contrast to that, the ON is obligated to appoint a representative according to §2-7. All representatives must act within their corresponding authority. The party that a representative is representing, is bound to the actions taken by the corresponding representative as long as this action is within the representatives' authority (M. Chao-Duivis et al., 2018). Who the representatives are exactly, must be completely clear for both the OG and ON in order to avoid any miscommunications (M. Chao-Duivis, 2015).

§4: Verplichtingen van de Opdrachtnemer

4-1 De Opdrachtnemer is verplicht de Ontwerp- en Uitvoeringswerkzaamheden zodanig te verrichten dat het Werk op de in de Basisovereenkomst vastgelegde datum van oplevering voldoet aan de uit de Overeenkomst voortvloeiende eisen. Voldoet het Werk niet aan die eisen, dan is er sprake van een gebrek.

(...)

4-5 De Opdrachtnemer is verplicht al datgene te doen wat naar de aard van de Overeenkomst door de wet, de eisen van redelijkheid en billijkheid of het gebruik wordt gevorderd.

4-6 De Opdrachtnemer dient de Werkzaamheden zodanig te verrichten dat noch de Opdrachtgever noch derden nodeloos hinder hebben, en dat schade aan persoon, goed of milieu zoveel mogelijk wordt beperkt.

4-7 De Opdrachtnemer is verplicht de Opdrachtgever onverwijld schriftelijk te waarschuwen indien:

(a) de Vraagspecificatie, of
(b) de bij de Vraagspecificatie gevoegdeannexen, of
(c) de Basisovereenkomst, of
(d) informatie die de Opdrachtgever aan de Opdrachtnemer ter beschikking stelt, of
(e) het terrein en/of het water dat de Opdrachtgever krachtens § 3 lid 1 sub b aan de Opdrachtnemer ter beschikking stelt, of
(f) de goederen die de Opdrachtgever krachtens § 3 lid 1 sub c aan de Opdrachtnemer ter beschikking stelt, of
(g) een maatregel die de Opdrachtgever krachtens § 43 lid 1 en 2 neemt, of

(h) een Wijziging die de Opdrachtgever krachtens § 14 lid 1 aan de Opdrachtnemer opdraagt, klaarblijkelijk zodanige fouten bevatten of gebreken vertonen, dat hij in strijd met de eisen van redelijkheid en billijkheid zou handelen als hij zonder waarschuwing bij het verrichten van Werkzaamheden daarop zou voortbouwen.

4-8 Indien de Opdrachtnemer zijn verplichting uit hoofde van lid 7 verzuimt na te komen, is hij aansprakelijk voor de schadelijke gevolgen van zijn verzuim.

4-9 Behoudens het bepaalde in § 28 is de Opdrachtnemer verantwoordelijk voor elk gebrek in het Werk dat niet krachtens de wet, de Overeenkomst of de in het verkeer geldende opvattingen aan de Opdrachtgever kan worden toegerekend.

4-10 De Opdrachtnemer is aansprakelijk voor schade aan met het Werk in verband staande werken van de Opdrachtgever en aan andere eigendommen van de Opdrachtgever, voorzover deze door de Werkzaamheden is toegebracht en te wijten is aan de schuld van de Opdrachtnemer, diens gemachtigden of hulppersonen, of aan een oorzaak die krachtens de wet of de in het verkeer geldende opvattingen voor zijn rekening komt.

(...)

§4-1 states that the design and execution Works must be completed according to the requirements in the contract, on the date that is set in the MBO. If the deliverable does not meet a requirement, this is seen as a defect (in Dutch: gebrek). §4-6 describes the ON's responsibility to perform the works in such a manner that hindrance for any party, and damage to people, materials and environment is prevented as much as possible. Damages to people are related to a certain level of safety. This is however not mentioned here.

§4-7 describes a duty to warn which the ON has regarding the information and documents which are provided by the OG. This duty to warn originates from the design works which the ON has to perform. In order to properly design the works according to the requirements (Vraagspecificatie), all provided information must be studied precisely (CROW, n.d.). If there are errors in the provided documents or information, the ON must warn the OG in order to rectify these errors. This duty to warn holds for the pre-contractual and contractual phase (M. Chao-Duivis, 2015). If the ON neglects his duty to warn, the ON is responsible for the damage that occurs due to the negligence of this duty to warn, according to §4-8.

According to §4-9, defects are the responsibility of the ON unless its the fault of the OG, or if the defect is found after handover but can be categorised as a non-hidden defect. According to §4-10, ON and its subcontractors are liable for damages which originate from their activities.

§6: Zelfstandige hulppersonen

6-1 De Opdrachtnemer is bevoegd onderdelen van de Werkzaamheden door zelfstandige hulppersonen te laten verrichten. Niettemin blijft hij voor die onderdelen ten volle verantwoordelijk jegens de Opdrachtgever.

(...)

6-7 Indien onderdelen van Werkzaamheden door een zelfstandige hulppersoon worden verricht, licht de Opdrachtnemer die hulppersoon volledig en schriftelijk in over de bepalingen van de Vraagspecificatie en de Documenten, voorzover deze voor het verrichten van deze onderdelen van de Werkzaamheden van belang kunnen zijn.

§6-1 deals with the right of the ON to hire external subcontractors. This does however not mean that if work is performed by subcontractors, the responsibilities and obligations regarding requirements, quality, regulations, etcetera, that the ON has towards the OG actually shift towards the

subcontractors. The ON is always responsible for the work performed by the subcontractors (M. Chao-Duivis, 2015).

The ON has a duty to inform the subcontractors to the extend that is needed to perform the activities. More specifically, subcontractors must be informed in writing about the requirements and other documents which are relevant for their works.

§7: Planning

7-1 De Opdrachtnemer is verplicht bij de uitvoering van de Overeenkomst de in de bij de Vraagspecificatie gevoegde annex opgenomen planning en de overeengekomen mijlpaal-data in acht te nemen.

7-2 Indien en voorzover dat in het acceptatieplan is vastgelegd, legt de Opdrachtnemer een detailplanning ter Acceptatie aan de Opdrachtgever voor, die gebaseerd is op de planning. De detailplanning dient een in het acceptatieplan vastgelegde periode te bestrijken. Het bepaalde in § 23 is van toepassing.

7-3 De Opdrachtnemer actualiseert de detailplanning zo dikwijls als dat in het acceptatieplan is vastgelegd. Het bepaalde in lid 2 is van toepassing.

According to §7, the ON is obligated to deliver a planning to the OG in which the predetermined milestones are obeyed. This planning must be revised as much as it is agreed in the plan of agreement (in Dutch: acceptatieplan).

§8: Verband met andere werken

8-1 Indien tijdens de nakoming van de Overeenkomst in opdracht van de Opdrachtgever werkzaamheden door nevenopdrachtnemers worden verricht, die van invloed kunnen zijn op het Werk en/of het Meerjarig Onderhoud, vermeldt de Opdrachtgever in een bij de Vraagspecificatie gevoegdeannex de aard van deze werkzaamheden, het voorziene tijdstip waarop zij worden verricht, alsmede de coördinatie daarvan.

8-2 Bij het verrichten van de Werkzaamheden houdt de Opdrachtnemer rekening met de in lid 1 bedoelde werkzaamheden van nevenopdrachtnemers.

8-3 De Opdrachtnemer is verplicht toe te laten dat nevenopdrachtnemers de in lid 1 bedoelde werkzaamheden verrichten op de in dat lid bedoelde tijdstippen. Hij is verplicht toe te laten dat nevenopdrachtnemers daarbij gebruik maken van resultaten van Werkzaamheden.

(...)

The OG is entitled to contract multiple independent auxiliary persons at the same time to work on site. For the ON, these parties are called subcontractors (in Dutch: nevenopdrachtnemer), and could influence the ON's activities at the interfaces between the ON and subcontractors. §8 is implemented in the UAC-IC to arrange the works between ON and subcontractors.

According to §8-1, the OG is obligated to inform the ON about the works to be performed by the subcontractors, the timing of these works, and information regarding the coordination between ON and subcontractors (CROW, n.d.). The manner of coordination is not specified in the UAC-IC, but this is rather arranged in the MBO. The MBO offers three options to arrange this coordination: by making the OG responsible, by making the ON responsible, or by using a coordination agreement (in Dutch: coördinatieovereenkosmt). The OG makes the decision in what manner this coordination

is arranged, by adding it to the contract requirements (CROW, n.d.).

The remaining part of §8 relates to the access to site and works by the ON towards the subcontractors, to make the subcontractors able to perform his activities.

§10: Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtnemer

10-1 De Opdrachtnemer spant zich in om met bekwame spoed en met inachtneming van het tijdstip dat is vastgelegd in de Basisovereenkomst de vergunningen, ontheffingen, beschikkingen en toestemmingen te verkrijgen die niet vermeld staan in de in § 9 lid 1 bedoelde annex, voorzover zij nodig zijn voor de opzet en het gebruik van het Werk en voor de realisatie van het Meerjarig Onderhoud. De Opdrachtgever is verplicht, voorzover dat in zijn vermogen ligt, de Opdrachtnemer de medewerking te verlenen die noodzakelijk is voor het verkrijgen van die vergunningen, ontheffingen, beschikkingen of toestemmingen.

10-2 De Opdrachtnemer zorgt voor de tijdige verkrijging van de vergunningen, ontheffingen, beschikkingen en toestemmingen die hij nodig heeft of wenst en die niet behoren tot die welke zijn bedoeld in lid 1 en die niet vermeld staan in de in § 9 lid 1 bedoelde annex.

(...)

According to §10, the ON has the obligation to get in his possession the permits which are needed for execution and use for the works, which are not specified in the requirements of the contract. If permits are not obtained on time, there are different consequences possible for the ON. Connected to §10 is §9 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtgever], in which the ON has the obligation to cooperate with the OG to get in the possession of permits if reasonably possible.

§11: Wettelijke voorschriften en beschikkingen

11-1 De Opdrachtnemer wordt geacht bekend te zijn met de voor de Werkzaamheden van belang zijnde wettelijke voorschriften en beschikkingen van overheidswege, voorzover deze op de dag waarop hij zijn Aanbieding heeft gedaan in werking zijn getreden. De aan de naleving van deze voorschriften en beschikkingen verbonden gevolgen zijn voor zijn rekening.

(...)

The UAC-IC assumes that the ON is aware of all applicable laws. Examples of these applicable laws are working conditions law and the building decree (M. Chao-Duivis, 2015).

§12: Veiligheid en gezondheid

12-1 De Opdrachtnemer is verantwoordelijk voor orde, veiligheid en gezondheid op alle plaatsen waar door of namens hem Werkzaamheden worden verricht, in het bijzonder op de in § 3 lid 1 sub b en § 17 bedoelde terreinen. Die verantwoordelijkheid omvat de veiligheid en gezondheid van alle gemachtigden en hulppersonen die hij voor de nakoming van de Overeenkomst aanwijst of inschakelt, de veiligheid en gezondheid van derden, alsmede de veiligheid van alle goederen die hij voor de nakoming van de Overeenkomst gebruikt.

12-2 De Opdrachtnemer moet ten tijde van de ondertekening van de Overeenkomst beschikken over een veiligheidssysteem dat van toepassing is op de Werkzaamheden. Het veiligheidssysteem moet zodanig functioneren dat de Werkzaamheden veilig en beheerst worden

uitgevoerd. Het veiligheidssysteem dient te worden vastgelegd in een veiligheidshandboek.

12-3 Indien en voorzover dat in het acceptatieplan is vastgelegd, legt de Opdrachtnemer een veiligheids- en gezondheidsplan (V&G-plan), eventuele V&G-deelplannen alsmede een V&G-dossier ter Acceptatie aan de Opdrachtgever voor. Het bepaalde in § 23 is van toepassing.

12-4 De Opdrachtgever is bevoegd om, uiterlijk op het moment waarop Acceptatie daarvan plaatsvindt, in het V&G-plan of, in het voorkomende geval, in de V&G-deelplannen, de tijdstippen vast te leggen waarop de Opdrachtnemer een geactualiseerde versie van het V&G-plan of de V&G-deelplannen ter Acceptatie voorlegt. Het bepaalde in § 23 is van toepassing.

12-5 Indien de Opdrachtnemer krachtens het bepaalde in lid 3 het V&G-plan, de V&G-deelplannen en het V&G-dossier ter Acceptatie aan de Opdrachtgever voorlegt, voegt hij daarbij desgevraagd tevens alle relevante Documenten waarnaar in het V&G-plan, de V&G-deelplannen en in het V&G-dossier wordt verwezen, voorzover dat noodzakelijk is om de Opdrachtgever in staat te stellen te beoordelen of de genoemde Documenten kunnen worden geaccepteerd.

As a point of departure, we have to conclude that its the OG who has the responsibility for health and safety during all phases of a project according to the Working Conditions Decree (in Dutch: Arbeidsomstandighedenbesluit). It is the OG's responsibility to make sure that there is a health and safety plan (in Dutch: veiligheids- & gezondsheidsplan). The OG is however entitled to delegate tasks that correspond to this responsibility to other parties such as the ON. This does however not mean that the responsibilities are changed.

According to §12-1, the ON is responsible for the health and safety at every location in which activities take place. §12-1 emphasises the working site as a location at which the health and safety of three groups must be safeguarded. This first group entails people on site that are entitled to be there. Looking at the three types of safety that are in the scope of this research, this group covers the safety on site aspect. The second group for which health and safety must be safeguarded, are third parties (in Dutch: derden). In this context, third parties is a very broad concept which includes people that live near the site, road users, passersby, etcetera. Looking back to the three types of safety, one could argue that this group covers the safety of the surrounding area. However, Rijksvastgoedbedrijf (2018) states that the safety of the surrounding area is recommended to be added to the health & safety plan, but it is not required to be in it. The third group for which health and safety must be safeguarded, are goods (in Dutch: goederen). Goods in this context means everything that is touchable, like materials, constructions, vehicles, hardware & software, etcetera (CROW, n.d.).

The safety system which is stated in §12-2 must be in place to assure that the works are executed in a safe and controlled manner (M. Chao-Duivis, 2015). This safety systems holds a health & safety plan. The content for this health & safety plan is not specified in the UAC-IC, but rather in the Working Conditions Decree. This Decree states that the health & safety plan must at least contain:

a. A description of the to be build deliverable, an overview of the involved parties on site, the name of the coordinator design phase.

b. The collection and evaluation of hazards for the to be build deliverable, which includes the presence of hazardous materials, and hazards that originate from the simultaneous activities of different parties (RI&E).

c. The safety measures that need to be taken related to the hazards from b.

d. The agreements in relation to the safety measures from c.

e. A description of how the safety measures are actually controlled in practice.

(...)

g. A description of the education process of the people that work on site.

The health & safety plan must be send to the OG for acceptation (if specified). This means that the ON cannot start any activity (design or execution) before the OG has accepted the health & safety plan. Using this acceptation procedure, the OG can steer the intensity and level of health & safety (CROW, n.d.). Rijksvastgoedbedrijf (2018) specifies the entitlement of the OG to audit and verify the documents. However, it does not mention any validation of the measures described in the documents.

The process described in §12 stops at a moment at which the activities actually start. The phases to come are actually the most crucial phases in relation to safety on site, safety for the surrounding area, and structural safety. Validation should take place to safeguard safety. The OG does however try to not intervene with the "how" of the activities, but only with the result of the activities (the to be build deliverable) since it is an UAC-IC contract. This leads to a practical responsibility for the ON to safeguard safety. This practical responsibility for the ON is dealt with using health & safety coordinators during the design phase and the execution phase. These coordinators are often different persons which have the responsibility to coordinate all tasks in relation to the health and safety plan, during the phase for which they bare the responsibility.

§19: Kwaliteitsbeheersing en kwaliteitsplan

19-1 Behoudens hetgeen overigens in de Overeenkomst is bepaald, is de Opdrachtnemer verantwoordelijk voor zowel de kwaliteitsbeheersing van alle Werkzaamheden als voor de kwaliteit van resultaten van Werkzaamheden en van Documenten.

19-2 Indien en voorzover dat in het acceptatieplan is vastgelegd, legt de Opdrachtnemer een kwaliteitsplan alsmede eventuele deelkwaliteitsplannen ter Acceptatie voor aan de Opdrachtgever. Het bepaalde in § 23 is van toepassing.

19-3 De Opdrachtnemer verstrekt de Opdrachtgever desgevraagd alle relevante Documenten waarnaar in het kwaliteitsplan en in eventuele deelkwaliteitsplannen wordt verwezen.

Different from the UAC 2012 in which the OG must verify whether the ON is making the deliverable according to the agreed requirements and quality, the ON is responsible for the quality control of all work and the quality of the results of work and documents himself in the UAC-IC 2005 (M. Chao-Duivis et al., 2018). This process is named "quality assurance" (in Dutch: kwaliteitsborging) and is described in §19 to §23. The first step of this quality assurance is the quality plan as described in §19. This quality plan must be drawn by the ON and can include multiple points related to the ON's organisation and the production process of the deliverable. This quality plan is in practice often referred to as the Project Management Plan (PMP).

3.2.6 Vital tasks & responsibilities in the UAC-IC 2005

The recommendation given by the DSB to make one party responsible for the integrated, systematic, and continues process of risk management is not enhanced in by the UAC-IC yet, logically. By taking the UAC-IC into account, this research is more focused on the theoretical framework of the Dutch construction industry while it does not focus on any projects specifically. The case studies and the corresponding reports of the DSB however highlight the problems that arise during more practical situations in the Dutch construction industry. To not only approach this problem from the

theoretical side, practical data must be gathered. This is done using interviews with two UAC-IC experts which can be found in appendices C.7 and C.8, and some project specific documents. In this section, the theoretical information and the practical data is combined in order to provide the answer to SQ5, and find the parts of the vital tasks & responsibilities that are not covered yet. Before we start the analysis, it is important to mention that risk management in the context of this research covers risks that could impact safety. We do therefore not talk about risk related to external factors such as political risks.

The OG provides information to the ON if this lies in the power of the OG according to §3 [Verplichtingen van de Opdrachtgever]. By doing so, the ON gets more familiar with the context of the project and is better able to identify risks which are needed in step 1 (i) from the vital tasks & responsibilities identified in section 2.5. The UAC-IC does not state anything else regarding elements from the vital tasks & responsibilities directly. This is however done indirectly by describing the health & safety plan in §12 [Veiligheid en gezondheid]. The ON is responsible for the health & safety dossier. According to the Working Conditions Decree, the health & safety plan must include a certain risk management system for safety related risks. This risk management system must include the collection of risk, the evaluation of these risks, and safety measures to protect from these risks. The main goal of this health & safety plan is to protect people on site. The people that are often responsible for this health & safety dossier are the manager project control, or the process manager [QUOTE3U2, QUOTE4U2]. The risks which third parties near the site are exposed to, are not mandatory to be in the health & safety plans. However, it is highly recommended to include these risks and risk related safety measures (Rijksvastgoedbedrijf, 2018). Thus, the contents of the health & safety dossier covers the first step of vital tasks & responsibilities.

In the second step of these vital tasks & responsibilities, the applicable laws and standards have to be indicated in order to show that the safety approach is practical and realistic for the context in which the project is situated. The ON can use §9 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtgever] and §10 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtnemer] to show that the safety approach is feasible with the permits he obtained under these two paragraphs. According to §11 [Wettelijke voorschriften en beschikkingen] the ON must be up-to-date on all applicable laws. The applicable laws are described in §48 [Toepasselijk recht]. This paragraph states that the Dutch laws apply to the Contract.

Box 4: OG's requirements

Besides the basics related to quality assurance which are found in the UAC-IC 2005 §19 to §23, additional information or requirements are specified in the OG's requirements (in Dutch: vraagspecificatie). Additional requirements related to risk management can also be found in this document. This document often has three parts which consists of a general part (VS0), requirements related to the product / deliverable (VS1), and requirements related to the processes to build the deliverable (VS2). Requirements related to risk management are given in the VS2 document if they are in place.

A project specific VS2 procurement document of the municipality of Noord-Brabant in collaboration with Witteveen+Bos was obtained to see whether any requirements related to risk management were included. Requirement 3.7 is shown below (in Dutch), since it covers the topic risk management (Provincie Noord-Brabant, 2022).

3.7.1 De Opdrachtnemer dient de Werkzaamheden met betrekking tot risicomanagement te verrichten, zodanig dat de kans van optreden dan wel het gevolg van ongewenste gebeurtenissen voor de Opdrachtnemer en waar mogelijk de Opdrachtgever wordt geminimaliseerd.

3.7.1.1 Het gaat om risico's die voor rekening komen van de Opdrachtnemer en om risico's die voor rekening komen van de Opdrachtgever maar waarop de Opdrachtnemer invloed kan uitoefenen.

3.7.1.2 De Opdrachtnemer dient een risicodossier op te stellen en actueel te houden.

3.7.1.3 De Opdrachtnemer dient in het risicodossier ten minste:

1. *de risico's op te nemen die zijn geïdentificeerd door de Opdrachtgever;*
2. *de risico's op te nemen die zijn geïdentificeerd door de Opdrachtnemer;*
3. *risico's te inventariseren en te analyseren;*
4. *risico's te koppelen aan werkpakketten en risico-eigenaren;*
5. *risico's te alloceren;*
6. *risico's te kwantificeren;*
7. *per geïdentificeerd risico een beschrijving op te nemen van de ongewenste gebeurtenis;*
8. *per geïdentificeerd risico een beschrijving op te nemen van de oorzaak (de oorzaken);*
9. *per geïdentificeerd risico een kwantificering op te nemen van het initiële risico en het restrisico;*
10. *per geïdentificeerd risico de preventieve en/of correctieve beheersmaatregel(en) op te nemen;*
11. *per geïdentificeerd risico op te nemen welke partij (de Opdrachtgever of de Opdrachtnemer) als risico-eigenaar verantwoordelijk is voor de beheersing van het risico, en wie de actiehouder is;*
12. *per geïdentificeerd risico de status en datum op te nemen waarop de beheersmaatregelen worden of zijn getroffen;*
13. *de beheersmaatregelen na uitvoering te evalueren.*

3.7.1.4 De Opdrachtnemer en de Opdrachtgever stemmen samen, op daartoe geëigende momenten, risico's en beheersmaatregelen af, met daarbij aandacht voor het treffen van beheersmaatregelen in relatie tot elkaars risico's.

Requirement 3.7.1.3.1 and 3.7.1.3.2 show that both the OG an ON can identify risks during the project. The OG identifies the risks in the initiation phase of a project. Whenever the project is procured, and an ON is selected, there is a handover moment after which the ON is responsible for the identification of risks.

On more requirement that is often seen in procurement documents, is the requirement for an ON to be in the possession of an ISO 9001:2015 certificate in which quality management is the central process. This certificate is a certain benchmark that shows that the organisation of the ON is able to have the proper capabilities to manage the quality assurance systems of their own organisation. However, whether this certificate also impacts the risk management processes during a project in practice is not clear.

In the third step of the vital tasks & responsibilities, the safety approach and safety measures must be executed and controlled. Step 3 (i) relates to the development of a safety approach, which closely correlates to the first step towards the integrated, systematic, and continues process of risk management. This is governed by the health & safety plan. The health & safety plan requirements, as specified in the Building Decree, does not go any further than step 3 (i). The OG is able to add more requirements to the safety approach and risk management system in the VS2 document. As shown in box 3, VS2 requirement 3.7.1.3.11 obligates the ON to specify the risk owner, which means the responsible party for the management of the risk. This responsible party is specified as

"OG" or "ON". Making (for example) the ON responsible for a risk, does however not guarantee that the measurement is eventually executed since no individual person is appointed. Requirement 3.7.1.3.11 makes a distinction between the responsible "party" for the controlling measure, and the "actionee". The term actionee implies an individual person which is part of the responsible party. Therefore, step 3 (ii) can be achieved by implementing this into the VS2 document. Interviewee 3U states that this actionee is described in the health & safety document, and is often the health & safety coordinator for the execution phase [QUOTE3U3].

Step 3 (iii) is not fulfilled by the UAC-IC nor the health & safety plan, and neither holds for step 3 (iv). The fact that requirement 3.7.1.3.11 specifies the risk owner, which can either be the OG or ON, indicates that there is no one central party which coordinates all activities related to the safety approach. This rather indicates that both the OG and ON should do something with risk management on both ends, or that this risk management can be a shared dossier. Project specific risks which are identified in the health & safety plan are controlled by the above mentioned health & safety coordinators. Looking at table A.4, there are multiple health & safety coordinators for different activities, during different phases of the project, for different parties. This makes the responsibility distribution diffuse. It is furthermore worth noticing that subcontractors cannot be appointed as the risk owner in the ON's risk register. If the ON is a risk owner, he is able to let a subcontractor perform a certain safety measure to control a risk. The overall responsibility will however stay at the party which is responsible for the safety measure in the risk register: the ON, which is in accordance with §6 [Zelfstandige hulppersonen].

The fourth step of the safety approach relates to the continues improvement of the safety plans and the corresponding safety measures, using proactive and reactive manners. The UAC-IC provides a general requirement to update the safety plans: §12-4 [Veiligheid en gezondheid] states that the ON must actualise the health & safety plan if the OG specifies this. Requirement 3.7.1.2 from the VS2 document in box 3 shows this specification, and this specification is also highlighted by interviewee 3U in QUOTE3U6. This means that there is indeed some kind of requirement which should make sure that the health & safety plan is up-to-date. Looking at the proactive manners mentioned in step 4 (i) we can note the following:

Risk analyses can be done by both the OG or ON using their own risk register. This is normally done using risk sessions in which the relevant risks are spoken through [QUOTE3U5, QUOTE4U5]. If the OG concludes that certain risks are missing, or that the ON does not succeed in controlling a risk, the ON is deemed to improve its safety approach. Observations, inspections, and audits are governed by the quality assurance system in the UAC-IC. *Observations* can either be done by the OG and ON. The ON is able to do this, because he is constantly on site. The OG is not on site to actively perform these observations [QUOTE3U1]. The OG however has the possibility to implement attendance points during the execution phase. *Inspections* are performed by the ON. These inspections are predefined in the inspection plan. The OG has the possibility to implement stop points during those inspections, in addition to the before mentioned attendance points. The OG also has the possibility to perform *audits*. This can be audits on the ON's quality management system, or the different processes during the project. An overview of the quality assurance system in the UAC-IC 2005, can be seen in figure 3.5 for both the design and execution quality assurance procedures.

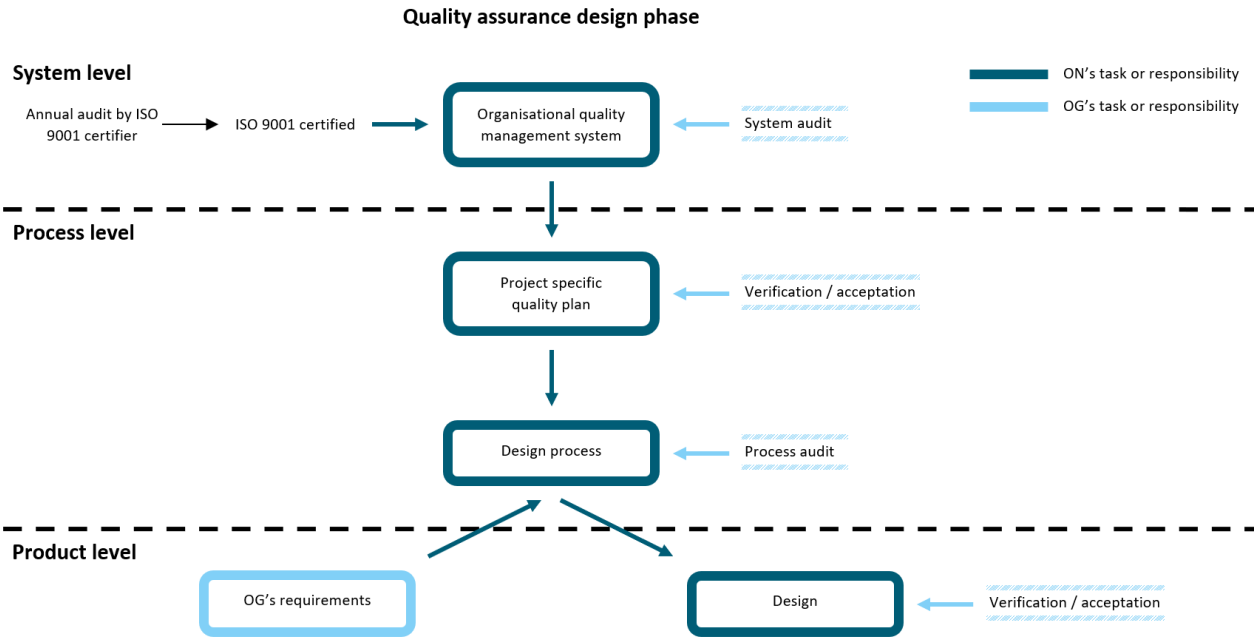
In practice, OGs use SCB (in Dutch: systeemgerichte contractbeheersing) to fulfil their role in the quality assurance system in the UAC-IC 2005. Using the quality assurance system and SCB, the OG can verify whether safety procedures are used and implemented correctly. This can be done in multiple ways. First, an audit on system level can be performed in order to see whether the ON's organisation handles safety in the correct manner. Second, using verification or acceptation a project specific quality plan can be checked. This project specific quality plan must include the safety approach. Third, an audit on process level can be used in order to check the actual execution of the

safety approach as described in the quality plan. This process audit gives a good overview whether the safety procedures are followed, whether the safety measures are implemented, and whether shortcomings are registered and dealt with. When the outcome of an audit is positive, it means that the OG does not have any objection towards the ON's safety processes. A positive audit outcome however means that the OG does not have any objection towards the safety processes at that moment in time. This positive audit outcome does not say anything about the safety processes at a later stage in the project, and this also does not guarantee safety at a later stage in the project. Most OGs only perform a safety related audit once [QUOTE3U4], which is not that extensive or thorough either since there are not much safety related requirements in the OG's requirements documents [QUOTE3U15]. This results in an OG which is not that aware of the safety related situation on site during most part of the execution phase. People might argue that this is a logical consequence since the goal of the quality assurance system is to provide the OG with a certain trust towards the ON, in which proper processes are the justification to believe that the ON will deliver a appropriate product. An OG being in the possession of this trust towards the ON, does not check all processes over and over again.

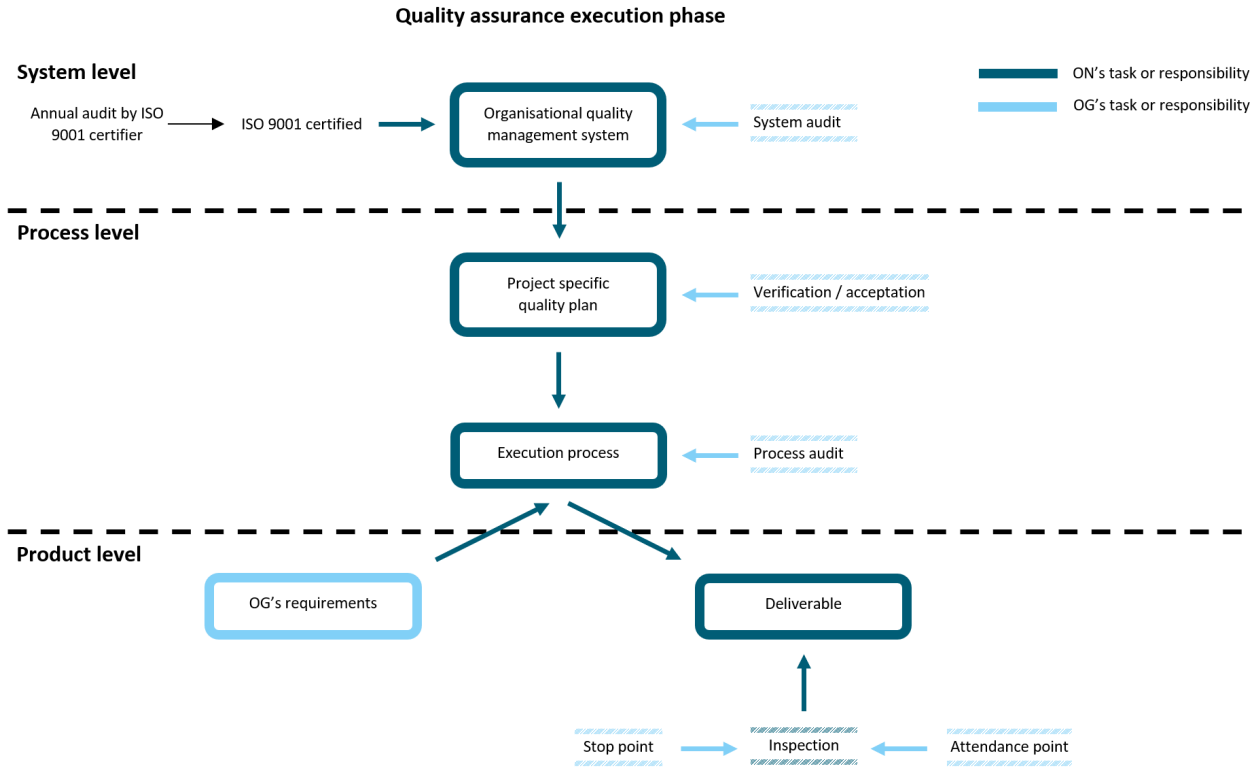
The theoretical mechanisms are in place to keep the safety approach and corresponding risk register and safety measures updated. First, the internal self control mechanism is assumed to be in place for everyone working at a client, contractor, or consultant. The control mechanism is however not explicitly mentioned in the UAC-IC. Second, the quality assurance system can be interpreted as an external control mechanism by the OG. This can not necessarily be categorised as an external independent or external authority control mechanism. The interviewees however come with a different image of reality. Interviewee 3U concludes that the ON has a very passive attitude towards his obligation to update the risk register and its corresponding safety approach [QUOTE3U6]. Interviewee 4U states that he faced the same top 5 risks many times during different phases of a project, even though these risks should actually change over time [QUOTE4U3]. This shows that the internal control mechanism does not always suffice when other aspect are given more priority. To counteract this, the OG should actively ask for updates in the monthly meetings or organised risk sessions with the ON. The OG will otherwise not know what the current status of most safety related risks is [QUOTE3U8]. However, even when an OG asks the ON for certain safety related risks, answers like: "we have done that a lot, so it will happen safely" are not rare [QUOTE3U9]. Interviewee 3U even states that most safety approaches are only made once, and most of the times not even updated after that [QUOTE3U7], even though these risks are constantly changing due to the different activities in the execution phase.

Whenever the ON has limited budget left, or is late on schedule, the ON gives more priority to his expenses or planning. Things such as the risk management process and corresponding safety approach are easily neglected from the side of the ON. What happens next, depends on the type of OG. There are two types of OG, a less involved OG and a more involved OG [QUOTE4U1]. The less involved type of OG would not do anything since they would argue that it is the responsibility of the ON to keep an eye on the risk management system and corresponding safety approach during the execution phase [QUOTE3U12]. This reaction is possible due to the OG's entitlement to not perform the acceptation or verification procedures in the UAC-IC's quality assurance system. The audits are also not mandatory. The external control mechanism by the OG is neglected. The second type of OG would actively search for risks which they judge as important, and ask the ON how they are controlling these risks [QUOTE3U10, QUOTE3U11]. The latter type of OG would therefore pursue the ON to still do something on risk management and the corresponding safety approach [QUOTE4U6]. This second type of OG uses his external control mechanism to steer the project and its processes. However, this is not mandatory to do for the OG.

The main incentive for the OG is to eventually get his deliverable according to the requirements in the contract. However, what is a bit contradictory is that this incentive is the sole responsibility of the ON to execute. Therefore, the main liability is located at the ON and a proper incentive for the OG to always use his external control mechanism is missing. Other incentives could be things such



(a) UAC-IC's quality assurance system during the design phase.



(b) UAC-IC's quality assurance system during the execution phase.

Figure 3.5: UAC-IC's quality assurance system on system, process, and product level during the design and execution phase of a construction project.

as bad exposure when an safety incident happens. This means that there is a situation possible in which the OG does not consider his incentives great enough to properly use his external control mechanism, while the ON is neglecting the risk management of safety related risks and the corresponding safety approach. This is what must be prevented at all times.

Besides the risk management process that gets neglected from the side of the ON when the project is under pressure, interviewee 3U highlights the lack of control mechanisms related to the work of subcontractors. This is partly due to the culture that is present at some ONs, which is comparable to a opportune cowboy culture [QUOTE3U13]. ONs just have the mentality that it will go fine, unless it does not. They will just deal with it if it does not go fine afterwards [QUOTE3U14]. This culture is however not present at all ONs.

3.3 Comparison Yellow Book 1999 Edition & UAC-IC 2005

Construction projects might be different from each other every time, agreements on the same topics have to be made over and over again. Therefore, it is a logical consequence that there are a lot of topics in both the FIDIC Yellow Book and the UAC-IC that show similarity. Some examples are that there are arrangements made for the access on site, permits and licences, obligations for the client, contractors and subcontractors, and ground aspects. In this section, the vital tasks & responsibilities of both the Yellow Book and the UAC-IC are compared. This comparison on theoretical and practical aspects is needed in order to see whether the Yellow Book and its Engineer can actually mean something for the UAC-IC with regard to the risk management processes and the corresponding safety approach.

In sections 3.1.8 and 3.2.6 we have found that for both contracts which are at the centre of this thesis, the risk management system and its corresponding safety approach is well organised, theoretically. For the UAC-IC it holds that the ON must arrange a risk management system according to the health & safety plan and OG's requirements document. This mainly relates to the risks that can occur during the execution phase. The OG should nevertheless also do something with risks that can affect him. Risk sessions can be organised in order to coordinate both the OG's and ON's risk management systems. The ON is supposed to follow his quality plans during the execution of the works. The situation in which activities as are executed as described in the quality plans, i.e. as intended, is named the work-as-imagined situation (Terwel, 2014, p.151). In this situation, the risk management system and corresponding safety approach are also working as intended. In addition it is assumed that the ON has implemented an internal control mechanism to check whether all his activities are performed as intended. The OG can use the quality assurance system, and the corresponding tools such as audits, inspections, verification procedures, and acceptation procedures in order to see whether the ON is working according to his quality plans in practice. More explicitly, the OG is able to use the tools within the quality assurance system to see whether the risk management processes and the safety approach are working-as-imagined. These tool within the quality assurance system give an OG the possibility to implement an external control mechanism. The control mechanisms as imagined in the UAC-IC can be seen in figure 3.6.

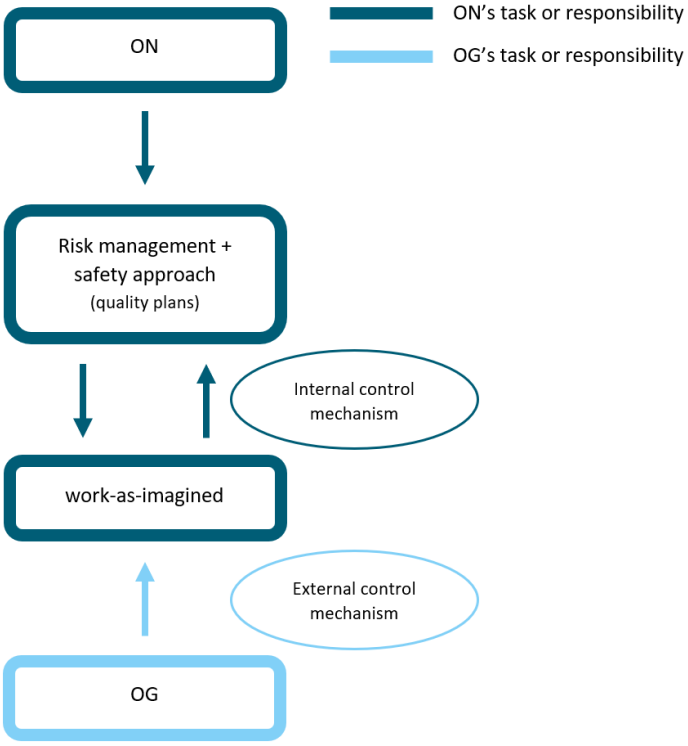


Figure 3.6: The situation in which the ON is performing the work-as-imagined, and both control mechanisms are used in the UAC-IC 2005.

The basic principles for the Yellow Book are the same. Safety related risks and the corresponding safety approach are broad defined in the Yellow Book, since the governing law of the country in which the project is situated will be more detailed. The Contractor is responsible for a risk management system with respect to execution and safety related risks. Since the Contractor is the party which can best control risks and the corresponding safety approach, this is most obvious. The Employer and Engineer should also identify risks, which can be discussed during risk sessions. The Contractor must establish a certain quality assurance system to demonstrate compliance with the Contract requirements. One of these Contract requirements will be a risk management system and a corresponding safety approach. This risk management system and safety approach should be executed as imagined. It is explicitly mentioned in Sub-Clause 4.9 [Quality Assurance] that an internal control mechanism at the Contractor must be present. The Engineer is entitled to audit any aspect of the quality assurance system, and thus audit the risk management system and the safety approach. The Engineer can also use tools such as tests and inspections to check whether the Works are executed as intended, conform the Employer's requirements. These tool provide an external independent control mechanism to be implemented by the Engineer. The Sub-Clause related to the quality assurance system is not that detailed since the Contractor himself can determine what this quality assurance system looks like exactly. Within the Yellow Book, a lot of tasks and responsibilities are transferred to the Engineer in order to have a more passive and distant Employer. One of these aspects can be found in the external control mechanism in the Yellow Book, which is performed by the Engineer instead of the Employer. The control mechanisms as imagined in the Yellow Book can be seen in figure 3.7

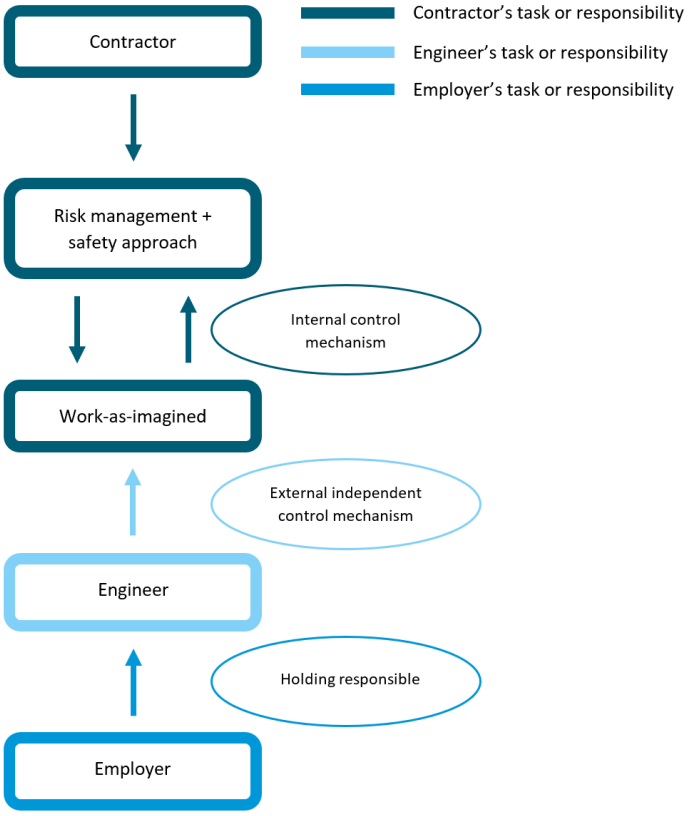


Figure 3.7: Theoretical situation of the different control mechanisms present in the Yellow Book 1999 edition.

Theoretically, both contracts are able to facilitate the execution of the vital tasks & responsibilities in their own way. However, the theoretical situation is utopia and will not always occur. It is not uncommon that during the project, other aspects like time, or money can get "more important" for the contracting party. Proper risk management processes and the corresponding safety approach can get neglected, or executed differently than intended. This situation is named the work-as-actually-done situation. The internal control mechanism which is normally present at the contracting party gets neglected too. The external control mechanism which is normally present in the quality assurance systems of both contracts, gets crucial, otherwise it will be to the detriment of risk management, the safety approach, and thus safety on site, safety of the surrounding area, and structural safety. This scenario can be seen in figure 3.8. The two contracts that are analysed in this thesis deal differently with this situation due to their differences in contractual approach.

Taking the UAC-IC into account first, we can see that the negligence of risk management processes and the corresponding safety can be recognised by the OG. This can for example be identified by non-changing top risks during different activities in the execution phase, as indicated by interviewee

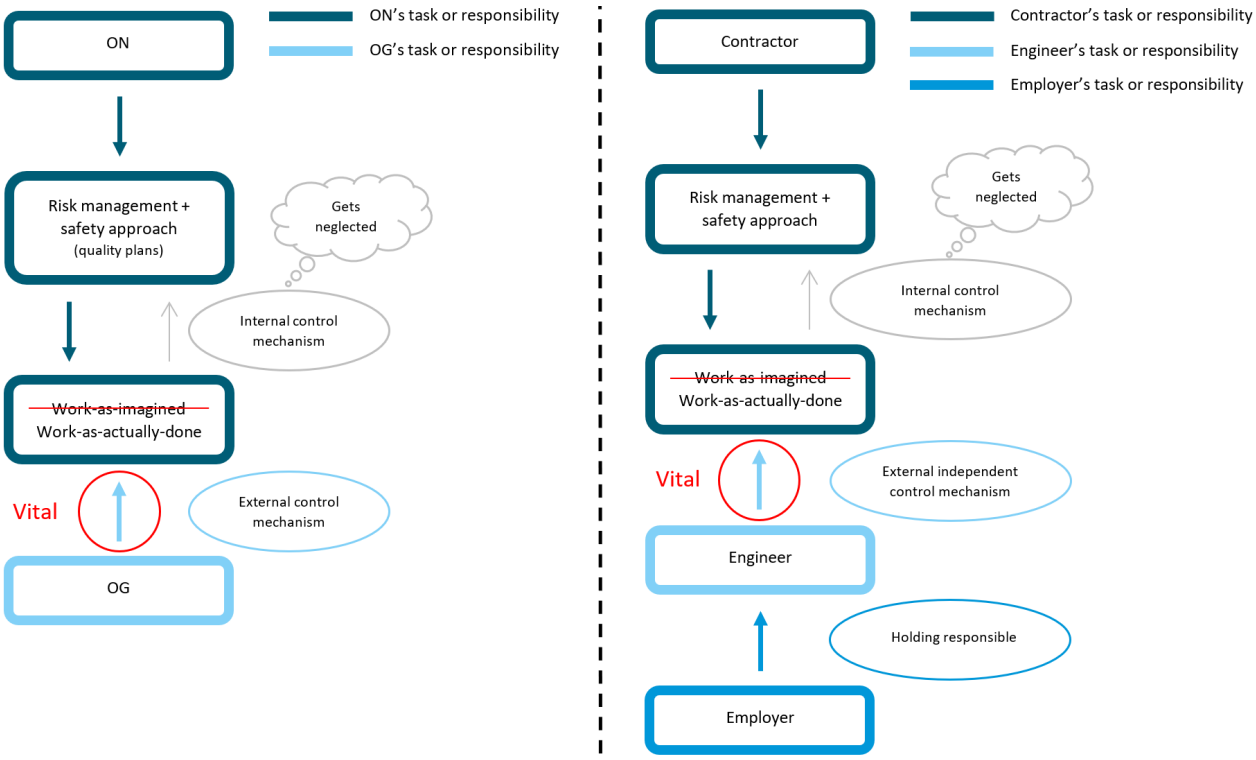


Figure 3.8: A situation in which the contracting party neglects risk management, the safety approach, and his internal control mechanism disappears. The external control mechanism becomes vital for safety. From left to right: UAC-IC 2005, Yellow Book 1999 edition.

3U. The other tools from the quality assurance system can also help the OG to identify the negligence of risk management processes and the safety approach. An OG which would use the external control mechanism to the best of his abilities, would use his own risk management system to identify the critical risks at that specific moment in time, and actively ask the ON about his controlling interventions. If there are no controlling interventions in place, the ON and OG can sit together and find a way to control the risk that might occur, before the execution works continue. As an ultimate action, the OG could make the ON stop working. An OG which does not use the external control mechanism to the best of his abilities, might also notice by coincidence that the risk management processes and the corresponding safety approach are not working as planned. This OG is more likely to say: "that is not my responsibility, it is the ON's responsibility!". The latter situation is actually a very risky one in which risks and the safety approach are not controlled anymore.

The somewhat careful attitude of the OG to use the external control mechanism can be explained. Some people might argue that when the external control mechanism is used a lot, and when the OG is very present during the project, the OG attracts more responsibilities towards himself. In reality, this is a bit of a grey area. Formal responsibilities do not change when the OG uses tools in the quality assurance system, such as the acceptation procedure. An ON can however argue that the OG has given approval for the accepted document. This leads to the discussion whether the OG or ON is responsible for the document when things are, for example, not according to the contract requirements. The OG might want to prevent this discussion, which could result in a dispute and a declining relationship.

Besides the attraction of responsibilities, there are some more incentives for the OG to actually use, or not use, the external control mechanism in an active and effective manner. These incentives are that the OG wants to receive the deliverable according to the requirements in the contract, and that the OG wants the deliverable available for him on the planned completion date. The first one is an incentive to perform the external control mechanism effectively since this can lead to an early finding that the ON is not working as agreed. This can eventually lead to a deliverable which is not

exactly as the OG would have liked. The second incentive might lead to the non-performance of the external control mechanism. An effective external control mechanism can lead to the extreme situation in which the OG must stop the construction works for whatever reason, which will incur delays. This delay is not desired by the OG since this can lead to less time that the deliverable can be operated, and thus less revenue in any form. This second incentive is therefore an incentive which the OG can use to not use his external control mechanism very actively and in an effective manner. Whether the external control mechanism is eventually performed effective or not, depends on the principles and the valuation of the different incentives by the OG. This is visualised in figure 3.9.

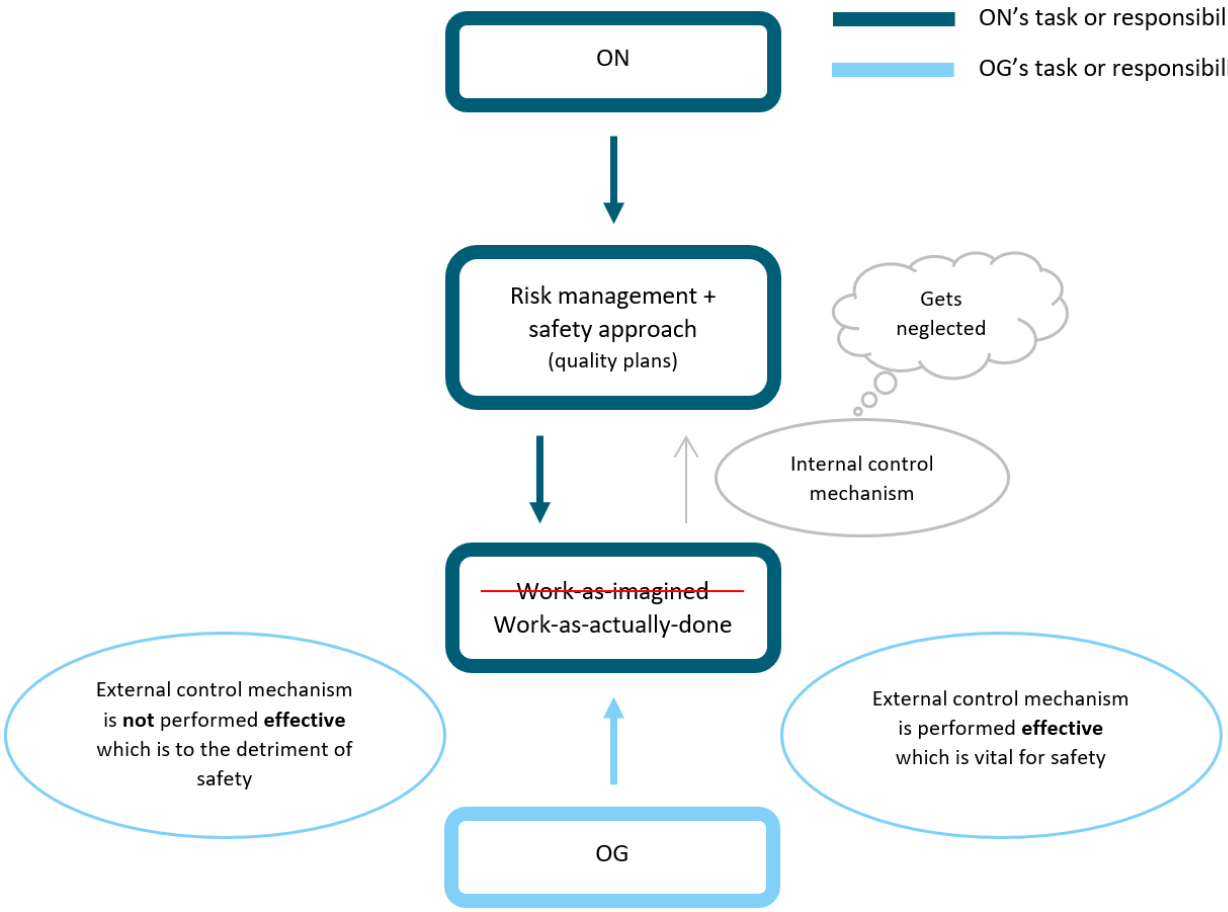


Figure 3.9: The situation in which the ON has neglected the risk management system, safety approach, and internal control mechanism in the UAC-IC 2005. Depending on the OG's incentives, the external control mechanism is performed effective or non-effective.

In the view of the interviewees, the better OG is the OG which uses the external control mechanism a lot and the OG which is closely working together with the ON. This OG would not say: "ON, that's your responsibility!", but rather wants to work things out together with the ON, even though a very involved and present OG is not the classic philosophy behind the UAC-IC. This is also the view of Rijkswaterstaat (2017), which state that the philosophy is changing from "the private parties unless..." (in Dutch: "markt tenzij...") towards "together with the private parties" (in Dutch: "samen met de markt"). Being an OG which does not use the external control mechanism a lot is however not forbidden, as long as that OG has realised that he has some kind of responsibility in the chain of the project, and he has provable controlled his risks using the quality assurance system. Provable in this context is however a bit vague.

Taking the FIDIC Yellow Book into account now, we can observe that there is a critical difference which originates from the involved parties in the contract. In the UAC-IC the OG is involved during the Works, while the Employer in the FIDIC Yellow Book is not that involved. Instead of the

Employer being involved, the Engineer is involved during the Works. The Yellow Book mechanisms is organised in such a manner that the Employer assumes that he can count on the Engineer with respect to all technological aspects, safety aspects, and contractual aspects [QUOTE2F2]. This creates some kind of responsibility for the Engineer which makes him want to execute his work to the best of his abilities. He needs to explain and justify his actions to the Employer. The Engineer must be very confident to take certain actions, e.g. stopping the work when something is going wrong [QUOTE2F4, QUOTE2F5, QUOTE2F6], because this affects both the Contractor and (more important) the Employer. The Engineer's feeling of being responsible makes him more involved in all processes during the project. That also holds for the risk management system and the corresponding safety approach. The 'pressure' that the Engineer encounters for the Employer holding him responsible as 'his agent', could result in an Engineer that has daily contact with the Contractor, and is on site more than the OG is in the UAC-IC. This enables the Engineer to spot things that are not going as planned, or things that are different from safety standards, or safety values. However, even with the presence of the Engineer, the Contractor can neglect the risk management system and the corresponding safety approach just as an ON could do in the UAC-IC. FIDIC's Engineer would however, partly because of him feeling responsible towards the Employer, make sure that the process of risk management does not get neglected completely [QUOTE2F19].

The above mentioned 'pressure' and 'responsibility' partly originate from the philosophy that the Engineer should justify his decisions to the Employer. Due to this pressure and responsibility, the Engineer makes sure that his duties are performed in a proper manner and with a good outcome. This means that the external independent control mechanism which the Engineer is responsible for in the quality assurance system, has a greater chance of being effective. However, there is another financial incentive which is implemented in the FIDIC White Book as can be read in section 3.1.9. The Engineer is responsible for his scope of work, and can be held liable if there is a breach in the White Book Contract. This breach could occur when the Engineer does not exercise reasonable skill, care and diligence which is to be expected from an Engineer experienced in the provision of such services for projects of similar size, nature, and complexity. This legal slang might be a bit vague. What is more important to note is that under certain circumstances, the Engineer can be held liable. This liability is the main incentive of FIDIC's Engineer. The direct magnitude of liability and the duration of liability are not capped in the FIDIC White Book. Therefore, the risk that the Engineer is exposed to in a FIDIC White Book, and the corresponding Yellow Book Contract, is very extensive. The Engineer will make sure that his external independent control mechanism is executed effectively. This process is visualised in figure 3.10. Interviewee 2F even states that the presence of an Engineer is a motivation for the Contractor to actively work on the risk management system and the corresponding safety approach, which is a positive side effect.

Comparing the incentives for the parties that are responsible for the execution of the external control mechanisms in both contracts, we can conclude that there are more critical incentives present for the Engineer, than there are critical incentives for the OG. Therefore, the chance that the external control mechanism is performed effective by the Engineer is greater. Since there will be an external control mechanism, even if the Contractor might neglect his own internal control mechanism, the Engineer is able to correct certain processes related to risk management and the safety approach. This results in better performance of the vital tasks & responsibilities, which leads to an enhancement of safety.

A comparison on Sub-Clause (FIDIC Yellow Book) and § (UAC-IC) level can be found in table 3.4. The topics shown in table 3.4 is just a selection of similar topics. Furthermore, this table summarises the differences on risk management and safety approach, and the differences on system level.

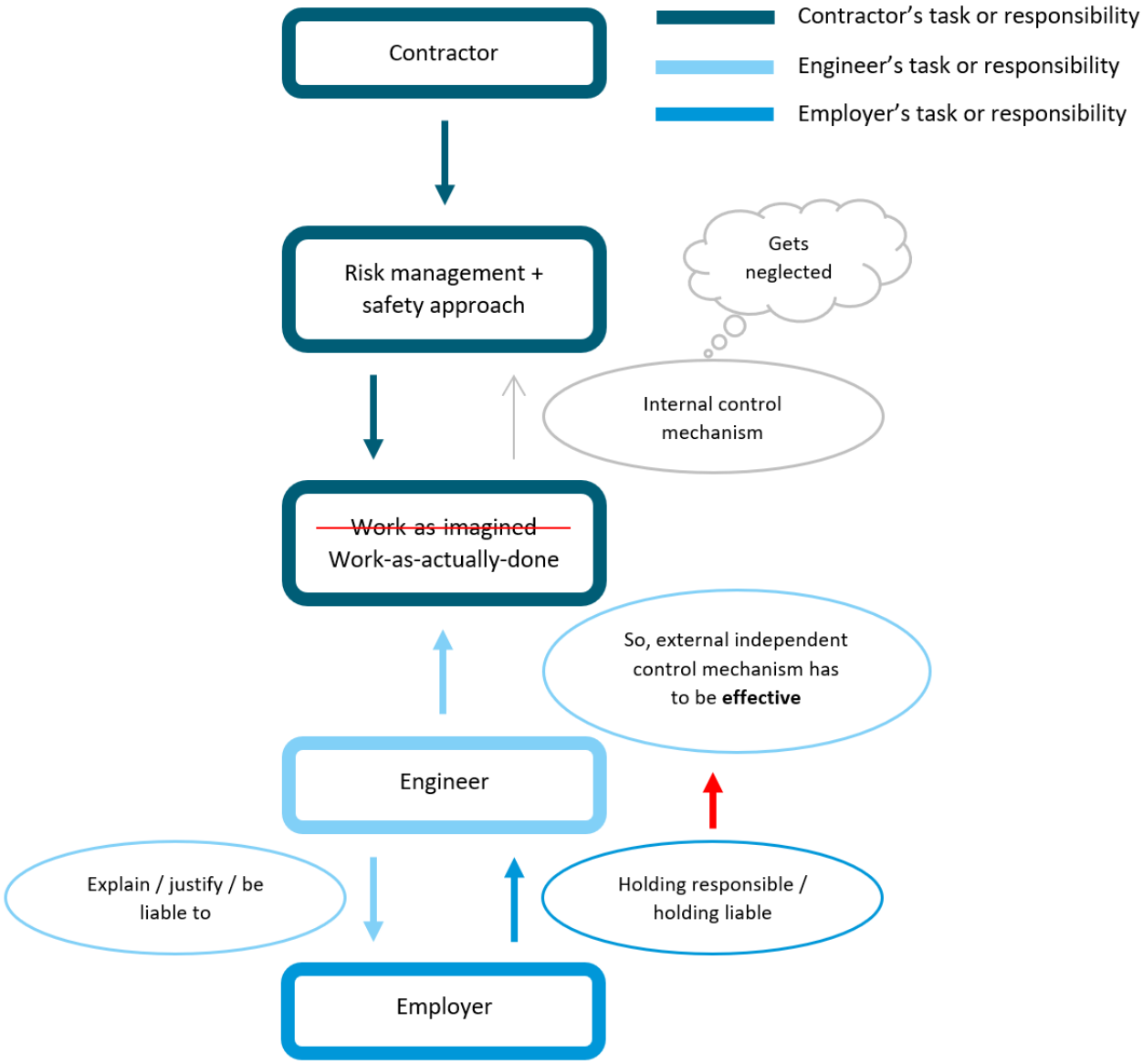


Figure 3.10: The situation in which the Contractor has neglected the risk management system, safety approach, and internal control mechanism in the Yellow Book 1999 edition. The responsibility and liability that the Engineer bears towards the Employer makes him perform the external independent control mechanism effectively.

Topic	FIDIC Yellow Book 1999	UAC-IC 2005
General aspects (number of Sub-Clause / §)		
Access to Site	Sub-Clause 2.1 [Right of Access to the Site]	§3 (b) [Verplichtingen van de Opdrachtgever]
Permits	Sub-Clause 2.2 [Permits, Licences or Approvals]	§9 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtgever] §10 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtnemer]
Basic requirements contractor	Sub-Clause 4.1 [Contractor's General Obligations]	§4 [Verplichtingen van de Opdrachtnemer]
Subcontractors	Sub-Clause 4.4 [Subcontractors]	§6 [Zelfstandige hulppersonen]
Ground aspects	Sub-Clause 4.10 [Site Data]	§13 [Bodemaspecten]
Defects after completion	Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] Sub-Clause 11.2 [Cost of Remedying Defects]	§28 [Aansprakelijkheid voor gebreken na de feitelijke datum van opleverin]
Payment	Sub-Clause 14.1 [The Contract Price] Sub-Clause 14.2 [Advance Payment] Sub-Clause 14.7 [Payment]	§33 [Betaling] §34 [Stelposten]
Risk management and safety approach		
Quality assurance	Sub-Clause 4.9 [Quality Assurance] Sub-Clause 5.2 [Contractor's Documents] Sub-Clause 7.3 [Inspection] Sub-Clause 7.4 [Testing] Quality assurance in the YB is less procedural. The Engineer has the possibility to perform inspections himself. Test are performed by the Contractor. There is more freedom for the Engineer to check, verify, or audit the Works from the Contractor [QUOTE2F3].	§19 [Kwaliteitsbeheersing en kwaliteitsplan] §20 [Toetsing van Ontwerpwerkzaamheden] §21 [Toetsing van Uitvoeringswerkzaamheden] §22 [Acceptatieprocedure - Uitgangspunten] §23 [Acceptatieprocedure - Procedureverloop] Quality assurance in the UAC-IC is more procedural since any verification/ acceptation / inspection must be defined when the contract is signed. This could lead to a false sense of safety [QUOTE2F29]. OG is not able to perform inspections himself. Inspections (equivalent to Tests in the YB) are performed by the ON or subcontractors.
Health & safety	Sub-Clause 4.8 [Safety Procedures] Sub-Clause 6.7 [Health and Safety] Health and safety regulations are a bit more extensive in the YB, especially since there is a dedicated Sub-Clause for safety procedures. What is added to these Health and safety related clauses is the local governing law.	§12 [Veiligheid en gezondheid] Not very detailed when the Building Decree is not taken into account. When the Building Decree is taken into account, the processes of safety related risks are very organised and structured.
System level		
Control mechanisms	Sub-Clause 4.9 [Quality Assurance] explicitly mentions that an internal control mechanism must be present at the Contractor. The tools in the quality assurance system provide an external independent control mechanism to be implemented by the Engineer.	An internal control mechanism is assumed to be present at the ON. This is however not literally mentioned in the UAC-IC. The tools in the quality assurance system provide the OG with the possibility to perform the external control mechanism.
Incentive	The Engineer's main incentive is found in liability. FIDIC's White Book describes that the Engineer's liability is set in the Particular Conditions. Since the Employer and Engineer can determine this liability themselves, this can lead to a very extensive amount which the Engineer can be held liable for. This can be a great risk for the Engineer. The Engineer will therefore make sure that the external independent control mechanisms is performed as effective as possible.	The main incentives for the OG can be found in the deliverable. The OG wants to receive the deliverable according to the OG's requirements and with no delay. This incentive might not be extensive enough to properly use the quality assurance system to perform the external control mechanism.

Table 3.4: Comparison between the FIDIC Yellow Book 1999 edition and the UAC-IC 2005

Closing words of chapter 3

The analysis in chapter 3 has resulted in the comparison between the FIDIC Yellow Book and the UAC-IC. In this comparison, the differences in the control mechanisms implemented in the quality assurance system, and the different incentives for the involved parties on system level, have been elaborated. It has been concluded that the incentives present for an OG in the UAC-IC, do not guarantee an effective external control mechanism. FIDIC's Engineer has better incentives present to effectively execute the external independent control mechanism in the quality assurance system. With a more effective external independent control mechanism, chances of negligence of risk management and the corresponding safety approach decrease. Lacking risk management processes and a lacking safety approach can still occur with the presence of an Engineer. Due to the presence of an effective external control mechanism, this will nevertheless be noticed and dealt with by the Engineer, instead of left to the ON with no checks which is currently possible in the UAC-IC. An effective external control mechanism eventually leads to the enhancement of safety: safety on site, safety of the surrounding area & structural safety. Now the role of FIDIC's Engineer has proven its value, the next chapter focuses on the actual integration of this role into the UAC-IC 2005.

4. Amendment of the UAC-IC 2005

This chapter focuses on the integration of the role of the Engineer into the UAC-IC 2005. This newly created UAC-IC concept is shown in figure 4.1. This chapter describes the adaptions that need to be made in order to create this new UAC-IC, it describes the bottlenecks are encountered, and makes a suggestion regarding when to actually perform projects with this new UAC-IC. This section does not discuss what must change textual in the UAC-IC 2005 since this can better be done by people specialised in construction law. This section rather talks about the changes that need to be made in terms of procedures. This chapter provides the answer on sub-question 7.

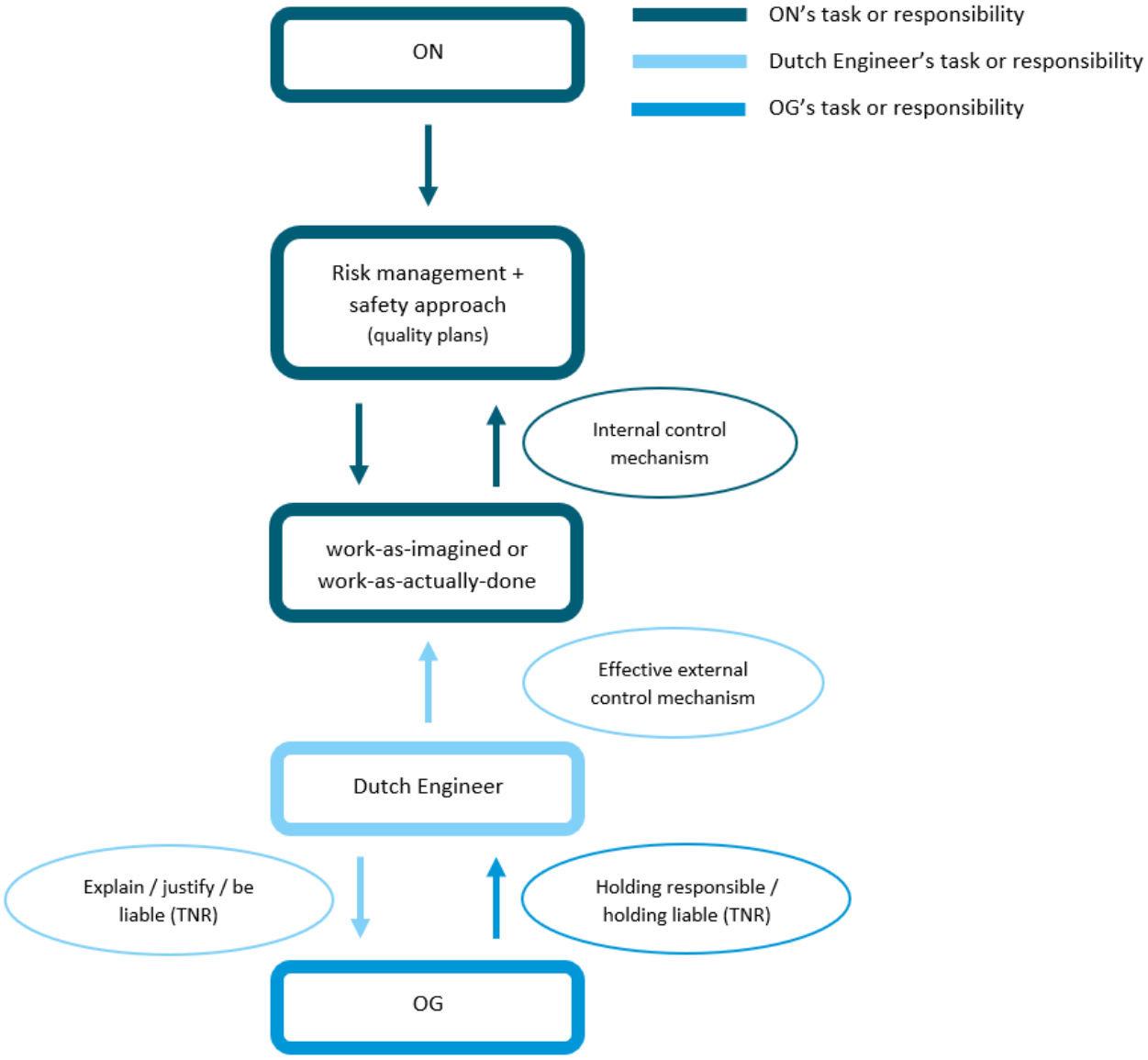


Figure 4.1: The new UAC-IC 2005 with the integrated role of the Dutch Engineer.

4.1 Adaptions for the current UAC-IC 2005

When the role of the Engineer is integrated in the UAC-IC contract, certain task and responsibilities must be performed by this Dutch Engineer. This research has found that this Dutch Engineer must be responsible for the external control mechanism in the quality assurance system to improve safety in UAC-IC projects. The current tools in the quality assurance system that are available for the

Dutch Engineer do not change. The external control mechanism that the Dutch Engineer is taking over consist of the tools that are discussed earlier: audits on system level, audits on process level, verification procedures, and acceptance procedures during both the design and execution phase. The inspections performed by the ON (or subcontractors) are also part of the quality assurance system since the Dutch Engineer can implement stop points and attendance points. By doing so, the OG can depend on the Dutch Engineer for effectively performing the external independent control mechanism in the quality assurance system. This can be seen in figure 4.1.

As concluded before, the quality assurance system in the FIDIC Yellow Book is less procedural than the quality assurance in the UAC-IC. It is not indicated in this thesis whether this is good or bad in terms of effectiveness. A more procedural quality assurance system does however come with some false sense of safety. A change in the level of intensity of procedures in the quality assurance system, would need more research. Therefore, the procedures and corresponding tools in the UAC-IC's current quality assurance system do not change when the role of the Dutch Engineer is integrated.

The integration of the Dutch Engineer, and thus resulting in an OG who steps back even more, would mean that the Dutch Engineer could perform even more tasks in the overall UAC-IC contract. These tasks could for example be payment related tasks, or dispute related tasks. It might be more practical and helpful if the Dutch Engineer performs tasks like these. However, this research's scope is restricted to the tasks in the quality assurance system and does not focus on these aspects. The OG keeps his tasks and responsibilities under §3 [Verplichtingen van de Opdrachtgever], §9 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtgever] and §33 [Betaling].

4.2 Bottlenecks

In the newly created situation, the same FIDIC structure might be best to go with. This holds that the UAC-IC remains a contract between the OG and ON, while certain rights and obligations only exist under the condition that the Dutch Engineer exercises his power. The contract between the OG and the Dutch Engineer would be a consulting contract. In FIDIC contracts, the White Book is used for this. In a Dutch context, a common contract which is used for this is a set of terms and conditions named "The New Rules 2011, Legal relationship client - architect, engineer and consultant" (in Dutch: De Nieuwe Regeling 2011). Dutch OGs, ONs, and other parties such as engineers and architects are familiar with TNR 2011.

This thesis has concluded that the Engineer's incentive in a FIDIC contract is due to the uncapped liability in the White Book. Since it is more likely that TNR 2011 will be used in the Dutch construction industry, we must take a look at the liability in TNR 2011. TNR's chapter 6 [Liability of the consultant] contains 6 Articles, Article 13 to 18, which are all about the consultant's liability (M. A. B. Chao-Duivis, 2013). A list of the Article names can be found in table A.5. Three important liability aspects can be found in TNR 2011. First, Article 14 [Liability of the consultant for culpable shortcomings] states that the consultant [Dutch Engineer] is only liable for compensation of the direct damages, in the case of culpable fault. This same condition is present in the FIDIC White book. Second, Article 15 [Extent of the compensation] states that the amount that the Dutch Engineer can be held liable for is twofold. The damage to be compensated by the Dutch Engineer can be limited to a sum equal to the consultancy costs with a maximum of €1,000,000 or limited to a sum equal to three times the consultancy costs with a maximum of €2,500,000. The parties themselves can determine which of the two options to choose. The TNR 2011 explicitly states the maximum amount which the Dutch Engineer can be held liable for. This is different from the FIDIC White book which does not state a maximum amount, and therefore does not cap the liability. Consultancy costs normally are not that extensive compared to the total budget available for a project. The risk that a Dutch Engineer would be exposed to in a project using TNR 2011 is therefore not that big. VROM-inspectie (2007) states that the limitation of liability does not results in a great sense of urgency for an effective external control mechanism. The absence of a big risk for the

Dutch Engineer does therefore take away the main incentive which should make sure that the Dutch Engineer would perform the external independent control mechanism effectively. Third, Article 16 [Liability period and expiration terms] states that the liability of the consultant [Dutch Engineer] expires after five years from the day upon which the commission is terminated either by completion or cancellation. The length of liability is not stated in the White Book, but it is argued by (Croft, 2017) that the White Book's liability is desired to be shorter than ten years. TNR 2011 and the White book therefore approximately have the same liability period. To reach the same incentives as FIDIC's Engineer, the amount that the Dutch Engineer can be held liable for should be increased.

An increased liability might not sounds interesting to parties that can fulfil the role of the Dutch Engineer. They are not used to the amount of risks that they would be exposed to with this increased liability. The author of this thesis expects that some parties would resists the plans for an increase in liability. However, this is the only possibility to increase the incentives which are needed in order to make a Dutch Engineer perform the external independent control mechanism effectively.

4.3 Requirements to make use of the Dutch Engineer

Safety comes with a price. The integration of a third party into the UAC-IC means that there is a new party that must be paid money. Logically, this must be paid by the OG. An OG might argue that a Dutch Engineer does not add value for every single project since some projects might just be relatively small. It is questioned whether the addition of a third party should be the new standard, or whether there should be some requirements which make the addition of a third party into the UAC-IC agreement mandatory.

In the opinion of this thesis' author, a Dutch Engineer must be mandatory to be added to the UAC-IC if certain requirements are met. The question what exact requirements to use is left to answer. The incidents in the case studies show that all these projects have some kind of complexity present. This complexity could for example be related to the number of parties involved or a complex context of the project. However, these aspects might not be completely clear when the OG and ON enter into the UAC-IC agreement, and therefore it is still unknown whether there is a need for a Dutch Engineer. Since the need for a Dutch Engineer must be determined prior to the moment when the OG and ON enter into an agreement, a different requirement must be found.

The requirement proposed in this thesis is related to the activities that the Dutch Engineer must perform as described in section 4.1. Since the Dutch Engineer would take over the role of the OG in the quality assurance system, the Dutch Engineer is checking whether the design is conform the OG's requirements. This is done using process audits or verification and acceptance procedures. NEN-1990:2021 Annex B describes several technical management measures which should help achieve to reach the intended level of structural reliability of a structure (NEN, 2021). Therefore, these technical management measures directly relate the structural safety. The first technical management measure that is proposed to use as a requirement is: design checking. All relevant information regarding design checking can be found in box 5.

Box 5: Design checking

There are three levels of design checking. These levels can be found in table 4.1. NEN-1990:2021 states that self-checking shall be performed for all designs. Design checking should be concentrated on those parts of a structure where failure would have the most serious consequences with regard to structural resistance, durability, and function. It furthermore states that design checking should cover:

- Loads, models for calculation of loads and design situations

- Structural models, calculation of load effects and design verification
- Adequate knowledge of ground conditions and the design parameters
- Where appropriate, separate calculations as alternatives to reviewing the design calculations
- Consistency of calculations, drawings, detailing and the execution specification

Table 4.1: The design check levels (DCL) described in NEN-1990:2021 appendix B.5.

DCL	Design checking	Required level
DCL3	Extended independent checking	To be defined nationally
DCL2	Normal independent checking	To be defined nationally
DCL1	Self-checking	To be defined nationally

DCL2 and DCL3 highlight design checking by an independent party such as a Dutch Engineer. This could result in the requirement that the new UAC-IC must be used for projects in which design checking level 2 is required.

Since the Dutch Engineer also take over the OG's tasks in the quality assurance system during the execution phase, this means that the Dutch Engineer is performing process audits or verification and acceptance procedures during the execution phase. The second technical management measure that is proposed to use as a requirement is: inspection during execution. All relevant information regarding inspection during execution can be found in box 6.

Box 6: Inspection during execution

There are three levels of inspection during execution. These levels can be found in table 4.2. NEN-1990:2021 states that self-inspection shall be performed for all executions. Inspections during execution should be concentrated on those parts of a structure where failure would have the most serious consequences with regard to structural resistance, durability, and function. It furthermore states that inspections during execution should cover:

- the execution specifications are available during manufacturing and execution
- The execution is performed according to the execution specification
- The personnel have the skills and training required for the work
- Inspection is properly documented
- Materials and construction products used are as specified

Table 4.2: The inspection levels (IL) described in NEN-1990:2021 appendix B.7.

IL	Design checking	Required level
IL3	Extended independent inspection	To be defined nationally
IL2	Normal independent inspection	To be defined nationally
IL1	Self-inspecting	To be defined nationally

IL2 and IL3 highlight inspection during execution by an independent party such as the Dutch Engineer. This could result in the requirement that the Dutch Engineer is added into the UAC-IC for

a project in which inspection during execution level 2 is required.

The question remains when both design check level 2 and inspection during execution level 2 are required. The levels of respectively design checking and inspections during execution are coupled to the consequence class (CC) of a structure, as is stated in NEN-1990:2021 appendix B.8. This concept was earlier mentioned in section 2.5, but not explained yet. The consequence class is a categorisation of the consequence of structural failure in terms of loss of human lives or personal injury and of economic, social, or environmental losses (NEN, 2021). The consequence classes and their qualifications can be found in table 4.3. This consequence class can be determined prior to the start of a project. The relation between the consequence class, design check level, and inspection during execution level can be seen in table 4.4. Using table 4.4 we can conclude that a the newly created UAC-IC with the integration of a Dutch Engineer must be used when the consequence class of the deliverable is CC2 or CC3.

Table 4.3: The consequence classes (CC) described in NEN-1990:2021 section 4.3 [Consequences of failure]. The consequence class is chosen based on the more severe of column 2 and 3.

Consequence class (CC)	**Loss of human life or personal injury**	**Economic, social or environmental consequences**	**Examples**
CC3	High	Very great	Buildings (>70m) Grandstands Concert hall Big public building
CC2	Medium	Considerable	Residential buildings Offices Public buildings Industrial buildings (>2 floors)
CC1	Low	Small	Agricultural buildings Greenhouses Single-family homes Industrial buildings (<2 floors)

Table 4.4: The relation between consequence class (CC), design checking level (DSL) and inspection level (IL) as described in NEN-1990:2021 appendix B.8.

Consequence class (CC)	**Minimum design check level (DSL)**	**Minimum inspection level (IL)**
CC3	DSL3	IL3
CC2	DSL2	IL2
CC1	DSL1	IL1

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5. Discussion

This chapter contains the discussion of this research. The first part consist of the discussion related on the research design while the second part is related to the results of this research. Both general comments and limitations are discussed in this chapter.

5.1 Discussion on research design

During the first steps of this research, a literature review of different types of sources has been performed. These different sources consist of scientific articles and project specific documents. These project specific documents can be categorised as grey literature. The validity of this literature, and the conducted interviews is discussed below.

Scientific literature

The used scientific literature in this research mainly relates to safety. More specifically, this scientific literature mostly relates to structural safety. The conclusions of this literature and other published reports explicitly say something about structural safety. These conclusion are however relevant for safety on site and safety of the surrounding area too since all the three types of safety used in this research are highly interwoven.

Grey literature

In this research, grey literature from different sources is used. The definition of grey literature varies from author to author. A broad and modern definition includes just about anything that is not published in a peer-reviewed academic journal, whether or not it is produced by those for whom publishing is the primary activity. For present purposes, all documents except journal articles that appear in widely known, easily accessible electronic databases will be considered grey literature (Rothstein & Hopewell, 2009). Examples of grey literature comprises newsletters, reports, working papers, theses, government documents, bulletins, fact sheets, conference proceedings and other publications distributed free, available by subscription or for sale (Rothstein & Hopewell, 2009). The grey literature in this research mostly consists of the reports and investigations of the DSB. These reports, in combination with scientific literature, are used to gain more insight in the safety related problems in the Dutch construction industry.

Scientific literature extensively debates the use of grey literature because the overall quality cannot be endorsed (Rothstein & Hopewell, 2009). Since this research's topic, safety, is often subject to news articles, reports, investigations, and governmental sources such as the publication of victims, the thesis' author has decided to include grey research into this research. The DSB's reports are included very extensively because this institution is known for its independence and high-quality research. Therefore, the quality is assumed to be constant compared to the scientific literature's quality.

Another form of grey literature which is used in this thesis are the sets of general terms and conditions. Several times, literature related to FIDIC's Red Book is used to say something about the Engineer, since the role of the Engineer is also present there. In these sources, the Yellow Book was often not mentioned. However, the role of the Engineer is comparable in both General Conditions. FIDIC's White Book that is used in this thesis to find the Engineer's incentives is the 2017 version. It is debatable whether the Yellow Book 1999 edition and the White Book 2017 edition would be used simultaneously, instead of the 2017 edition for both of them. However, this White Book 2017 version was the only version available at Witteveen+Bos.

Interviews

The interviews that are conducted to gather the practical knowledge that was needed for this research, do actually contradict each other a few times. E.g. interviewee 3U states that the risk management is kept up-to-date very passively by the ON [QUOTE3U6] under the UAC-IC 2005. Interviewee 4U states that this happens quite actively (with some boundary conditions) in the UAC-IC 2005 [QUOTE4U4]. The researcher of this thesis has thought about this, and other contradictions a lot and talked about it with his company supervisor. Together they concluded that the origin of these contradictions lies in the experience of the interviewees and the problems they faced during projects they have worked on. Interviewee 3U has really seen that the ON neglected the risk management system at a project the interviewee worked on. Interviewee 4U has not seen that before, and that can be explained quite easily. At most projects, the risk management system is well organised and up-to-date. Projects at which this is not the case, are more rare. Interviewee 3U has worked during the execution phase more intensely than interviewee 4U. The execution phase is the project phase in which risk management gets neglected the most (if it happens at all). Therefore, the chance of working at a project in which the risk management system is neglected, is greater for interviewee 3U. The answers that interviewee 3U gave in the questionnaire, are therefore more accurate and valid than interviewee 4U's answers. That is also the reason why there are more quotes used from interviewee 3U compared to interviewee 4U. The same contradictions holds for the FIDIC experts: interviewee 1F states that the Engineer is not independent [QUOTE1F4, QUOTE1F5], while interviewee 2F states that the Engineer actually is independent [QUOTE2F7]. Using the same reasoning as before, more quotes are used from interviewee 2F than interviewee 1F. Both 1F and 2F are very experienced. Interviewee 2F is however experienced within the execution phase, and has acted as the Engineer multiple times. Interviewee 1F did not. Therefore, interviewee 1F's answers to the questionnaire are very theoretical focused, i.e. his answers directly relate to the General Conditions.

Another point of discussion might be the Dutch mentality or culture in the construction industry. Some interviewees have reacted quite cynical when the introduction of a third party was suggested. The interviewees do not believe in the effectiveness of this party, and they believe that it is an enormous assignment to actually get this party integrated. The analysis of the FIDIC Yellow Book has however shown that with the proper incentive of a Dutch Engineer, the required effectiveness can be reached. The author however has to agree with the interviewees regarding the argumentation of the enormous assignment. Only looking at the period that it is taking for the Law safeguarding quality for building to be eventually implemented, this is not going to be different for the introduction of an Engineer in the UAC-IC. Furthermore, as stated by interviewee 4U, it is unknown whether Dutch engineering firms are actually willing to take the risks when the liability for the Engineer is increased.

5.2 Discussion on results and scientific relevance

This section first reflects on the obtained results discussing its validity and limitations. Secondly. it states the scientific contribution of this thesis.

Results

This research concludes with the integration of a Dutch Engineer in the UAC-IC 2005, which receives the main responsibility to perform the external control mechanism and therefore safeguard the risk management processes and the corresponding safety approach of the ON. Looking at the previously identified meso factors, we can conclude that this new party mainly effects the allocation of responsibilities, risk analysis and allocation, and the implemented control mechanisms. One could even argue that it also contributes to the safety culture, communication and collaboration meso factors. With an increased liability under TNR 2011, this research also comes up with a possible solution

for the low accountability of engineers which was identified as a macro factor in literature.

The requirement to make use of the Dutch Engineer in UAC-IC projects have been found in the consequence class of deliverables. When the consequence class is at least CC2, the Dutch Engineer is proposed to be mandatory. Looking at the case studies that have been used in order to gain more insight into the safety related problems in the Dutch construction industry, we can see whether this would indeed be a proper requirement to make the Dutch Engineer mandatory. For the falling facade plates case from section 2.3.1 we can conclude that this series of incidents have happened at buildings with a consequence class varying from CC1 (housing) to CC3 (multiple story flats). For the Eindhoven incident from section 2.3.5 we can conclude that this incident happened at a building with consequence class CC2 since it is a public building. The consequence class for the crane incident from section 2.3.4 is a bit harder to determine. It can be categorised as a renovation project of a small to medium size bridge. Looking at table 4.3, it is assumed to be a CC2 deliverable. For the B-Tower incident from section 2.3.2 we can conclude that this incident happened at a building with consequence class CC3 since the building is 70 meters tall and has a number of public stores on the bottom floors. This also holds for the Grolsch Veste and AZ stadium incident from sections 2.3.3 and 2.3.6 since they contains grandstands and are big public deliverables. We can conclude that the proposed requirement is a requirement that would have made a Dutch Engineer mandatory in most of these cases, which could have resulted in the prevention of the accidents.

The Engineer is taking over tasks and responsibilities from the OG in the amended UAC-IC. Besides the tasks and responsibilities in the quality assurance system, the Dutch Engineer can even take over more aspects as explained in section 4.1. Which tasks or responsibilities the Engineer could possibly take over, has not been a topic in this research. The author would rather highlight the following discussion point. In the Dutch construction industry, it is previously seen that Rijkswaterstaat (RWS), one of the biggest OGs, stepped back to procure more knowledge from private parties. After some years however, RWS reverted that strategy, and started to increase their own technical knowledge again. With the integration of the Dutch Engineer in the UAC-IC contract, OGs would be forced to procure certain technical knowledge from the market while they might have that knowledge themselves, within their own organisation. The writer of this thesis doubts whether this development would be positive.

Having a slightly closer look at the Dutch construction market, we can see that bigger projects are often executed with the use of IPM roles, especially with public OGs such as municipalities, provinces, and RWS. Without going into much detail, the philosophy of this method holds that all interest are recognised and acknowledged using five main roles (Wermer, 2018). These roles can be seen in figure C.1 and hold the PM, MPB, OM, TM, and CM. Engineering firms can be hired to perform the CM role, which often includes the TC sub-role. This role is, varying from project to project, responsible for a part of the external control mechanism in the quality assurance system of the UAC-IC 2005. One could argue that the liability of this role can also be increased in order to make sure that this external control mechanism is performed effectively. By doing so, the UAC-IC would not need to be adapted. However, when the UAC-IC is amended, this leads to standardisation for all projects. This standardisation is beneficial for the complexity of overall construction projects since it can be used to step away from the prototype or 'every building is unique' mentality.

With the amended UAC-IC, and therefore the increased liability under the amended TNR 2011, the question arises who is willing to take the risk of the increased liability. This is also questioned by interviewee 4U. Engineering companies such as Witteveen+Bos, being the parties that could fulfil the role of the Dutch Engineer, might not be able to bare the increased risks financially. TNR obligates the Dutch Engineer to have several insurances. Under the correct circumstances, these insurances cover the damages which have been induced by the Dutch Engineer. The insurance premium depends on the revenue of the engineering firm, the risk of the activities, and the number of workers (Boot et al., 2012). The Dutch Engineer would in fact be exposed to the insurance premium and the

deductible in the case of being liable, while the insurance firm is exposed to the real damages. When the risk of activities increase, the insurance premium will automatically increase too. Insurance companies and engineering firms might need to work together even more, to eventually fulfil the role of the Dutch Engineer in close collaboration. Whether this could be implemented with the Dutch mentality and culture, has not been in the scope of research.

This thesis also has its limitations. One of these limitations is that the amendment of the UAC-IC with the integrated role of the Dutch Engineer is not validated. The amendment could be validated by using an expert session. In this expert session, a variety of experts can be asked if the integration of the Dutch Engineer, and the increased liability under TNR 2011, could help to perform the external control mechanism more effectively. Experts with over 10 years of experience, or even more, during the execution phase of UAC-IC projects are proposed to be invited, since these experts will have more relevant knowledge regarding the work-as-actually-done situation and the implemented control mechanisms.

Another limitation of this thesis holds that no exact answer can be given towards what type of safety is safeguarded by proper performance of the vital tasks & responsibilities. It is assumed that the vital tasks & responsibilities can improve safety on site, safety of the surrounding area & structural safety. Even though this is true, the exact effect on the individual safety types is hard to determine.

The interview sample size has been rather small during this thesis, which can also be recognised as a limitation. The overall sample size is n=4, while the FIDIC and UAC-IC sample size are both n=2. With a greater sample size, and more variation in the sample size, the quotes can be made more valid. The interviews would be even of more help when the interviewees are familiar with projects that most incidents happen in: during the construction of buildings with consequence class 2 and higher. The lack of interviews with contractors could also be seen as a limitation, but contractors might be very reluctant to be interviewed and tell the truth.

Scientific contribution

Looking at the results of this research we can conclude that this thesis fills some research gaps related to the control mechanisms present in the quality assurance systems of both the UAC-IC 2005 and FIDIC Yellow Book 1999 edition, incentives of involved parties to actually use this control mechanism in both contracts, and the influence of FIDIC's Engineer on safety.

While scientific literature provides four types of control mechanisms which can be used to influence the level of safety, there is no research available showing which control mechanisms are integrated in the UAC-IC 2005 or FIDIC Yellow Book. This research provides the answer to this research gap by showing that both contracts are able to facilitate an internal and external control mechanisms in the quality assurance system.

There are in fact some scientific papers that show the different incentives for clients in the construction industry. However, there are no scientific papers which highlight the incentives of FIDIC's Engineer to safeguard certain contractual processes. This thesis fills this research gap by showing the Engineer's liability incentive originating from the FIDIC White Book contract with the Employer. This research states that while having the proper incentives, the external control mechanism is executed more effective. This statement must however be validated in practice.

While the direct effects on safety caused by the presence of FIDIC's Engineer might be hard to grasp, this thesis has found that the Engineer can influence safety at least indirectly. This is done by the effective execution of the external independent control mechanism in the quality assurance system, which leads to better execution of the vital tasks & responsibilities which have to be performed in order to safeguard the three types of safety.

6. Conclusions & recommendations

This chapter starts with the conclusions of this thesis in section 6.1. In this section, answers on all sub-questions and the main research question are given. Section 6.2 gives the final recommendations for future research.

6.1 Conclusions

The main objective in this research has been to examine whether there is any potential to integrate a third party into the UAC-IC 2005 contract. This potential has been examined using a comparison between the UAC-IC 2005 and FIDIC Yellow Book 1999. In this comparison, the main focus points are the "vital tasks & responsibilities" that are necessary in order to safeguard safety on site, safety of the surrounding area & structural safety. In order to reach this objective, a research question and multiple research sub-questions were formulated. In this section, the research sub-questions are answered first in order to conclude with the research question.

Sub-question 1: What are the industry-wide issues related to safety on site, safety of the surrounding area & structural safety in Dutch construction projects?

The construction industry is one of the most unsafe industries in The Netherlands (Ministerie van Sociale Zaken en Werkgelegenheid, 2021). Ellingwood (1987), Fruwald et al. (2007), and Schneider and Matousek (1976) have concluded that structural failure is often caused by human errors, which is the origin of a lack in structural safety. Crucial factors that can affect the level of structural safety are communication & collaboration, control mechanisms, allocation of responsibilities, knowledge infrastructure, risk management, and the safety culture within companies which include safety on site and safety of the surrounding area (Terwel, 2014). Six case studies have been analysed using the reports of the Dutch Safety Board, which show that there are several underlying issues present in most safety related incidents. First, four contextual aspects are often present when an incident happens: competition based on price instead of quality, diffuse responsibilities & coordination, organisational complexity, and techniques which are operated on their limit. Second, organisations are not able to close the feedback loop for structural safety since it is not clear who actually has the final responsibility to safeguard structural safety. For safety at work, the feedback loop can be closed. This is however more related to working conditions and not necessarily to safety on site and safety of the surrounding area. Third, trust is is used as a controlling intervention, while this can never be a reason to neglect designated checks and inspections at crucial handover moments (Onderzoeksraad voor Veiligheid, 2018). In addition to this, quality assurance processes that are agreed on and approved in the earlier phases of a project, are not followed in practice.

Sub-question 2: What is currently being done to tackle these issues?

Some of the industry-wide issues have been first mentioned in the beginning of this century. During that period, different initiatives have been presented to try to improve the current safety situation. These initiatives are for example 'Plan van Aanpak Constructieve Veiligheid', 'Compendium Aanpak Constructieve Veilgheid', 'Gedragscode Constructieve Veiligheid', and 'Governance Code Veiligheid in de Bouw'. The last few years, the government is trying to implement a new law named 'Law safeguarding quality for building'. The law has the intention to improve the quality of buildings when handed over to the employer and increase responsibilities for the contractor. When implemented, an independent and private quality safeguarder checks whether the construction is build according to the building decree during the design and execution phase of a project (Rijksoverheid, n.d.). However, many people argue that this law is not going to provide a solution to the overall safety related problems.

Sub-question 3: What are vital tasks & responsibilities that need to be performed in order to safeguard safety on site, safety of the surrounding area & structural safety?

The Dutch Safety Board has come up with several recommendations which have the aim to safeguard the different types of safety. The main recommendation is to arrange an integrated, systematic, and continues process of risk management in order to improve safety. These vital tasks & responsibilities are (Onderzoeksraad voor Veiligheid, 2006, 2012a):

1) Potential risks must be collected to structure the safety approach. This is done by:
   (i) Exploring the context of the project.
   (ii) Risks which have the possibility to arise in this context must be collected.
   (iii) The risks must be evaluated in order to find out what risks must be managed.
   (iv) Safety measures must be coupled to the risks that must be managed.

2) Prove that the safety approach is practical and realistic. This is done by taking into account:
   (i) The applicable laws
   (ii) Available standards, best practices, and own experience.

3) The safety approach needs to be carried out and controlled. This is done by:
   (i) A description of how the safety approach is performed, showing the goals, plans, and corresponding safety measures that are used to achieve these goals.
   (ii) A transparent, clear, and accessible distribution of responsibilities for the execution of the safety plans and safety measures.
   (iii) The number of workers and level of experience required must be specified for tasks that must be performed.
   (iv) All activities related to the safety approach are coordinated by one central party.

4) The safety approach must be improved continuously whenever required. This is done at the following moments:
   (i) After risk analyses, observations on site, inspections, and audits (proactive manner)
   (ii) After incidents, or near-misses (reactive manner)

The first step of the recommendation mainly relates to the management of project specific and safety related risks. The second, third, and fourth step are related to the safety approach that is a result of the identified risks in the first step. These vital tasks & responsibilities include three crucial factors from literature, namely: risk management, allocation of responsibilities, and control mechanisms.

Sub-question 4: How is the vital task & responsibility distribution in the Yellow Book 1999 edition organised?

The Contractor is the responsible party that needs to do something with risk management in the FIDIC Yellow Book. Therefore, the first step of the vital tasks & responsibilities is conducted by the Contractor. The Engineer can use different Sub-Clauses to steer the risk management system to the preferred level. The Engineer can for example make the Contractor adapt the risk management system after reviewing it under Sub-Clause 5.2 [Contractor's Documents]. The Sub-clauses in the Yellow Book, especially Sub-Clause 2.2 [Permits, Licenses or Approvals], 4.8 [Safety procedures], 6.5 [Working Hours] and 6.7 [Health and Safety], provide the information which is necessary to comply with the second step of the vital tasks & responsibilities.

The third step relates to the execution of the safety plans and the necessary control mechanisms. Step 3 (i) is the responsibility of the Contractor. This also holds for step 3 (ii). The Engineer is able to check whether the Contractor has made the responsibility distribution clear and accessible enough for every party involved, since all communication must be send to the Engineer too under Sub-Clause 1.3 [Communications]. If responsibilities are placed at subcontractors, the Engineer is

able to check whether the Contractor has specified the responsibilities of each individual subcontractor in a clear and effective manner under Sub-Clause 5.2 [Contractor's Documents]. Step 3 (iii) can be facilitated by the Yellow Book if this is a requirement in the Employer's Requirements. Since the Contractor is the main party that is responsible for the execution of the Works, he is also best able to perform step 3 (iv): be the on central party that coordinates the safety approach during the Works.

The fourth step is the responsibility of the Contractor. The quality assurance system entitles the Engineer to implement an external independent control mechanism by using the proactive tools mentioned under step 4 (i): the Engineer is entitled to audit the quality assurance system of the Contractor under Sub-Clause 4.9 [Quality Assurance], perform inspections during the design phase under Sub-Clause 5.2 [Contractor's Documents], perform inspections during the execution phase under Sub-Clause 7.3 [Inspections], and make the Contractor performs tests under Sub-Clause 7.4 [Testing]. The outcome of these tools show whether the Contractor is continuously improving the risk management system and the corresponding safety approach, or whether the risk management system and the corresponding safety approach are not used as agreed. The continues improvement based on a reactive manner is governed by the Yellow Book in Sub-Clause 6.7 [Health and Safety] which states that after incidents, or near-misses, the Contractor must inform the Engineer. They can together improve the risk management system and corresponding safety approach accordingly.

Theoretically, the vital tasks & responsibilities are completely able to be executed after the analysis of all Sub-Clauses in the Yellow Book. Most aspects are performed by the Contractor, with some guidance and control by the Engineer.

Sub-question 5: How is the vital task & responsibility distribution in the UAC-IC 2005 organised?

The Health and Safety dossier belongs to the responsibility of the ON. §12 [Veiligheid en gezondheid] and the Building Decree state that safety related risks must be collected, evaluated, and safety measures must be assigned to these risks. The first step of the vital tasks & responsibilities is therefore conducted by the ON. The second step is not explicitly mentioned in the UAC-IC, but paragraphs such as §9 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtgever], §10 [Vergunningen, ontheffingen, beschikkingen en toestemmingen: Opdrachtnemer], §11 [Wettelijke voorschriften en beschikkingen], and §48 [Toepasselijk recht] provide the boundary conditions in which the ON must prove that the safety approach is practical and realistic.

Step 3 (i) is not governed by the UAC-IC, but rather by the health and safety dossier specifications from the Building Decree. The ON is responsible for this. Step 3 (ii) is not facilitated by the UAC-IC itself, but this can rather be done using the OG's requirements in a project. The same holds for step 3 (iii). A look at a project specific OG's requirements has shown that risk management should be performed by both the ON and OG. This means that there is no central party that is coordinating the corresponding safety approach, but rather indicates a shared responsibility. The safety approach related to execution risks are however the responsibility of the ON.

§12-4 [Veiligheid en gezondheid] states that the ON must actualise and thus improve the health & safety plan if the OG specifies this. This means that there is a duty for the ON to keep the health and safety dossier, and thus the risk management system and the corresponding safety approach up-to-date. The proactive tools mentioned in step 4 (i) are facilitated in the quality assurance system which can be used by the OG to implement an external control mechanism. This quality assurance system is set out in §19 to §23, and is relatively procedural.

Theoretically, the vital tasks & responsibilities are cannot all be facilitated by the UAC-IC. If the Building Decree and OG's requirements are included in the analysis, the vital tasks & responsibilities are all able to be executed, mainly by the ON. The OG is able to perform an external control using

the quality assurance system.

Sub-question 6: What are the differences to properly execute the vital tasks & responsibilities in both the UAC-IC 2005 and the FIDIC Yellow Book 1999?

With some differences present in both contracts, they are both able to let a party perform the vital tasks & responsibilities in relation to the risk management system and corresponding safety approach. This is however concluded from a theoretical point of view. The situation is different in practice. During the execution phase of a project, it is not uncommon that other aspects like time, or money can get "more important" for the contracting party than proper risk management processes and the corresponding safety approach.

Looking at the UAC-IC, the internal control mechanism gets neglected by the ON, and it is up to the OG to properly perform the external control mechanism in order to notice the negligence. The incentive present for the OG to properly perform the external control mechanism, is to eventually get his deliverable according to the contract requirements, and within the specified time. For an involved OG, this incentive would be enough to perform the external control mechanism effectively. He will see that the ON is not working according the the quality plans, and will make sure that the ON is adapting the risk management processes and safety approach before any works continue. For a less involved OG, this incentive would not be sufficient to perform the external control mechanism effectively. He would argue that it is the ON's responsibility to properly perform all tasks and responsibilities as he has specified in the quality plan. Subsequently, if the ON is not working according to his quality plans, and there is no effective control mechanism present, risky situations can occur which will be to the detriment of safety (Terwel, 2014, p.33).

Looking at the FIDIC Yellow Book, there is one essential difference which is due to the presence of the Engineer: the Yellow Book mechanisms is organised in such a manner that the Employer assumes that he can count on the Engineer with respect to all technological aspects, safety aspects, and contractual aspects. The Engineer needs to explain and justify his actions to the Employer and he therefore must be very confident to take certain actions. Due to the accountability that is assigned to the Engineer, and the uncapped amount that the Engineer can be held liable for when he is in breach with FIDIC's White Book contract, there is a significant greater incentive for FIDIC's Engineer compared to the OG in the UAC-IC. This incentive will make sure that the Engineer is performing his external independent control mechanism more effectively compared to the OG in the UAC-IC.

Sub-question 7: How to model the Engineer as part of the UAC-IC 2005?

First, several adaptions to the UAC-IC must be made in order to make the Engineer perform the external independent control mechanism. The tools to do this can be found in the quality assurance system and include audits on system level, audits on process level, verification procedures, and acceptance procedures during both the design and execution phase. This external independent control mechanism must however be performed effectively in order to enhance safety.

Second, the liability as stated in TNR 2011 is not extensive enough, compared to the liability of the White Book, to make a Dutch Engineer perform the independent control mechanism effectively. Therefore, the amount that the Dutch Engineer can be held liable for must be increased in TNR 2011. However, this might not sound interesting for Dutch engineering firms which are able to fulfil the role of the Dutch Engineer since their exposure to risk will increase. An increase in liability is however the only possibility to increase the incentives which are needed in order to make an Engineer perform the external independent control mechanism effectively.

Third, it is expected that the use of the amended UAC-IC with the integrated Dutch Engineer in

small and simple projects is rather costly compared to the added value. This thesis states that certain requirements must be met in order to make a Dutch Engineer mandatory in Dutch projects. These requirements are found in two technical management measures (NEN, 2021) namely, design checking and inspection during execution. These two technical management measures must already be performed by the Dutch Engineer since this is a duty in the quality assurance system when performing his external independent control mechanism. Both of the technical management measures must at least be level 2 in order to make a Dutch Engineer mandatory. However, these levels are hard to determine when a project is in the early phases. The consequence class is a something which can be determined more easy looking at the functional requirements. The design checking level, inspection during execution level, and consequence level can be coupled to each other as is shown in table 4.4. Therefore, when the consequence class is at least CC2, the use of the amended UAC-IC with the integrated Dutch Engineer is mandatory.

Research question: In what way can safety on site, safety of the surrounding area & structural safety be improved by modelling a third party into the UAC-IC 2005, based on the experience of FIDIC's Engineer?

This thesis has found that the three types of safety can be improved if the vital tasks & responsibilities are properly performed. These tasks & responsibilities mainly relate to the management of project specific and safety related risks, and to the safety approach that is a result of this risk management system. From a theoretical point of view, the UAC-IC 2005 and the Dutch Building Decree are able to facilitate these vital tasks & responsibilities. The ON is responsible for most of the vital tasks & responsibilities, and the OG has the possibility to use an external control mechanism to verify this. The practical situation is however different. It is not uncommon that other aspects like time, or money can get "more important" for the contracting party than proper risk management processes and the corresponding safety approach. Work is not executed as intended, but rather as work-as-actually-done. The OG's incentives in the UAC-IC can however be insufficient for him to effectively perform this external control mechanism. This leads to the possibility that a situation can occur in which no internal nor external control mechanism is present, which is to the detriment of safety. The Engineer, being the party that is responsible for an external independent control mechanism in the Yellow Book's quality assurance system, does have more incentives to actually make him perform this external independent control mechanism effectively. This incentive has its origin in the uncapped liability which the Engineer can be held liable for when he is in breach of FIDIC's White Book contract.

If the Dutch version of the role of the Engineer would be integrated into the UAC-IC, he would be able to improve the three types of safety when he takes over the responsibility for the external control mechanism from the OG under the assumption that this external control mechanism will be performed more effectively. This assumption is valid if the Dutch Engineer would have a comparable liability as in the White Book. Since TNR 2011 would most likely be used in the Dutch construction industry, the liability in TNR 2011 must be increased for Dutch Engineers in order to be comparable to FIDIC's White Book. This results in a final figure, figure 4.1, in which the Dutch Engineer is integrated within the UAC-IC 2005 contract.

6.2 Recommendations for future research

The recommendations following from this research are mentioned in this section.

- This research mentions an increase in liability for the Dutch Engineer under TNR 2011. It is recommended to research to what extent the Engineer should be held liable in order to create the proper incentive to perform the external independent control mechanism in an effective manner.
- In this research, the prospect of the integration of a Dutch Engineer is discussed while this

Dutch Engineer would take over the responsibility of the external control mechanism in the the quality assurance system. This adaption is needed in order to enlarge the effectiveness of the external control mechanism. However, it might be interesting to research whether it is possible to enlarge the effectiveness of the external control mechanism, without integrating a third party. To do this, other incentives must be created for the OG. It is recommended to research whether more incentives can be created for the ON. By doing so, the safety related problems would be tackled at the origin.

- A false sense of safety that is created by a very procedural quality assurance system is mentioned during the semi-structured interviews which have been conducted for this research. This false sense of safety was mentioned in the context of the UAC-IC 2005 and its quality assurance system. The quality assurance system of the Yellow Book is less procedural, but still procedural. It is unknown whether the false sense of safety can still be created in the FIDIC Yellow Book. It is recommended to investigate whether the Yellow Book's quality assurance system can induce some kind of false sense of safety too. If not, it might be interesting to research whether it is possible to make the UAC-IC's quality assurance system less procedural as in the Yellow Book.

- This research has proposed to use the classification of the consequence class as a requirement in order to determine whether an Engineer is mandatory in a project. Even though it is said that the Dutch Engineer would have been mandatory in most of the case studies, it is recommended to research what requirement would a better option for this purpose.

- It is recommended to do research into other building contracts in other European countries such as France, to find out how they approach the same problem in relation to safety and assurance. European Federation of Engineering Consultancy Associations (2019) already takes a closer look at consulting engineers and insurances in other European countries, but does not completely cover this topic.

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A. Tables

Table A.1: Top ranking meso factors for both the delta approach and direct judgement method (Terwel, 2014).

Rank	Delta approach (delta score)	Direct judgement (cumulative score)
1.	Collaboration (1.33)	Risk analysis (115)
2.	Communication (1.22)	Control (93)
3.	Control (1.21)	Allocation of responsibilities (89)
4.	Risk analysis and allocation (1.18)	Safety culture (71)
5.	Allocation of responsibilities (1.14)	Collaboration (64)
6.	Safety culture (1.13)	Budget (50)
7.	Knowledge infrastructure (1.08)	Knowledge infrastructure (42)
8.	(Change) protocols (0.89)	Time (38)
9.	Safety goals (0.77)	Safety goals (37)
10.	Budget (0.73)	Communication (36)
11.	Time (0.70)	Protocols (13)
12.	Instruments (0.38)	Instruments (7)
13.	Working conditions (0.30)	Working conditions (1)

Table A.2: Clauses of the Yellow Book 1999 Edition (FIDIC, 1999)

Clause	Nr. of Sub-Clauses
1. General Provisions	14
2. The Employer	5
3. The Engineer	5
4. The Contractor	24
5. Design	8
6. Staff and Labour	11
7. Plant, Materials and Workmanship	8
8. Commencement, Delays and Suspension	12
9. Tests On Completion	4
10. Employer's Taking Over	4
11. Defects Liability	11
12. Tests After Completion	4
13. Variations and Adjustments	8
14. Contract Price and Payment	15
15. Termination by Employer	5
16. Suspension and Termination by Contractor	4
17. Risk and Responsibility	6
18. Insurance	4
19. Force Majeure	7
20. Claims, Disputes and Arbitration	8

Table A.3: Chapters in the UAC-IC 2005 (CROW, 2020)

Chapter	Nr. of §
1. Algemeen	2
2. Algemene verplichtingen van partijen	2
3. Contractoverneming en zelfstandige hulppersonen	2
4. Planning en Coordinatie	2
5. Vergunningen, ontheffingen, beschikkingen en toestemmingen; wettelijke voorschriften	3
6. Bodemaspecten	1
7. Wijzigingen, schorsing, ontbinding, opzegging	3
8. Werkterrein, reclame	2
9. Kwaliteitsborging	5
10. Oplevering en onderhoudstermijn	5
11. Meerjarig Onderhoud	4
12. Betaling, stelposten, omzetbelasting, boetebeding, bonus, verpanding en cessie	5
13. Zekerheidstelling, verzekering	2
14. Intelletuele eigendomsrechten	1
15. Schade aan het werk	1
16. In gebreke blijven, onvermogen of overlijden van een van de partijen	2
17. Kostenvergoeding, termijnverlenging, procedureafwikkeling gevolgen Wijzigingen door de Opdrachtgever	2
18. Vastleggen van de toestand; beslechting van geschillen	3

Table A.4: A table of project specific health & safety (in Dutch: V&G) coördinators. It can be seen that the health & safety coordination is diffusely distributed over multiple people, being responsible for , during different project phases (Witteveen+Bos, 2015).

Functionaris	Naam	Taken
V&G-coördinator uitvoeringsfase heiwerk + montage	[redacted]	Project V&G coördinatie
V&G-coördinator uitvoeringsfase K&O + monitoring	[redacted]	Project V&G coördinatie
KAM manager = V&G cordinator Ontwerpfase	[redacted]	Algehele KAM coordinatie
Contractmanager	[redacted]	Project V&G coördinatie OG

Article	Title of Article
Article 13	Liability of the consultant for culpable shortcomings
Article 14	Compensation
Article 15	Extent of the compensation
Article 16	Liability period and expiration terms
Article 17	Other provisions with respect to compensation
Article 18	The client is a consumer

Table A.5: The New Rules 2011 Article titles in chapter 6 [Liability of the consultant].

B. Figures

			Role Nature			Role Type			Role Fulfillment Capacity	
Sub-Clause	Sub-Clause Title	Underlying Main Roles	Proactive	Reactive	Passive	Administrative	Technical	Managerial	Employer's Agent	Independent
1.3	Communications	Giving Notice	✓	✓		✓			✓	
1.5	Priority of Documents	Clarifying		✓			✓		✓	
1.5	Priority of Documents	Instructing		✓			✓		✓	
1.8	Care and Supply of Documents	Receiving Documents			✓	✓			✓	
1.9	Errors in the Employer's Requirements	Agreeing		✓			✓			✓
1.9	Errors in the Employer's Requirements	Determining		✓			✓			✓
1.12	Confidential Details	Requiring	✓				✓			✓
2.1	Right of Access to the Site	Agreeing		✓			✓			✓
2.1	Right of Access to the Site	Determining		✓			✓			✓
2.5	Employer's Claims	Giving Notice	✓			✓		✓	✓	
2.5	Employer's Claims	Agreeing		✓			✓			✓
2.5	Employer's Claims	Determining		✓			✓			✓
3.1	Engineer's Duties and Authority	Asking for Employer's approval when the contract requires		✓		✓			✓	
3.1	Engineer's Duties and Authority	Checking		✓						✓
3.2	Delegation of the Engineer	Assigning/ Revoking assignment of assistants	✓					✓	✓	
3.2	Delegation of the Engineer	Confirming		✓			✓			✓
3.2	Delegation of the Engineer	Varying		✓			✓			✓
3.2	Delegation of the Engineer	Reverse		✓			✓			✓
3.2	Delegation of the Engineer	Rejecting		✓			✓			✓
3.5	Determinations	Consulting with both parties to obtain an agreement		✓		✓		✓		✓
3.5	Determinations	Agreeing		✓			✓			✓
3.5	Determinations	Determining		✓			✓			✓
3.5	Determinations	Giving Notice	✓			✓				✓
4.1	Contractor's General Obligations	Requiring	✓				✓			✓
4.2	Performance Security	Consenting			✓	✓			✓	
4.3	Contractor's Representative	Consenting		✓		✓		✓	✓	
4.3	Contractor's Representative	Instructing	✓				✓			✓
4.4	Subcontractors	Consenting		✓		✓		✓	✓	
4.5	Nominated Subcontractors	Instructing	✓			✓			✓	
4.6	Co-operation	Instructing	✓				✓		✓	
4.6	Co-operation	Consenting			✓	✓			✓	
4.7	Setting Out	Giving Notice	✓			✓	✓			✓
4.7	Setting Out	Agreeing		✓			✓			✓
4.7	Setting Out	Determining		✓			✓			✓
4.9	Quality Assurance	Auditing the QA	✓				✓		✓	
4.9	Quality Assurance	Consenting			✓	✓			✓	
4.12	Unforseeable physical conditions	Inspecting		✓			✓			✓
4.12	Unforseeable physical conditions	Investigating		✓			✓			✓
4.12	Unforseeable physical conditions	Instructing		✓			✓			✓
4.12	Unforseeable physical conditions	Reviewing		✓			✓			✓
4.12	Unforseeable physical conditions	Agreeing		✓			✓			✓
4.12	Unforseeable physical conditions	Determining		✓			✓			✓
4.16	Transport of Goods	Consenting		✓		✓		✓	✓	
4.19	Electricity. Water and Gas	Agreeing		✓			✓			✓
4.19	Electricity. Water and Gas	Determining		✓			✓			✓
4.20	Employer's Equipment and Free-Issue Material	Agreeing		✓			✓			✓
4.20	Employer's Equipment and Free-Issue Material	Determining		✓			✓			✓

Figure B.1: Database (part 1 of 5) of the Engineer's role classification in the Yellow Book, adapted from Abdul-Malak and El Masri (2016).

			Role Nature			Role Type			Role Fulfillment Capacity	
Sub-Clause	Sub-Clause Title	Underlying Main Roles	Proactive	Reactive	Passive	Administrative	Technical	Managerial	Employer's Agent	Independent
4.21	Progress Report	Consenting			✓	✓			✓	
4.22	Security of the Site	Authorizing to the Site	✓			✓			✓	
4.23	Contractor's Operations on Site	Agreeing		✓			✓			✓
4.24	Fossils	Instructing		✓			✓			✓
4.24	Fossils	Agreeing		✓			✓			✓
4.24	Fossils	Determining		✓			✓			✓
5.1	General Design Obligations	Consenting		✓		✓			✓	
5.1	General Design Obligations	Determining		✓			✓			✓
5.1	General Design Obligations	Giving Notice	✓			✓				✓
5.2	Contractors's Documents	Reviewing		✓			✓	✓		✓
5.2	Contractors's Documents	Approving		✓			✓	✓		✓
5.2	Contractors's Documents	Giving Notice	✓			✓		✓		✓
5.2	Contractors's Documents	Instructing	✓				✓			✓
5.2	Contractors's Documents	Consenting		✓			✓	✓		✓
5.4	Technical Standards and Regulations	Determining		✓			✓			✓
5.4	Technical Standards and Regulations	Varying		✓			✓			✓
5.6	As-Built Documents	Reviewing		✓			✓	✓		✓
5.6	As-Built Documents	Consenting		✓			✓	✓		✓
5.6	As-Built Documents	Receiving Documents			✓	✓			✓	
5.7	Operation and Maintenance Manuals	Receiving Documents			✓		✓		✓	
6.5	Working Hours	Consenting		✓		✓		✓	✓	
6.7	Health and Safety	Consenting			✓	✓		✓	✓	
6.7	Health and Safety	Requiring	✓			✓	✓		✓	
6.7	Health and Safety	Instructing	✓			✓	✓		✓	
6.9	Contractors Personnel	Requiring	✓			✓		✓	✓	
6.1	Records of Contractor's Personnel and Equipment	Approving		✓			✓		✓	
6.1	Records of Contractor's Personnel and Equipment	Consenting		✓		✓			✓	
7.2	Samples	Reviewing		✓			✓			✓
7.2	Samples	Instructing	✓				✓		✓	
7.2	Samples	Varying		✓			✓			✓
7.3	Inspection	Examining		✓			✓			✓
7.3	Inspection	Measuring		✓			✓			✓
7.3	Inspection	Inspecting		✓			✓			✓
7.3	Inspection	Testing		✓			✓			✓
7.3	Inspection	Giving Notice		✓		✓		✓		✓
7.3	Inspection	Requiring		✓			✓	✓		✓
7.4	Testing	Varying		✓			✓	✓		✓
7.4	Testing	Agreeing		✓			✓			✓
7.4	Testing	Giving Notice	✓			✓		✓		✓
7.4	Testing	Instructing		✓			✓			✓
7.4	Testing	Determining		✓			✓			✓
7.4	Testing	Certifying		✓			✓			✓
7.5	Rejection	Rejecting		✓			✓			✓
7.5	Rejection	Requiring		✓			✓			✓
7.5	Rejection	Giving Notice	✓			✓		✓	✓	
7.5	Rejection	Determining		✓			✓			✓
7.6	Remedial Work	Instructing		✓			✓			✓
8.1	Commencement of Work	Giving Notice	✓			✓			✓	
8.3	Programme	Consenting			✓	✓			✓	
8.3	Programme	Giving Notice	✓				✓	✓	✓	

Figure B.2: Database (part 2 of 5) of the Engineer's role classification in the Yellow Book, adapted from Abdul-Malak and El Masri (2016).

			Role Nature			Role Type			Role Fulfillment Capacity	
Sub-Clause	Sub-Clause Title	Underlying Main Roles	Proactive	Reactive	Passive	Administrative	Technical	Managerial	Employer's Agent	Independent
8.3	Programme	Giving Notice	✓				✓	✓	✓	
8.3	Programme	Requiring	✓				✓			✓
8.4	Extension of Time for Completion	Reviewing		✓			✓			✓
8.4	Extension of Time for Completion	Determining		✓			✓			✓
8.6	Rate of Progress	Instructing	✓				✓			✓
8.6	Rate of Progress	Giving Notice	✓			✓			✓	
8.6	Rate of Progress	Determining		✓			✓			✓
8.8	Suspension of Work	Giving Notice	✓					✓	✓	
8.8	Suspension of Work	Instructing	✓				✓	✓	✓	
8.9	Consequences of Suspension	Agreeing		✓			✓			✓
8.9	Consequences of Suspension	Determining		✓			✓			✓
8.10	Payment for Plant and Materials in Event of Suspension	Instructing	✓			✓			✓	
8.11	Prolonged Suspension	Giving permission		✓		✓			✓	
8.11	Prolonged Suspension	Authorizing Variations		✓		✓			✓	
8.12	Resumption of Work	Giving permission	✓			✓			✓	
8.12	Resumption of Work	Examining	✓				✓			✓
8.12	Resumption of Work	Instructing		✓				✓	✓	
9.1	Contractor's Obligations	Instructing	✓					✓	✓	
9.1	Contractor's Obligations	Assessing and analyzing		✓			✓			✓
9.1	Contractor's Obligations	Approving		✓			✓			✓
9.2	Delayed Tests	Giving Notice	✓			✓			✓	
9.2	Delayed Tests	Requiring	✓					✓	✓	
9.3	Retesting	Giving Notice	✓			✓			✓	
9.3	Retesting	Requiring	✓			✓			✓	
9.4	Failure to Pass Tests on Completion	Requiring		✓				✓	✓	
9.4	Failure to Pass Tests on Completion	Rejecting		✓			✓			✓
9.4	Failure to Pass Tests on Completion	Issuing Taking-Over Certificate		✓		✓			✓	
10.1	Taking Over of the Works and Sections	Issuing Taking-Over Certificate		✓				✓	✓	
10.1	Taking Over of the Works and Sections	Rejecting		✓			✓			✓
10.1	Taking Over of the Works and Sections	Instructing		✓			✓			✓
10.1	Taking Over of the Works and Sections	Receiving Notice			✓	✓			✓	
10.2	Taking Over of Parts of the Works	Issuing Taking-Over Certificate	✓					✓	✓	
10.2	Taking Over of Parts of the Works	Agreeing		✓			✓			✓
10.2	Taking Over of Parts of the Works	Determining		✓			✓			✓
10.3	Interference with Tests on Completion	Issuing Taking-Over Certificate		✓				✓		✓
10.3	Interference with Tests on Completion	Agreeing		✓			✓			✓
10.3	Interference with Tests on Completion	Determining		✓			✓			✓
10.3	Interference with Tests on Completion	Giving Notice	✓			✓			✓	
10.3	Interference with Tests on Completion	Requiring	✓			✓				✓
11.1	Completion of Outstanding Work and Remedying Defects	Instructing	✓				✓			✓
11.4	Failure to Remedy Defects	Agreeing		✓			✓			✓
11.4	Failure to Remedy Defects	Determining		✓			✓			✓
11.6	Further Tests	Requiring	✓				✓			✓
11.8	Contractor to Search	Requiring	✓			✓				✓
11.8	Contractor to Search	Agreeing		✓			✓			✓
11.8	Contractor to Search	Determining		✓			✓			✓
11.9	Performance Certificate	Issuing Performance certificate	✓				✓		✓	
12.2	Delayed Tests	Receiving Notice			✓	✓				✓
12.2	Delayed Tests	Agreeing		✓			✓			✓
12.2	Delayed Tests	Determining		✓			✓			✓
12.4	Failure to Pass Tests after Completion	Receiving Notice			✓	✓				✓

Figure B.3: Database (part 3 of 5) of the Engineer's role classification in the Yellow Book, adapted from Abdul-Malak and El Masri (2016).

			Role Nature			Role Type			Role Fulfillment Capacity	
Sub-Clause	Sub-Clause Title	Underlying Main Roles	Proactive	Reactive	Passive	Administrative	Technical	Managerial	Employer's Agent	Independent
12.4	Failure to Pass Tests after Completion	Agreeing		✓			✓			✓
12.4	Failure to Pass Tests after Completion	Determining		✓			✓			✓
13.1	Right to Vary	Instructing	✓				✓		✓	
13.1	Right to Vary	Requiring	✓			✓			✓	
13.1	Right to Vary	Cancelling		✓			✓			✓
13.1	Right to Vary	Confirming		✓			✓			✓
13.1	Right to Vary	Varying		✓			✓		✓	
13.2	Value Engineering	Receiving Proposal			✓	✓			✓	
13.3	Variation Procedure	Requiring	✓			✓			✓	
13.3	Variation Procedure	Approving		✓			✓			✓
13.3	Variation Procedure	Commenting		✓			✓			✓
13.3	Variation Procedure	Instructing		✓			✓			✓
13.3	Variation Procedure	Agreeing		✓			✓			✓
13.3	Variation Procedure	Determining		✓			✓			✓
13.5	Provisional Sums	Instructing	✓				✓		✓	
13.5	Provisional Sums	Requiring	✓				✓		✓	
13.6	Daywork	Instructing	✓				✓		✓	
13.6	Daywork	Approving		✓			✓			✓
13.6	Daywork	Valuating		✓			✓			✓
13.6	Daywork	Varying		✓			✓			✓
13.6	Daywork	Receiving and Signing off		✓		✓				✓
13.7	Adjustment for Changes in Legislation	Agreeing		✓			✓			✓
13.7	Adjustment for Changes in Legislation	Determining		✓			✓			✓
13.8	Adjustment for Changes in Cost	Determining		✓			✓			✓
14.2	Advance Payment	Issuing Interim Payment Certificate		✓			✓			✓
14.3	Application for Interim Payment Certificates	Approving		✓		✓			✓	
14.4	Schedule of Payments	Agreeing		✓			✓			✓
14.4	Schedule of Payments	Determining		✓			✓			✓
14.5	Plant and Materials Intended for the Works	Certifying		✓			✓			✓
14.5	Plant and Materials Intended for the Works	Determining		✓			✓			✓
14.6	Issue of Interim Payment Certificate	Determining		✓			✓			✓
14.6	Issue of Interim Payment Certificate	Giving Notice	✓			✓			✓	
14.6	Issue of Interim Payment Certificate	Issuing Interim Payment Certificate		✓			✓			✓
14.6	Issue of Interim Payment Certificate	Correcting		✓			✓			✓
14.9	Payment of Retention Money	Certifying		✓				✓	✓	
14.1	Statement at Completion	Certifying		✓			✓			✓
14.11	Application for Final Payment Certificate	Receiving Documents			✓		✓		✓	
14.11	Application for Final Payment Certificate	Agreeing		✓			✓			✓
14.11	Application for Final Payment Certificate	Verifying		✓			✓			✓
14.11	Application for Final Payment Certificate	Requiring		✓			✓			✓
14.11	Application for Final Payment Certificate	Issuing Interim Payment Certificate		✓			✓			✓
14.13	Issue of Final Payment Certificate	Issuing Final Payment Certificate		✓			✓			✓
14.13	Issue of Final Payment Certificate	Requiring	✓			✓				✓
14.13	Issue of Final Payment Certificate	Determining		✓			✓			✓
15.1	Notice to Correct	Requiring	✓				✓		✓	
15.2	Termination by the Employer	Consenting			✓	✓			✓	
15.3	Valuation at Date of Termination	Agreeing		✓			✓			✓
15.3	Valuation at Date of Termination	Determining		✓			✓			✓
16.1	Contractor's Entitlement to Suspend Work	Agreeing		✓			✓			✓
16.1	Contractor's Entitlement to Suspend Work	Determining		✓			✓			✓

Figure B.4: Database (part 4 of 5) of the Engineer's role classification in the Yellow Book, adapted from Abdul-Malak and El Masri (2016).

			Role Nature			Role Type			Role Fulfillment Capacity	
Sub-Clause	Sub-Clause Title	Underlying Main Roles	Proactive	Reactive	Passive	Administrative	Technical	Managerial	Employer's Agent	Independent
16.2	Termination by Contractor	Issuing Payment Certificate		✓			✓			✓
16.3	Cessation of Work and Removal of Contractor's Equipment	Instructing	✓					✓		✓
17.4	Consequences of Employer's Risks	Requiring		✓			✓			✓
17.4	Consequences of Employer's Risks	Agreeing		✓			✓			✓
17.4	Consequences of Employer's Risks	Determining		✓			✓			✓
18.1	General Requirements for Insurances	Consenting			✓	✓			✓	
19.4	Consequences of Force Majeure	Agreeing		✓			✓			✓
19.4	Consequences of Force Majeure	Determining		✓			✓			✓
19.6	Optional Termination. Payment and Release	Determining		✓			✓			✓
19.6	Optional Termination. Payment and Release	Issuing Payment Certificate		✓			✓			✓
20.1	Contractor's Claims	Inspecting		✓		✓	✓	✓		✓
20.1	Contractor's Claims	Approving		✓				✓		✓
20.1	Contractor's Claims	Agreeing		✓			✓			✓
20.1	Contractor's Claims	Commenting		✓			✓			✓
20.1	Contractor's Claims	Monitoring/Record-keeping		✓		✓	✓	✓		✓
20.1	Contractor's Claims	Requiring		✓			✓	✓		✓
20.1	Contractor's Claims	Proposing time bars		✓				✓		✓
20.1	Contractor's Claims	Instructing		✓			✓			✓
20.1	Contractor's Claims	Determining		✓			✓			✓
20.6	Arbitration	Witnessing		✓			✓			✓

Figure B.5: Database (part 5 of 5) of the Engineer's role classification in the Yellow Book, adapted from Abdul-Malak and El Masri (2016).

C. Interviews

C.1 List of interviewees

Contract expertise	Initials	Name	Role	Company
FIDIC	1F	[redacted]	Involved during initiation and procurement phases	Witteveen+Bos
FIDIC	2F	[redacted]	Involved during all project phases	Witteveen+Bos
UAC-IC	3U	[redacted]	Involved during all project phases	Witteveen+Bos
UAC-IC	4U	[redacted]	Involved during initiation, procurement, and execution phase	Witteveen+Bos

C.2 Example of an interview agenda

Interview:	**FIDIC in practice**
Date of interview (DD/MM/YYYY):	22-07-2022
Time:	10:00 - 11:00
Location:	Witteveen+Bos office, Deventer
Interview planned by:	Stijn Vermeulen

1. Interview objective

This master thesis' topic concerns the current safety situation in the Dutch construction industry. Safety in this context relates to the safety on site, safety of the area near the site, and structural safety. This thesis mainly focuses on the standardised set of general terms and conditions UAC-IC 2005, and the FIDIC's Yellow Book 1999 General Conditions. However, during this research, the researcher missed out on practical information to see whether the theory of the general terms and conditions is also applicable to the more practical situations. Interviews with experts are conducted to gather more practical related information. These interviews concern general practical information, and do not relate to specific projects.

2. Attendees

Name	**Role**	**Organisation**	**E-mail**
Stijn Vermeulen (SV)	Graduate intern	TU Delft/ Witteveen+Bos	[redacted]@witteveenbos.com
[redacted] (2F)	Group lead "[redacted] [redacted]"	Witteveen+Bos	[redacted]@witteveenbos.com

3. Interview agenda

Subject	**Time**
(a) Introduction – Introduction researcher – Introduction research – Goal interview	10:00 - 10:05
(b) Opening – Introduction interviewee – FIDIC experience	10:05 - 10:07
(c) Questionnaire: relations between FIDIC parties – Approving by Employer – The role of the Engineer, reflected on the Dutch contracts – "Fair determinations" in practice	10:07 - 10:26
(d) Questionnaire: risk management – Engineer's influence on risk management – The Engineer being the central party – Interface risks – The Engineer on site	10:26 - 10:56
(e) Questionnaire: suggestions for UAC-IC (optional) – Risk management lessons learned for the Dutch market – Value of a third party	10:56 - 11:00
(f) Closing	11:00 - 11:02

C.3 Questionnaire FIDIC

Introductie onderzoek [10:00 - 10:05]

Kort mezelf voorstellen

Een aantal onderzoeken, waaronder die van de Onderzoeksraad Voor Veiligheid, laten ziet dat het niet goed gesteld staat met de veiligheid op de bouw. Veiligheid in dit kader kent drie soorten veiligheid. 1) veiligheid op de bouwplaats, 2) veiligheid voor de omgeving van de bouwplaats, 3) constructieve veiligheid. De oorzaak: versplintering in de bouw. Door deze versplintering zijn de verantwoordelijkheden diffuus verdeeld, niet altijd duidelijk in raakvlakken met onderaannemers, en bovendien voelt niet iedereen zich verantwoordelijk voor alles wat er om hen heen gebeurd. De aanbeveling van de Onderzoeksraad Voor Veiligheid: zorg dat er 1 centrale partij is die verantwoording draagt voor een integraal, systematisch en continue proces voor risico management om zo alle drie de veiligheidstype te verbeteren.

Integraal: een gecentraliseerd risicomanagement systeem waarin 1 centrale partij de verantwoording heeft voor het proces. Om deze verantwoordelijkheid te dragen moet deze partij veiligheid en risico management centraal hebben staan tijdens al haar werkzaamheden. Deze partij zou bovendien de bevoegdheid moeten hebben om andere partijen te verplichten mee te werken aan dit proces, zodat dit niet verwaarloost kan worden.

Systematisch: inventariseer risico's, evalueer risico's, implementeer maatregelen tegen de risico's, maak duidelijk wie er verantwoordelijk is voor de uitvoering van een maatregel, zorg dat maatregelen worden nageleefd.

Continue: blijf het systematische deel herhalen (opnieuw inventariseren, etc.) wanneer er signalen optreden tijdens de ontwerp- of uitvoeringsfase. (En deze centrale partij moet dus ook echt de nadruk leggen op het continue bijhouden van deze risico's)

Mijn doel: erachter komen wat het FIDIC mechanisme, met name de Engineer die hier specifiek in benoemd is, zou kunnen betekenen voor de aanbeveling die gedaan is door de Onderzoeksraad Voor Veiligheid. De uitgangspunten bij dit doel zijn de UAVgc en FIDIC Yellow Book, tijdens de ontwerp- en uitvoeringsfase.

Start interview

0. **Algemeen [10:05 - 10:07]**

   0.1 Naam, bedrijf, functie, ervaring in bouwwereld (jaren), ervaring met FIDIC, ervaring met UAVgc (projecten/ jaren).

1. **Verhoudingen tussen de 3 FIDIC partijen [10:07 - 10:26]**

   1.1 De Engineer wordt gezien als een soort contract manager / 'contract administrator', die besluiten neemt aan de hand van het Contract. De Employer heeft echter de mogelijkheid om approve momenten in te bouwen om zo de acties van de Engineer te kunnen goedkeuren of te kunnen weigeren. Over deze approve momenten: worden deze vaak ingebouwd in de praktijk? En op wat voor aspecten moet de Engineer vaak toestemming vragen? [10:07 - 10:10]

   1.2 Wanneer de Engineer een beslissing neemt zonder dat hij approval nodig heeft van de Employer, moet de Engineer deze beslissing dan op een bepaalde manier verantwoorden tegenover de Employer? Zo ja, hoe verantwoord de Engineer zijn beslissing tegenover de Employer? In hoeverre is de Engineer verantwoordelijk voor deze beslissingen waar geen approval van de Employer voor nodig is? [10:10 - 10:13]

1.3 De Engineer staat traditioneel bekend als de 'independent' partij binnen het FIDIC Contract. Hoe vrij kan de Engineer daadwerkelijk handelen wanneer hij approval nodig heeft van de Employer? Is het approve mechanisme niet gewoon een manier om de Engineer te controleren voor de Employer?/ Wordt de Engineer niet gewoon gecontroleerd door de Employer door middel van het approve mechanisme? [10:13 - 10:18]

1.4 De Engineer neemt over veel aspecten (Contract gerelateerd) een besluit, behalve een X aantal punten die vooraf in het Contract zijn afgestemd. Hierover moet de Employer besluiten nemen. Handelt de Engineer binnen FIDIC YB niet vergelijkbaar met de OG binnen de UAVgc ? / Zijn de verantwoordelijkheden en acties van de Nederlandse OG, binnen FIFIC niet gewoon doorgeschoven naar de Engineer? [10:18 - 10:22]

1.5 Volgens de General Conditions handelt de Engineer namens de Employer, maar moet hij tegelijkertijd eerlijke besluiten nemen door de belangen van zowel de Employer en de Contractor mee te nemen (SC 3.5 [Determinations]). Gebeurd dit eerlijke handelen ook in de praktijk? Wat heeft het 'eerlijke handelen' van de Engineer voor effect op de verhoudingen tussen 1) Employer / Engineer, en 2) Contractor / Engineer? Hoe ervaart u de afweging tussen 'eerlijk handelen' en het zijn van de 'Employer's agent' tijdens de ontwerp- en uitvoeringsfase? [10:22 - 10:26]

1.6 Wat houdt de Accident Prevention Officer in bij FIDIC?

2. **Risicomanagement binnen FIDIC [10:26 - 10:56]**

2.1 Wordt risico management toegepast door de Contractor (of door een andere partij)? Zo ja, wat voor invloed heeft de Engineer op dit proces? Hoe controlerend is de Engineer op dit risico management systeem? [10:26 - 10:30]

2.2 Hoe kan de Engineer dit proces sturen en proberen te verbeteren? [10:30 - 10:33]

2.3 Zou je kunnen zeggen dat de Engineer een 'centrale partij' is die het risico management proces probeert te sturen, zodat hij zelf de verantwoording af kan geven richting de Employer? Zo niet, Zou de Engineer de centrale partij moeten of kunnen zijn die verantwoordelijk is voor het naleven van/ sturen van/ controleren van risico management? [10:33 - 10:38]

2.4 Wordt risicomanagement binnen FIDIC strakker gehanteerd door de Engineer, omdat de Engineer moet kunnen laten zien aan de Employer dat alles goed verloopt? [10:38 - 10:40]

2.5 Bewaakt/ controleert de Engineer ook de raakvlak risico's (met betrekking tot verschillende partijen en verschillende project fases (ontwerp - uitvoering)? [10:40 - 10:43]

2.6 Wat zijn de gevolgen van een zeer betrokken/ controlerende/ sturende Engineer? [10:43 - 10:47]

2.7 Kan risico management onder druk komen te staan wanneer tijd en geld een rol gaan spelen in de negatieve zin? En hoe uit zich dat dan? [10:47 - 10:49]

2.8 In hoeverre is de Engineer aanwezig op de bouwplaats zelf? En voert hij dan zelf ook vaak actief testen uit? (SC 7.3 [Inspection]) [10:49 - 10:53] Is dit dan een controlerende rol?

2.9 FIDIC contracten worden gekenmerkt door de aanwezigheid van de Engineer in de Sub-Clausules. Is deze partij noodzakelijk? Zou deze niet gewoon uit de General Conditions gehaald kunnen worden, en vervolgens alleen een adviserende rol toegewezen krijgen zoals in Nederland? [10:53 - 10:56]

3. **Indien bekend met UAVgc [10:56 - 11:00]**

3.1 Wat zouden lessen kunnen zijn vanuit FIDIC en de aanwezigheid van een Engineer, die we in de Nederlandse UAVgc mee kunnen nemen met betrekking tot het beter uitvoeren van risicomanagement? [10:56 - 10:58]

3.2 Draagt een Engineer / derde partij bij aan de UAVgc, kijkende naar de verhoudingen die er zijn binnen het contract? [10:58 - 11:00]

4. **Slot [11:00 - 11:02]**

4.1 Anonimiteit [ja/nee], en andere dingen die discreet / geheim moeten blijven

4.2 Verbetering interview

4.3 Vragen per mail stellen? (nabrandertjes)

4.4 uitgewerkte variant valideren

C.4 Questionnaire UAC-IC

Introductie onderzoek

Kort mezelf voorstellen

Een aantal onderzoeken, waaronder die van de Onderzoeksraad Voor Veiligheid, laten ziet dat het niet goed gesteld staat met de veiligheid op de bouw. Veiligheid in dit kader kent drie soorten veiligheid. 1) veiligheid op de bouwplaats, 2) veiligheid voor de omgeving van de bouwplaats, 3) constructieve veiligheid. De oorzaak: versplintering in de bouw. Door deze versplintering zijn de verantwoordelijkheden diffuus verdeeld, niet altijd duidelijk in raakvlakken met onderaannemers, en bovendien voelt niet iedereen zich verantwoordelijk voor alles wat er om hen heen gebeurd. De aanbeveling van de Onderzoeksraad Voor Veiligheid: zorg dat er 1 centrale partij is die verantwoording draagt voor een integraal, systematisch en continue proces voor risico management om zo alle drie de veiligheidstype te verbeteren.

Integraal: een gecentraliseerd risicomanagement systeem waarin 1 centrale partij de verantwoording heeft voor het proces. Om deze verantwoordelijkheid te dragen moet deze partij veiligheid en risico management centraal hebben staan tijdens al haar werkzaamheden. Deze partij zou bovendien de bevoegdheid moeten hebben om andere partijen te verplichten mee te werken aan dit proces, zodat dit niet verwaarloost kan worden.

Systematisch: inventariseer risico's, evalueer risico's, implementeer maatregelen tegen de risico's, maak duidelijk wie er verantwoordelijk is voor de uitvoering van een maatregel, zorg dat maatregelen worden nageleefd.

Continue: blijf het systematische deel herhalen (opnieuw inventariseren, etc.) wanneer er signalen optreden tijdens de ontwerp- of uitvoeringsfase. (En deze centrale partij moet dus ook echt de nadruk leggen op het continue bijhouden van deze risico's)

Mijn doel: erachter komen wat het FIDIC mechanisme, met name de Engineer die hier specifiek in benoemd is, zou kunnen betekenen voor de aanbeveling die gedaan is door de Onderzoeksraad Voor Veiligheid. De uitgangspunten bij dit doel zijn de UAVgc en FIDIC Yellow Book, tijdens de ontwerp- en uitvoeringsfase.

——————— Start interview ———————

0. **Algemeen**

    0.1 Naam, bedrijf, functie, ervaring in bouwwereld (jaren ervaring met UAVgc), ervaring met FIDIC?

1. **OG & ON**

    1.1 De UAVgc bestaat formeel gezien uit twee partijen. De OG en ON organisaties zitten zelf een stukje ingewikkelder in elkaar. Zou je een standaard organisatie van de OG kunnen tekenen? En van de ON? Zijn dit allemaal interne mensen van de OG/ON, of worden hier andere partijen voor ingehuurd? Wie / op welk niveau wordt er tussen de partijen gecommuniceerd ?

    1.2 Tijdens de uitvoeringsfase, welke personen van de OG bevinden zich (wel eens / structureel) op de bouwplaats? Wat zijn hun taken daar?

2. **Risicomanagement binnen de UAVgc**

2.1 Een onderdeel van de UAVgc is het V&G plan. Hierin, en in het bouwbesluit, staat gespecificeerd wat de V&G documentatie allemaal moet omvatten. Een onderdeel van het V&G dossier heeft betrekken op risicomanagement. Dit wordt uitgevoerd door de ON. Wat is de ISO9001, en heeft deze ISO9001 invloed op het risicomanagement proces binnen het V&G dossier?

2.2 Wie is er uiteindelijk binnen de organisatie van de ON verantwoordelijk voor het risico management proces op een project? Dit gaat om V&G risico's, maar ook overige risico's die de werkzaamheden met zich meebrengen (denk aan hijswerkzaamheden of gebruik van stijger als ondersteuningsconstructie).

2.3 De (verschillende) risico dossiers moeten up-to-date worden gehouden. Gebeurd dit in de praktijk ook? Wie doet dit dan? En hoe gebeurd dit (actief, passief, of reactief)?

2.4 Is het up-to-date houden van de risicodossiers ook echt een prioriteit tijdens de uitvoeringwerkzaamheden, in acht nemende de dynamische wereld van de bouw en alle activiteiten die zich daaromheen afspelen?

2.5 De V&G coördinator is vaak een deeltaak of deelfunctie die toegewezen wordt aan een persoon. Indien de V&G Coördinator uitvoering verantwoordelijk is voor het (laten) uitvoeren van de beheersmaatregelen, zou hier dan niet meer prioriteit op moeten liggen? Moet dit niet gewoon een voltijd functie zijn? Denk je dat deze persoon door zijn overige verplichtingen wel genoeg aandacht kan geven aan alle V&G aspecten en uberhaupt ziet of de vooraf afgesproken maatregelen ook echt worden genomen?

2.6 Wat voor rol of invloed heeft de OG op het risicomanagement proces?

2.7 Kan risico management onder druk komen te staan wanneer tijd en geld een negatieve rol gaan spelen? En hoe uit zich dat dan? Heb je ooit meegemaakt dat risico management tijdens de uitvoering van het project verwaarloosd werd (zowel V&G risico's als werk specifieke risico's)? En zo ja, hoe stond de OG hier dan tegenover?

2.8 Geld is voor de ON een van de belangrijkste drijfveren. Wat betekent het voor de veiligheid dat de aannemende partij verantwoordelijk is voor zowat alle vormen van risico management? Waarom zou de aannemende de bouw bijvoorbeeld stil leggen als hij weet dat er dan consequenties in de vorm van tijd en geld aan verbonden zijn? Een voorbeeld van een mogelijke quote: "De kans dat dit risico daadwerkelijk tot uiting komt is zo klein, we gaan gewoon door!", niet in acht nemende dat de gevolgen immens kunnen zijn.

2.9 De ON heeft het recht om zelfstandige hulppersonen / onderaannemers in te huren voor activiteiten. Hoe worden de activiteiten van de onderaannemers beheerst of gecontroleerd door de ON? Hoe controleert de ON of een onderaannemer de risico's beheerst die de onderaannemer zou moeten beheersen?

2.10 Speelt vertrouwen van de ON richting de onderaannemer nog een rol in het controleren / beheersen van risico's? Kunnen, door de aanwezigheid van vertrouwen, de benodigde checks op het werk van de onderaannemers uitblijven?

2.11 Hoe worden de ontwerp risico's overgedragen van de ontwerp fase naar de uitvoeringsfase? (Aangezien er toch andere personen betrokken zijn bij de verschillende fases) Gaat hier kennis verloren?

2.12 Vind je dat er in de UAVgc voldoende controle mogelijkheden zijn ingebouwd, met name kijkende naar de keten waar werkzaamheden afhankelijk zijn van de voorafgaande werkzaamheden die waarschijnlijk ook nog eens door een andere partij zijn uitgevoerd?

3. **Schijnveiligheid**

3.1 De OG is verantwoordelijk om te checken of de ON in staat is veilig en verantwoord te werken. Hier voor wordt onder andere SCB toegepast. Levert SCB niet eigenlijk een soort schijnveiligheid op waarin de OG kan zeggen: "Wij hebben er alles aan gedaan om het allemaal zo veilig mogelijk te laten verlopen", terwijl ze eigenlijk alleen maar de procedures hebben doorlopen die verplicht zijn?

3.2 Wordt omgevingsveiligheid niet verwaarloost door te zeggen dat het “geadviseerd wordt om dit mee te nemen tijdens de uitwerking van bepaalde plannen”? En als het dan wordt meegenomen, is het dan niet gewoon een vinkje dat gezet wordt, waarna partijen zeggen: “zo, we hebben er over nagedacht”?

4. **Toekomstige situatie**

4.1 Wat zou het betekenen voor de Nederlandse bouw wanneer er een nieuwe, onafhankelijke partij wordt geïntroduceerd die:

- Verantwoording af gaat leggen tegenover de OG voor het proces van risicomanagement (dat nog steeds wordt uitgevoerd door de ON) zodat dit beter gewaarborgd is,
- Het proces van risicomanagement bij de ON gaat kunnen controleren en bij sturen, niet alleen op papier maar juist actief tijdens de uitvoering,
- Alle partijen actief kan laten meewerken aan het actief beheren van de risico’s,
- Actief controleert of de verantwoordelijkheidsverdeling sluitend is (voornamelijk tijdens de uitvoeringsfase).

5. **Slot**

C.5 Interview report interviewee 1F

Relevant quotes that are used in the data analysis are highlighted and coded [QUOTE1F#].

0. Algemeen	
Vraag	**Antwoord**
0.1	1F: [redacted]

1. Verhoudingen tussen de 3 FIDIC partijen	
Vraag	**Antwoord**
1.1	1F: Het [approven] gaat met name om meerwerk, als er scope changes zijn. Daar wil de Employer graag nog bij betrokken worden aangezien dat invloed heeft op het budget [QUOTE1F1]. Als iets gewoon conform het Contract is, dan is het de hoofdtaak van de Engineer om te zorgen dat gerealiseerd wordt wat in het Contract staat. Zolang het niet van het contract afwijkt, zijn er geen approve momenten. Naast die approve momenten heb je nog wel de momenten dat er iets opgeleverd wordt, en daar wil de Employer wel vaak bij zijn om te kijken of het functioneert zoals het voorgeschreven is. Dan praat je echt over Sub-Clause Tests on Completion [Clause 9], Employer's Taking Over [Clause 10], dat zijn een beetje de punten waar ze [Employer] bij zijn. Voor de rest doet de Engineer gewoon heel veel. Het is natuurlijk wel een beetje klant afhankelijk.
1.2	1F: In principe volgt de Engineer gewoon het Contract [QUOTE1F2]. Dus dat zijn met name de goedkeuren van ingediende detail tekeningen en ontwerp stukken van de Contractor. Daar kijkt de Engineer gewoon naar om te checken of ze inhoudelijk goed zijn en conform de uitvraag. Daar kan hij [Engineer] gewoon wat van vinden. Wanneer er vervolgens werk wordt uitgevoerd, er wordt bijvoorbeeld een weg gebouwd, of beton gestort, dan kan je gewoon kijken of het kwalitatief voldoet aan wat er in de tender is voorgeschreven. Dus dat is gewoon een taak van de Engineer, daar moet de Employer gewoon op vertrouwen dat de Engineer dat gewoon goed uitvoert. Waarschijnlijk heb je wel progress reports vanuit de Engineer richting de Employer waarin staat wat er afgelopen week of maand allemaal gebeurd is, en daar hebben ze dan een overleg over. Maar niet ieder besluit hoeft hier besproken te worden. Het gaat voornamelijk over voortgang en of het allemaal nog binnen planning en budget loopt, of er nog bepaalde risico's zijn. SV: Tijdesn zo'n progress meeting tussen Employer en Engineer, kan de Employer dan nog zeggen tegen de Engineer dat hij bepaalde dingen bij moet sturen? 1F: De Engineer moet gewoon aan de hand van het Contract werken, dus als er iets niet goed gaat dan kan de Employer de Engineer gewoon bijsturen. De Employer kan alleen niet zeggen dat de Engineer andere dingen moet uitvoeren dan wat er in het contract staat voorgeschreven. Anders zou het echt gaan om een Variation. Die heb ik net niet specifiek genoemd, maar bij een Variation zal de Employer er altijd iets van moeten vinden omdat dat om zijn eigen portemonnee gaat [QUOTE1F3]. De Engineer heeft dan geen recht om iets goed te keuren of iets te specificeren. De Engineer kan hoogstens een advies over de Variation geven. SV: Wie is de engineer, aangezien ze contract management kennis moeten hebben, maar ook technische kennis ? 1F: Meestal is het gewoon een consultant die ingehuurd wordt om toezicht te

1.2	houden, daar komt het eigenlijk op neer: directievoering en toezicht. Daar is het mee te vergelijken, alleen zit er een klein grijs gebied in. De directievoerder [binnen de UAV] moet zich normaal gesproken verantwoorden naar de OG. Soms is het iemand van de OG maar die moet dat dan intern ook verantwoorden. Bijvoorbeeld omdat hij geen onbeperkte zeggenschap heeft over het budget. De Engineer is wel echt een specifieke functie, en hij is specifiek in dienst van de Employer en niet onafhankelijk [QUOTE1F4]. Hij moet zorgen dat het Contract dat de Employer uitbesteed heeft, dat dat uitgevoerd wordt conform alle eisen. Dus ja, dat is meestal één persoon die dat dan echt voorstelt, en die heeft een aantal toezichthouders onder zich die dan alles rapporteren aan de Engineer. Dit is natuurlijk allemaal afhankelijk van de grootte van het werk, want de Engineer neemt toe in omvang wanneer de project scope toeneemt. De Engineer is in principe wel gewoon één projectleider die dat dan in naam zo is.
1.3	1F: Je hebt natuurlijk ook een contract tussen de Engineer en de Employer, dat is meestal een White Book. Independent zie ik de Engineer niet nee [QUOTE1F5]. In principe is die in dienst van de Employer, die werken echt samen. Over dat controle mechanisme, nee dat is het niet. Het gaat erom als er iets gebeurd dat echt impact heeft op scope en budget dan moet de Employer daar gewoon een rol in hebben. Dan wordt het project namelijk anders dan dat hij eerst had bedacht. Daar is approval noodzakelijk voor. De Engineer moet vervolgens gewoon zijn werk doen. Van te voren is vastgelegd waar de Engineer approval voor nodig heeft, daar kan je afspraken over maken maar dit staat ook al in de General Conditions.
1.4	1F: Nee, in principe huurt de OG ook wel eens een consultant in om dit te doen. Daar moet je het mee vergelijken. OG huurt dierctievoering en toezicht in [UAV]. Sommige OGs hebben de mensen zelf in huis, dan doen ze het zelf. Dat kan natuurlijk ook. Als je YB hebt in het buitenland dan zou de Employer ook zelf de rol van de Engineer kunnen vervullen. Je kan iemand uit de organisatie aanstellen om dat te doen terwijl er andere mensen zijn binnen de organisatie die de rol als Employer vervullen. Volgensmij is dat niet zo'n groot ding. Het is dan maar net hoe de organisatie van de Employer er intern uit ziet, en welke kennis en ervaring ze zelf in huis hebben.
1.5	1F: Dat vind ik lastig om te beantwoorden aangezien ik nooit in de praktijk de uitvoering van een YB heb meegemaakt. Ik doe nu dus wel de directievoering bij een UAV project, dan ben je ook gewoon eerlijk aan het handelen. Het is in niemand zijn belang om onredelijk te zijn. Dat kan voor de Employer misschien wel geld opleveren, door bijvoorbeeld dingen af te wijzen en het probleem bij de aannemer te laten liggen, maar dat komt de relatie tussen OG en ON niet ten goede. Vervolgens gaat de ON toch weer op een andere manier op zoek naar geld. Dus het is een kwestie van hoe ga je met elkaar om, en daar gaat natuurlijk van alles in mis, maar in principe als je ie mand oneerlijk behandeld dan krijg je gewoon gezeur en gezeik van terug. Het is maar net hoe een Employer daar in staat, daar kan je als Engineer natuurlijk ontzettend druk mee worden wanneer dat gaat gebeuren. Als een contractor constant probeert ergens een slaatje uit te slaan, dan krijg je natuurlijk een slechtere verstandshouding. Niet alleen voor dit project maar ook op de langere termijn. Niemand is er bij gebaat, maar het gebeurd toch wel omdat sommige mensen of partijen er wel zo in staan. Maar in principe als je gewoon eerlijk handelt, dat is mijn standpunt althans, en je de risico's legt waar ze horen, dan kan je gewoon alles volgens het contract afhandelen. Alles blijft dan transparant en het is voor iedereen duidelijk hoe je het gaat doen. Wanneer er dan iets gebeurd waar niemand rekening mee heeft kunnen houden, bijvoorbeeld als je nu kijkt naar de extreme materiaal prijs stijgingen, ja dat kan een aannemer niet allemaal voorzien, en ook het risico niet helemaal alleen dragen. Dan moet er ook een deel risico op worden gepakt door de OG, anders raakt de verstandhouding echt beschadigd. Je moet gewoon de eerlijke verdeling vinden.
1.6	1F: Ik heb van de specifieke term nog nooit gehoord, maar het zal iets zijn van een health and safety officer, in combinatie met iets van environment etc. Dat is dan allemaal in 1 functie gecombineerd en die kijkt of alles volgens milieu en veiligheidsregels gaat.

2. Risicomanagement binnen FIDIC	
Vraag	**Antwoord**
2.1	1F: De contractor moet dit inderdaad beheersen, dat wordt in de uitvraag gespecificeerd [QUOTE1F6]. De Engineer beoordeeld of het systeem van risico management voldoet, of er risico's missen, en of de mitigerende maatregelen genomen worden, en of ze het risico systeem nog een beetje bijhouden door te kijken van hoe zit het nu met dat risico [op een later moment]. Dat is de functie van de Engineer [QUOTE1F7]. SV: Je noemt twee interessante dingen: 1) daardwerkelijk kijken of ze [Contractor] de minitigerende maatregelen implementeren, en 2) kijken of ze [Contractor] het risico management systeem bijhouden. Is dit binnen FIDIC anders geregeld dan in Nederland? Ligt er binnen FIDIC meer accent op risico management? 1F: Nou dat weet ik niet. Bij een YB zijn er meer vrijheden voor de aannemer, dus dan moet hij daar ook wat meer aan doen. Maar ook bij een RB of UAV zijn er nogsteeds uitvoerings risico's, bij een YB heb je ook nog risico's in de ontwerp fase. Risico management bij het YB is dus uitgebreider. Dus het is bij een geintegreerd contract belangrijker dat de contractor daar invloed op heeft, want dan kan het nog erger uit de hand lopen. Het verschil tussen YB en UAVgc op gebied van risico mangement kan ik echter niet beantwoorden.
2.2	1F: Zo'n risicoplan moet worden ingediend en dat moet dan worden goedgekeurd door de Engineer. Die kan dan dus zeggen: dit is nog niet goed dus pas het maar aan onder Sub-Clause 5.2 [Contractor's Documents]. Dit moet dan natuurlijk wel schriftelijk worden gedaan.
2.3	1F: Dat denk ik niet. De Contractor moet meestal de risico's beheersen, omdat hij het ontwerp en het vervolgens moet uitvoeren. De Contractor moet daar [de bijkomende risico's] dan ook wat mee doen. De Engineer moet dit dan alleen beoordelen en monitoren. De Engineer moet dit risico management systeem niet daadwerkelijk uitvoeren. De Engineer moet wel zorgen en dwingen dat het uitvoeren ook gedaan wordt. Het is dus een controlerende functie die de Engineer heeft. Coördineren moet de Contractor doen, anders haal je activiteiten en verantwoordelijkheden bij de Contractor weg en gaat hij [Contractor] achterover leunen zo van: "Engineer los jij het maar op". SV: Stel, de Contractor is verantwoordelijk voor het uitvoeren van een mitigerende maatregel, maar laat een subcontractor dit doen, kan de Engineer dit dan nog steeds controleren? 1F: Ja dat moet en dat doet de Engineer ook. Het blijft echter nog steeds de verantwoordelijkheid van de Contractor.
2.4	1F: Ik heb niet die indruk. In principe moet de directie [UAV] ook aan de OG laten zien dat alles goed verloopt. Dat is gewoon vergelijkbaar.
2.5	1F: Dat kan je niet zo stellen. In principe wordt er natuurlijk altijd naar raakvlakrisico's gekeken op project specifiek niveau. Wat doet de Contractor nou, en hoe beheerst hij deze raakvlakrisico's tussen verschillende partijen en fases. Daar moet de Contractor gewoon wat voor opstellen, en dat wordt vervolgens gemonitord en beoordeeld [door de Engineer]. Wanneer de Engineer echter zelfs iets nieuws opbrengt, een nieuw risico signaleert bijvoorbeeld, dat kan natuurlijk gewoon, en dan moeten daar opnieuw afspraken over worden gemaakt in het risico management systeem. Dat is echter niet specifiek voor FIDIC volgensmij. SV: In hoeverre lezen of krijgen subcontractors het Contract te zien? 1F: Ja in principe een stuk minder, die krijgen sowieso het hele contract vaak niet te zien, alleen het stukje dat van toepassing is op de scope van de subcontractors.

2.5	Ze [subcontractors] missen dan wel de raakvlakken met andere subcontractors, maar het is aan de Contractor om deze raakvlakken dan te borgen.
2.6	1F: De Engineer handelt vanuit het contract. Je brengt het een beetje alsof de Engineer zich bemoeit waarmee dat eigenlijk niet hoort. Dat brengt risico's met zich mee. De engineer kan taken naar zich toetrekken die hij eigenlijk niet heeft, en dan ontstaat er contractueel een schimmig gebied. De Engineer wordt dan verantwoordelijk waar de Contractor eigenlijk verantwoordelijk voor is. Ik heb een keer meegemaakt dat de Engineer bang was dat er uitloop ging op treden, en hij vervolgens een onderdeel van het ontwerp zelf ging maken in plaats van dat hij de Contractor dit liet doen. Dan zegt de Contractor natuurlijk dat hij daar geen verantwoordelijkheid voor heeft wanneer het mis gaat op een bepaald vlak. En de Contractor kan dan bovendien ook zeggen van: ja dit gaat extra kosten e.d., daar heb ik niet op gerekend. Dan kan je als Engineer ook geen oordeel meer vellen over extra geld toekennen. Dus dit soort dingen moet je proberen te voorkomen, en je moet je gewoon alleen bemoeien met hetgeen dat tot je taken behoord. Anders wordt het een rommel contractueel gezien, ook al gaat het heel vaak gewoon goed en wordt het gezien als iets waar ze elkaar bij kunnen helpen.
2.7	1F: Risico management zou bijvoorbeeld verwaarloosd kunnen worden. Met druk is er alleen nog maar focus op de kerntaak waarbij alle risico's vergeten worden en er snel naar het doel wordt gewerkt. Dan kunnen er risico's voor lief genomen worden waar ze geen tijd of geld voor hebben om te mitigeren. Dan hopen ze maar gewoon dat het goed komt. SV: Kan de Engineer dan proberen bij te sturen? 1F: Jazeker, het is dan aan de Engineer om erop te wijzen dat er maatregelen vergeten worden. SV: Maar voor de Contractor is natuurlijk op dat moment geld het aller belangrijkste. 1F: Ja precies, dat heb je heel vaak, dat de Engineer en de Contractor niet het zelfde belang hebben. Maar daar is het Contract voor. Wanneer je je niet aan het Contract houdt heb je binnen FIDIC verschillende mogelijkheden om bijvoorbeeld de Contractor minder te gaan betalen. Het kan bijvoorbeeld een soort boete kwestie worden wanneer er niet aan het Contract wordt voldaan. Je kan altijd kijken hoe hoog je als Engineer het wil laten opspelen. Als het om een gevaarlijk risico gaat, waarvan de mitigerende maatregel echt genomen moet worden, kan de Engineer gewoon de gehele bouw stilleggen. Er moet in ieder geval een melding worden gemaakt wanneer er iets mis gaat of wanneer er een maatregel niet genomen wordt.
2.8	1F: Ja hij is op de bouwplaats aanwezig, dat is wel de bedoeling. Dit hoeft niet permanent te zijn. Het is wel zijn taak om te kijken wat er gebouwd wordt of dat dit conform Contract is en de tekeningen die hij zelf [de Engineer] goedgekeurd heeft. Die inspecties, dat is inderdaad het toezicht houden. Dat is gewoon zijn taak. Binnen de UAVGC gebeurd dit wel minder, dat toezicht, omdat er gezegd wordt dat dit de verantwoordelijkheid van de ON is dat wat er komt te staan wat er afgesproken is. SV: Is de Engineer minder aanwezig op de bouwplaats bij een YB dan bij een RB? 1F: Ja dat denk ik wel ja. Bij een RB moeten ze dagelijks aanwezig zijn en alles controleren of het gebouw wordt volgens het bestek.
2.9	1F: De Engineer is echt een beschermde term die door FIDIC internationaal is afgesproken, en die Engineer heeft bepaalde taken en bevoegdheden. Die taken en bevoegdheden kan je als Employer naar jezelf toetrekken, maar dat hoeft natuurlijk niet. In principe blijft die Engineer gewoon de Engineer maar zijn het dan gewoon andere mensen die

2.9	van de Employer afkomen. SV: Maar wat is nu het voordeel van die Engineer specifiek benoemen in je General Conditions? 1F: Dit Contract is natuurlijk opgesteld om overal in de wereld toegepast te worden. Heel veel Employers hebben die mensen [die de rol van de Engineer zouden kunnen vervullen] helemaal niet intern beschikbaar waardoor je ze moet gaan inhuren. Als je dan een consultant in huurt om die Engineer functie te vervullen, daar is FIDIC voor bedacht. Er komt een consultant en die moet een bepaalde rol vervullen in het project, dan is dat dus de rol van de Engineer, die is zo afgebakend. Dat is in de meeste gevallen een consultant die ingehuurd is. Sommige dingen mag de consultant niet besluiten aangezien je dan aan de portemonnee van de Employer komt. SV: Laat ik de vraag anders stellen: waarom is de Engineer niet specifiek benoemd in de Nederlandse voorwaarde? 1F: Er is wel iets benoemd, er is een directie voerder en toezicht houder [UAV], paragraaf 3 van de UAV uit mijn hoofd. Maar in de UAVgc durf ik het zo even niet te zeggen. Wat die partij echter moet doen is inderdaad niet gespecificeerd in de standaard voorwaarden.

3. Indien bekend met UAVgc	
Vraag	**Antwoord**
3.1	1F: Mijn conclusie is dat de Engineer wel overeenkomend is met de directie uit de UAV. Ik ken de UAVgc niet zo goed om daar dan weer een antwoord op te geven. Qua risico management blijft de taak bij de Contractor liggen. Borgen dat de Contractor het uitvoert, dat ligt dan weer bij de engineer.
3.2	1F: Dit is gewoon zoals het in Nederland gaat. In Nederland zou het ook uitbesteed kunnen worden. Maar overheden hebben vaak intern wel mensen die het project kunnen managen binnen Nederland.

C.6 Interview report interviewee 2F

Relevant quotes that are used in the data analysis are highlighted and coded [QUOTE2F#].

0. Algemeen	
Vraag	**Antwoord**
0.1	2F: [redacted]

1. Verhoudingen tussen de 3 FIDIC partijen	
Vraag	**Antwoord**
1.1	2F: Ik heb even een project voor ogen nu in [redacted], een groot project, Yellow Book, omzet van ongeveer [redacted] uit mijn hoofd. Een baggercontract. Wat je daar ziet is dat die approve momenten, die zitten eigenlijk structureel op alles maar met financiën te maken heeft [QUOTE2F1]. Maandelijks moet er een termijnstaat ingediend worden door de Contractor op basis van de voortgang van zijn werk. De Engineer keurt die goed, en uiteindelijk is de Employer daar vaak toch wel een partij die zeker meekijkt, want die zal die betalingen moeten verrichten. Dus die wil wel weten of hij niet te veel of te weinig betaalt. Dat is dus zeker een moment dat de Employer zich meld. Systematisch meldt hij zich ook altijd wel op de bouwvergaderingen [progress reports], de contract meetings die ze ook wel vaak eens in de maand houden. Dat zijn wel de twee belangrijkste momenten. Vaak levert de Contractor de progress reports van te voren in, zodat er tijd is voor de Engineer en Employer om deze even te bekijken. In de progress reports zit dan ook de termijnstaat, en samen met alles wat besproken wordt tijdens deze meeting, als je alles eens bent met elkaar dan, dat is dan de basis voor de betaling. Mijn ervaring is dat als het gaat over de techniek, maar ook over veiligheid, dan leunt hij [Employer] toch wel op de Engineer, en dan gaat de Employer er vanuit dat de Engineer dat allemaal in de gaten houdt. Als er bijvoorbeeld wat loos is, dan vertrouwt de Employer erop dat de Engineer aan de bel trekt [QUOTE2F2]. SV: Dus approve momenten komen voor wanneer de Employer de portemonnee moet trekken, en misschien bij uitbreiding of juist inkrimping van de scope? 2F: Ja dat zou je wel kunnen zeggen, want inderdaad in zo'n contract meeting komt dat ook wel ter sprake, eventuele VTW's [verzoek tot Wijziging], ja dat klopt zeker. Op die twee punten zit inderdaad de drang van de Employer en interesse om in te grijpen.
1.2	SV: net zei je ook al dat de Employer een beetje leunt op de Engineer wanneer het op techniek en contract aan komt... 2F; Nou ja, je had het er over dat we kijken naar YB en UAVgc, dat is nogal

1.2 een andere benadering dan RB of een UAV contract, wat we in Nederland ook wel veel kennen en kende vooral. Wat een Engineer doet bij een UAVgc of YB is heel duidelijk: sturen op de verantwoordelijkheid van de Contractor. Dus het is niet zo zeer dat hij dan bepaalde beslissingen moet nemen, maar hij kan veel meer sturen op het feit dat de Contractor de verantwoordelijkheid heeft. En dat gaat vooral over voorbereiding en overvoering, maar juist als het over voorbereiding gaat en bijvoorbeeld over de techniek, en wat de Contractor bedacht heeft qua ontwerp, kan de Engineer ten alle tijden zeggen: “Hey Contractor, het is jouw ontwerp, jij moet ervoor zorgen dat je jouw werkzaamheden zelf toetst, dat er een kwaliteitssysteem is, etc. Ik [Engineer] controleer of jij [Contractor] je gedraagt volgens dat kwaliteitssysteem wat we met elkaar hebben afgesproken”. Daar valt veiligheid onder, maar nog veel meer dingen. Het is vooral de rol van de Engineer om te zorgen en erop toe te zien dat die Contractor zijn eigen kwaliteitssysteem volgt en dat hij zich hieraan houdt, dat hij rapporteert, dat hij zijn testen uitvoert, en dat hij zijn eigen werk controleert. Daar zit een belangrijke rol voor de Engineer [QUOTE2F3]. De beslissingen nemen, kijk een Engineer heeft op bepaalde punten beslissingsbevoegdheid. Dat gaat er bijvoorbeeld over dat hij het werk stil mag leggen. Stel hij treft buiten iets aan waarvan hij zegt: "Dit kan niet, dit hebben we niet afgesproken, dit is niet volgens het Contract", wat het dan ook is (veiligheid, of wat die aannemer aan het bouwen is dat komt niet overeen met het contract), dan moet de Engineer goed opletten, maar hij heeft weldegelijk bevoegdheid om zonder instemming van de Employer het werk stil te leggen. Want vaak zijn dit dan wel acute zaken, dus het kan niet zijn dat hij dan weer eerst langs de Employer moet voor toestemming. Bovendien moet hij het dan wel natuurlijk achteraf verantwoorden. Een Contractor zal wanneer het werk stil wordt gelegd natuurlijk zeggen: "jij [Engineer] hebt het werk stilgelegd, kijk eens wat voor schade dat voor mij opbrengt". De Engineer moet dan dus wel zijn papieren en argumentatie op orde hebben. Zeker naar de klant, want die moet natuurlijk de portemonnee trekken wanneer er vertraging is ontstaan [QUOTE2F4].

SV: En wat doet die verantwoordelijkheid van die Engineer in zijn houding en gedrag?

2F: Nou dat die zich dondersgoed moet afvragen of hij inderdaad moet ingrijpen of niet [QUOTE2F5]. En nogmaals, in de situatie van veiligheid dan is het toch vaak wel redelijk onbetwist, want een veiligheidsaspect is vaak wel heel duidelijk. Dus ik denk dat een Contractor daar toch niet al te snel tegenin gaat. En wat voelt die Engineer daarbij? Die Engineer moet echt wel stevig in zijn schoenen staan om die keuzes te maken [QUOTE2F6].

1.3 2F: De punten waar ik het net over had, vooral de financiële kant, als daar de approvals vooral op zitten, dan denk ik dat dat meer het controleren is van: “Ik [Employer] moet wel een goede onderbouwing zien om die VTW of extra werk toe te staan”. Ik vind dat heel normaal. Dus de Engineer, en dat kan vanuit een onafhankelijk rol, die kan gewoon objectief beoordelen of er een bepaalde voortgang is geboekt op het werk, daar staan weinig vraagtekens bij, dat kan je zien en aantonen. Bij VTW’s gaat het vooral over rechtmatigheid en de betaling. Is het inderdaad rechtmatig dat dit extra scope is, klopt het wat de Contractor nu zegt, en wat is dan de omvang van de VTW. Daar kan hij allemaal vanuit zijn kennis en kunde [Engineer] behoorlijk zijn mening over geven. Dan is het natuurlijk wel aan de Employer om te zeggen: “Ik ben het daar wel mee eens”. Hij kan ook zeggen: “Ik wil die extra scope niet”, en dan is hij het er niet mee eens [met het VTW]. Dan kan er wat druk ontstaan, ook op de Engineer: “Je zegt dat het klopt, maar ik [Employer] ben het er niet mee eens”. Dan krijg je er natuurlijk een discussie over, en dan kan het zijn dat de Employer en de Engineer het niet met elkaar eens zijn. Dat kan voorkomen en ze hoeven het ook niet altijd 100% met elkaar eens te zijn.

1.3 De Contractor heeft nog wel eens zijn bedenkingen over de onafhankelijkheid van de Engineer om wat verschillende redenen. Uiteindelijk wordt de Engineer ook betaald door de Employer, dat is al een afhankelijkheid, als hij zijn werk niet doet dan betaald de klant hem ook niet. Maar voor de Contractor valt hetzelfde te zeggen. Ze krijgen allebei betaald van dezelfde Employer. Maar, het is weldegelijk zo dat de Contractor niet per se altijd dat idee heeft, dat de Engineer onafhankelijk is, en dat moeten we dan vaak nog wel eens letterlijk zeggen zo van: "Wij [Engineer] zijn een onafhankelijke partij, we zitten hier in een driehoek te werken, en we zijn drie partijen, het is niet dat wij [Engineer] samen met de Employer een partij zijn". Dat herhalen we wel vaak om dat goed te benadrukken [QUOTE2F7]. Simpel gezegd, een openlijke discussie met een Employer, vanuit de Engineer gezien, met de Contractor erbij, helpt! Daarmee laat je ook duidelijk zien dat je onafhankelijk bent. Ik zeg niet per se dat je dat moet doen, maar je moet het wel durven doen. En je moet ook dus in al je objectiviteit dat ook oppakken wanneer dat nodig is: “Maar Employer luister eens, de Contractor heeft dit en dit gedaan, en dat is gewoon goed. Hij handelt juist!” En dan is de Employer er misschien niet blij mee dat hij extra moet betalen of dat de planning uitloopt, maar het klopt wel dus wij [Engineer] adviseren je wel mee te gaan. Het is altijd maar te hopen dat dit soort situaties zich voordoen want dan kan je laten zien als Engineer dat je dus echt onafhankelijk bent tegenover de Contractor.

1.4 2F: Binnen de UAVgc heb je vaak gewoon een team van de klant, waarin dan bijvoorbeeld ook specialisten zitten op gebied van omgeving, techniek, etc. Dat is het RWS model met IPM [integraal projectmanagenemt] rollen. Die hebben eigenlijk hun eigen organisatie voor elkaar om dat project voorledig te sturen om het maar zo te zeggen. Dus dan is het maar de vraag of er een derde partij bij zit [consultant binnen UAVgc]. Dus is zo’n Engineer in het YB vergelijkbaar met zo’n team vanuit de klant binnen de UAVgc... Hij [de Engineer] is in veel opzichten het zelfde met een heel belangrijk verschil: de objectiviteit die de Engineer moet hebben tussen de twee partijen. Anders kan je gewoon zeggen: “De Engineer zit bij de OG op schoot”. In ieder geval is het op papier duidelijk anders, want je hebt in de UAVgc eigenlijk formeel maar twee partijen. In de YB situatie zit je echt met drie partijen, de driehoek. Dus zijn [Engineer] rol is veel meer in het midden bij een YB [QUOTE2F8]. Bij de UAVgc is dat natuurlijk gewoon een van de twee partijen. Dus in die zin klopt het niet [de vraagstelling ontkracht]. Als het over de inhoud van zijn rol gaat, is het misschien wel zo. Waar is hij verantwoordelijk voor? Dat is natuurlijk erop toezien dat er veilig gewerkt wordt, dat er volgens het contract gewerkt wordt, dat het technisch klopt, etc. Dus al die taken heeft hij [Engineer] wel om erop toe te zien, dat is de inhoudelijke rol die hij Engineer heeft [QUOTE2F9]. Maar in zijn positie, als het gaat om zijn onafhankelijkheid, dan is de Engineer wel echt onafhankelijk, hij is niet de een of de andere partij. Hij zit in de driehoek. Dus in die zin is hij [Engineer] anders.

SV: Pakt de Engineer binnen FIDIC YB het anders aan vergeleken met de OG in NL, en dan bedoel ik de manier van controleren van de aannemer, dus hoe hij het werk uitvoert etc.

2F: Nee, hij pakt het niet anders aan, dat denk ik niet. Ik denk dat het eigenlijk best wel op elkaar lijkt. Als je naar het resultaat kijkt, kan het ook precies hetzelfde zijn. Als je een OG hebt die zijn oren goed open heeft, en die eerlijk en oprecht en objectief probeert te zijn, richting de aannemer ook... RWS pretendeert dat altijd he, “wij zijn een eerlijke OG die gewoon recht doet aan de aannemer en aan het werk, dus als het meer is dan betalen we daar voor”. Die proberen ook gewoon een goede OG te zijn in die zin. Dat is eigenlijk wat een Engineer ook doet, die probeert ook een goede Engineer te zijn en naar eer en geweten te handelen volgens het Contract.

SV: De Engineer heeft de mogelijkheid om Contractors Documents [Sub-Clause

1.4 5.2] in te zien, en te inspecteren [Sub-Clause 7.3], kan de OG dat in NL ook?

2F: Ja, dat doet de OG ook in een UAVgc. Ze hebben de drie toets methode in de UAVgc: systeem- proces- en product toetsen, en de product toets leent zich daar voor. Dat betekent in veel gevallen dat je naar locatie gaat en gewoon een gaat kijken wat er nou allemaal gebeurd. Als je weet dat ze vandaag palen gaan zetten, kan de OG besluiten dat te bekijken. Er zijn dan twee dingen die je kan doen, je kan een soort "witnessing" doen, dat is iets informeler, je gaat gewoon kijken wat er gebeurd en je rapporteert erover. Dat koppel je nog eens terug naar de ON. Daarbij kan je nog een soort veiligheidscheck doen, dat kan altijd. Maar je kan ook een formele product toets doen, die moet je echt goed aankondigen, je moet dan ook vertellen wat je als OG gaat doen, dan zorgt iedereen dat tie er is, en dat er een bepaald stukje werk wordt uitgevoerd wat je afgesproken hebt. Dat is dan de formele manier om buiten te checken, maar het kan weldegelijk, en het gebeurd ook.

SV: Zojuist zeiden we dat de Employer de Engineer vertrouwt wanneer het op technisch vlak aankomt. Is de Engineer vaker bij testen aanwezig binnen het YB, vergeleken met de OG bij de UAVgc, vooral kijkende naar de houding van de Engineer die dan toch een soort van verantwoording af wil kunnen leggen naar de Employer, terwijl de Nederlandse OG misschien zal zeggen van: "ik vertrouw wel dat de ON het goed doet aangezien hij toch zelf verantwoordelijk is".

2F: Ja dan kom je toch op een iets andere situatie uit waarbij we in NL, althans dat proberen we al heel lang, proberen we volgens het boekje te werken. Als je de UAVgc bekijkt, dan betekent dat je het werk op afstand gaat begeleiden als OG. Je komt niet veel op de site, je vertrouwt op het kwaliteitssysteem dat je afgesproken hebt met de ON, de ON is dus zelf verantwoordelijk voor zijn toetsen, en hij moet er zelf voor zorgen dat het in de praktijk ook allemaal zo uitgevoerd wordt en dat het allemaal gecontroleerd is. Afwijkingen gaan ook allemaal formeel op papier, dus je zou in principe niet op de site hoeven te komen. Als je de YB bekijkt, dan zijn het vooral projecten in het buitenland, in mijn geval zelfs buiten Europa, wat je ziet is dat een YB vaak toch wel een beetje misbruikt wordt door een Employer om zo veel mogelijk verantwoordelijkheid bij de Contractor te leggen, maar zijn eigen rol niet per se netjes naleeft, als zijnde een partij die op afstand het werk begeleidt. Wat je vaak ziet is dat bij veel Employers ze een vinger in de pap willen hebben, ze willen op site zijn, ze willen die controles uitvoeren, dus ze maken er eigenlijk in de manier van werken een halve YB / RB begeleiding van [QUOTE2F10]. En dat is iets, ja, ik weet niet, ze vinden het toch lastig om het los te laten met de instelling van 'we zien wel wat we krijgen'. Ik denk dat dat meespeelt. Of dat nou met cultuur te maken heeft, of met ervaring van de Employer, dat weet ik niet. Maar je ziet het wel vaak.

SV: Laten ze die inspecties dan uitvoeren door de Engineer of doen ze het zelf?

2F: Ja dat laten ze de Engineer doen. Ze verwachten ook vaak dat de Engineer dan inspecteurs meeneemt en noem maar op. Die lopen dan weer bijna iedere dag op de Site rond. Maar ja de vraag is dan of je wel op de YB manier bezig bent [QUOTE2F11].

1.5 2F: Dat eerlijke handelen hangt ook echt wel sterk af van wie er in de rol van de Engineer zit. Ik ken verschillende directievoerders of representatives van een Employer die echt wel verschillend handelen. Het zit hem dus echt wel een beetje in de persoon. Wat je ziet is dat je soms een Engineer hebt die een wat grotere neiging heeft om aan de aannemers kant te zitten [QUOTE2F12]. Je moet je niet vergissen dat het soms wel makkelijk is om aan de Contractor's kant te zitten omdat een Contractor best wel sterk kan zijn, en best wel dwingend zelfs, ook richting een Employer. Het zit soms ook in de aard van die Engineers.

1.5	SV: Omdat de Engineer dan beïnvloedt wordt door de Contractor? 2F: Ja zeker, omdat hij [Engineer] het dan ook lastig vindt om te weerleggen dat de Contractor geen gelijk heeft. Misschien een beetje een rare opmerking, maar je ziet het echt wel gebeuren. Het zijn wel van die situaties die voorkomen op werken, waarbij het veel makkelijker is om te zeggen: de Contractor heeft gewoon gelijk, het verhaal klopt. In plaats van een heel gelaas op te zetten om aan te tonen dat de Contractor geen gelijk heeft, want dan moet je [Engineer] natuurlijk best wel sterk staan, je moet het contract goed kennen, je moet weten wat er precies wel of niet is afgesproken... Dus het is soms wel wat makkelijker om in te stemmen met wat de Contractor voorstelt of wilt, dus dat is soms een neiging die je ziet op werken. Dat mag natuurlijk niet, dat ben je misschien niet op de juiste manier bezig, maar ik wil er mee zeggen dat er verschillende manieren zijn waarop Engineers opereren. Je hebt ook Engineers die eerlijker zijn dan de Paus, het Contract erbij pakken en continu de confrontatie aan gaan met de Contractor: Nee dit staat er niet precies, dit wel, dat niet. Dat is dus echt het andere uiterste [QUOTE2F13]. Wat zie je nou op een werk uiteindelijk, waar het om gaat is feitelijk dat je met die twee partijen een werk moet maken. En met drie partijen zit je er met een zelfde doel. De beste Engineer is eigenlijk die gene die nauwelijks het Contract op tafel legt, waarbij het contract in de lade blijft liggen, en die het lukt om met een tevreden Employer en een tevreden Contractor het werk af kan maken. Die dus heel goed kan laveren, die heel goed kan luisteren naar beide partijen, die continue zoekt naar waar de partijen wel op één lijn zitten, en dus samen wel het juiste kunnen doen voor het project. Ja en dan zal de ene partij een keer in moeten leveren, en soms de andere partij. Maar dat is de Engineer die je het liefst hebt op je werk, die dat voor elkaar krijgt, en die dat contract gewoon in de lade kan laten liggen. Er zijn dus twee uiterste vormen van een Engineer, en een Engineer die daar tussenin zit, en dat wil je. Die Engineer die in het midden zit is ook de beste voor de relaties tussen alle partijen op de langere termijn. Want zolang je door de Contractor en de Employer gerespecteerd wordt, dan zit je op de goede weg. Maar zonder respect van een van de twee partijen, krijg je een lastige tijd.
1.6	2F: Dat durf ik niet te zeggen. Ik kan hem wel raden denk ik, iets met QHSE of iets dergelijks.

2. Risicomanagement binnen FIDIC	
Vraag	**Antwoord**
2.1	2F: Risico management wordt inderdaad toegepast door de Contractor [QUOTE2F14], die is aan zet om een risico dossier op te stellen, daar is dan vaak een software systeem voor. Maar, er zullen op gezette momenten risico sessies moeten zijn, vooral in het begin, dan moet dit uitgebreid gebeuren met zowel de Employer als andere mensen die betrokken zijn bij het project. Daar zit de mogelijkheid om invloed uit te oefenen op het risico dossier [QUOTE2F15]. Het risico dossier, maar ik heb dat nog niet zo veel gezien, zou in principe ook echt gebruikt moeten worden door de Engineer om zijn hele toetsingssysteem min of meer op te baseren. Dus die pakt het risico dossier, die ziet dat er drie grote risico's zijn, laat ik [Engineer] nu eens gaan toetsen hoe die risico's beheerst worden door die Contractor, en kijken of hij dat doet volgens hoe we het hebben afgesproken in die risico sessies. Dat zou de manier moeten zijn, in principe, waarop het moet gebeuren. Ik denk dat het tot op zekere hoogte wel gebeurd, maar ik denk het meer gebeurd dat die risico's geregeld terugkomen in bijvoorbeeld die bouw / voortgang overleggen. Daar zal altijd een hoofdstuk risico's in zitten waar de risico's besproken worden. Dat is dan het moment waarop de Employer, Contractor, en Engineer er samen over kunnen praten en om te bespreken of het wel of niet goed gaat. Ik weet dat in NL dit echt 1 op 1 gebeurd: je hebt je risico dossier en je doet je toetsing gebaseerd op die risico's echt actief SCB [systeem gerichte contract beheersing]. Zo werkt het bij de

2.1 UAVgc. Bij de YB is het iets minder gekoppeld aan het risico dossier. Het risico dossier is zeker belangrijk, er wordt geregeld naar gekeken, maar het is niet zo duidelijk gekoppeld aan het toets systeem zoals dat in NL wordt gedaan. Dat is mijn ervaring. Het komt dus meer terug in die vergaderingen.

2.2 SV: bijvoorbeeld op het moment dat er iets anders gaat dan dat afgesproken is.

2F: Dat kan hij zeker [QUOTE2F16]. Ik denk dat de Engineer het ter sprake brengt. Hij zit namelijk vaker dan 1 keer per maand samen met de Contractor. Dus wanneer de Engineer dingen ziet en constateert, dat is zijn rol, dan zal de Engineer dat gewoon met de contractor bespreken. Dan kunnen ze samen kijken wat de Contractor daar aan gaat, of moet doen. Dan is het vervolgens aan de Contractor om zich te houden aan de afspraken die uit dat gesprek komen. Hij checkt dan van ben je nu wel aan het mitigeren, ben je je risico's aan het beheersen, of moet je extra maatregelen nemen? Dat doet de Engineer vaak in die daily of weekly gesprekken die hij heeft met de Contractor. Dat kan hij ook escaleren naar het maandelijks overleg wanneer de Employer er ook bij zit, als dit bijvoorbeeld te weinig gebeurd [het beheersen van de risico's] [QUOTE2F17].

2.3 2F: Wat zou hij precies moeten verantwoorden dan tegenover de Employer?

SV: Dat het proces van risico management wordt uitgevoerd zoals dat van te voren is afgesproken, contractueel gezien.

2F: Ja dat denk ik wel. Ik denk dat de Engineer de centrale partij is. Wat er gebeurd als een Engineer of Employer daar geen aandacht aan geeft, dan heb ik er geen vertrouwen in dat de Contractor zich daar dan zorgen om gaat maken, over dat risicomanagement. Dus je bent wel degelijk een centrale partij om dat proces in gang te houden, daarop te toetsen of in ieder geval feedback te geven richting die Contractor in bijvoorbeeld die daily of weekly of progress meetings. Je kan dan zeggen van: Dit gaat niet goed, hier moet meer aandacht voor, etc. Dus ja, ik denk dat je daar mee een centrale partij bent [QUOTE2F18]. Want de Employer doet het ook niet, die kent het vaak niet zo goed, dat hele systeem van op risico's sturen en risicomanagement in het algemeen. Dus ja de Engineer is hier de centrale partij in. Door dat te zijn, en door alleen maar te zeggen van "gaat dat goed?", of "dat systeem, wordt dat gehandhaafd?", daardoor kan hij dat terugkoppelen aan de Employer en daarover rapporteren. En dat zal hij dan ook moeten doen. En dat gebeurd ook wel denk ik. Het zal misschien, nogmaals, niet zo formeel zijn via keurige rapportages [zoals in de UAVgc], maar het komt weldegelijk terug in verschillende rapportages.

2.4 2F: Ja zeker, dat zou ik wel zeggen. Als er geen Engineer zou zijn, dan denk ik dat er minder gestuurd wordt op risicomanagement [QUOTE2F19].

SV: Zou je dan nu mogen zeggen dat er beter gestuurd wordt op risicomanagement binnen de YB dan bij de UAVg?

2F: Nee dat zou ik dan weer niet willen zeggen. Bij de UAVgc is het formeel goed geregeld, met de nadruk op formeel. De procedures liggen bij de UAVgc veel meer vast dan dat dat bij de YB zo is. De YB heeft gewoon een actievere rol omdat het dus allemaal wat strak is georganiseerd, is mijn beleving bij de YB. Bij de UAVgc kan je niet om die procedures heen.

2.5 2F: De risico's liggen natuurlijk bij de Contractor, maar je bedoeld dan waarschijnlijk meer de stakeholders die daar omheen bij betrokken zijn?

SV: Nou met name de onderaannemers die bij het project betrokken zijn.

2F: Als het om onderaannemers gaat dan heb je als de Engineer niet zo'n zware rol. Die ziet de Contractor gewoon als 1 Contractor. Maakt niet uit of het een

2.5 onderaannemer is of niet. Dat geldt ook voor het risicomanagement. Dus ik denk dat die raakvlakken, daar zegt de hij [Engineer] heel snel van: "hey Contractor, let op je onderaannemer!". Daar zitten risico's op, maar dat ligt allemaal bij de Contractor. Dus de Engineer gaat niet sturen op onderaannemer niveau [QUOTE2F20]. Dan gaat het er wel om, en dat is een belangrijke, is dat je vaak ziet dat als het gaat over stakeholders, dat je daar heel echt op bedacht moet zijn binnen de YB. Er zijn een paar stakeholders waarbij het niet duidelijk is, wie verantwoordelijk is voor die stakeholder, of moet zorgen dat de interface met die bepaalde stakeholder goed geregeld wordt. Binnen FIDIC contracten worden daar ook wel vaak aparte afspraken voor gemaakt. Dan gaat het bijvoorbeeld over een bepaalde levering die door de Employer wordt geregeld. Dan is die stakeholder de verantwoordelijkheid van de Employer. Het heeft direct verantwoordelijkheid op het project, want de Employer heeft gezegd: "ik zorg dat er op locatie X, 100.000 kuub zand ligt, die jij [Contractor] op kan halen". Dus dit is dan een hele belangrijke interface met je project. Dan gaat het dus altijd over de Employer of de Contractor, maar niet over de Engineer die een actieve rol heeft, of verantwoordelijkheid, voor een bepaalde stakeholder. Het ligt altijd bij de Employer of Contractor.

SV: Maar die Engineer zal dan misschien wel bij de Employer controleren een week van te voren zo van: "Hey Employer, ligt dat zand klaar?"

2F: Absoluut! Hij voelt zich in die zin veel verantwoordelijker voor de Employer dat die zijn werk goed moet blijven doen, dan voor de Contractor. Maar mind you, dat heeft eigenlijk alles te maken met het feit dat je er een beetje van uit moet gaan als Engineer, dat jouw Employer niet zo kundig is, en de Contractor weet alles. En daarmee maak je al een onderscheid, en ben je inderdaad veel beduchter erop dat die Employer het goed regelt en geregeld heeft, dan dat die Contractor het goed geregeld heeft. Je weet gewoon dat die Contractor zijn doen en laten wel weet, en dat hij die Stakeholders wel goed regelt aangezien dat allemaal in het Contract staat. Daar hoeft de Engineer bij de Contractor dan echt niet bovenop te zitten.

2.6 2F: Ja die zijn er zeker, dat is eigenlijk de engineer die overal bovenop zit en geen ruimte geeft aan de Contractor. De gevolgen zijn dan dat het vaak niet zo best is voor de onderlinge relatie. Dat is het belangrijkste eigenlijk.

2.7 2F: Als tijd en geld een rol gaan spelen, wat je dan ziet is dat de Contractor in het nauw komt. Die gaat nog meer dan dat hij soms al doet, gaat hij kijken wat zijn uitvlucht mogelijkheden zijn in het Contract zodat hij niet in de rode cijfers komt, of later klaar is dan gepland. Dat gaat hij doen. Die neiging van de Contractor om uitwegen te zoeken, dat zie je dan ook terug in het risicomanagement. Dan komt het risicomanagement gewoon onder druk te staan, in het algemeen [QUOTE2F21]. Ook andere zaken komen onder druk te staan dan, dat geldt niet alleen voor risico management.

SV: Hoe is de houding van de Engineer er dan in, wetende dat tijd en geld een rol speelt voor de Contractor, maar ook wetende dat de Engineer het tot een goed einde wil brengen [het project]?

2F: Zijn houding is dat de Engineer dat ziet, dat zie je overigens niet onmiddellijk. Vervolgens ligt zijn houding echt aan het type Engineer. Je kunt een Engineer hebben die zegt dat het erom gaat dat het product wordt opgeleverd. Dan gaat de Engineer best wel makkelijk mee in voorstellen van de Contractor om dingen anders of simpeler te doen, om toch binnen tijd en budget klaar te zijn [QUOTE2F22]. Dan moet de Engineer naar de klant om dat natuurlijk uit te leggen, wil de Employer dat wel is dan de vraag. De andere Engineer gaat dan juist nog meer met zijn hakken in het zand staan. Die zegt dat de Contractor moet doen wat we afgesproken hebben, en dat is dat [QUOTE2F23]. Dat geldt in het algemeen, en dat is niet alleen voor risicomanagement maar ook voor al het andere, dan wordt het een spannende tijd. De Engineer moet dan

2.7	ook wat meer op zijn hoede zijn en opletten. Je moet vooral ook gaan nadenken hoe je hier als Engineer in wil staan, en hoe je er mee om wil gaan [QUOTE2F24]. En dan het belang van het project het zwaarst meegenomen. Uiteindelijk, ook in het belang van je relatie met en de Employer en de Contractor. Dat wordt dus echt wel laveren, dat is echt wel een lastige fase. SV: En met betrekking tot veiligheid? 2F: Ik weet niet of dit helemaal een veiligheidsdingetje gaat zijn. Daar hebben tijd en geld nog wel het minste effect op. Soms heb je natuurlijk wel een Contractor die veiligheid sowieso al niet helemaal onder controle heeft, dan wordt het in deze situatie nog wel een tandje erger [QUOTE2F25]. De grotere Contractors die ik ken die hebben gewoon overal procedures voor en die passen ze dan gewoon keurig toe. Vaak zijn deze veiligheidszaken echt wel op orde, procesmatig dan, want op het werk gaat het soms wel iets minder goed.
2.8	2F: Relatief weinig eigenlijk. We hadden een project in XXX, en daar moesten we als Engineer van de Employer wel echt testen uitvoeren. Maar in de YB hoeft dat eigenlijk helemaal niet, de Contractor moet dat gewoon zelf doen en die testen kan je dan witnessen. Het is allemaal iets dat de Contractor moet doen, ook survey werk, monitoren, noem maar op, dat hoort allemaal bij de Contractor te liggen. Jij [Engineer] kijkt dan of hij [Contractor] dat dan goed doet [QUOTE2F26]. SV: Waarom voerde jullie dan in XXX wel zelf testen uit als de Engineer zijnde? 2F: Dat wilde de Employer dan heel graag. De Contractor vind dat altijd wel prima, want die weet vaak gewoon dat hij zijn werk goed gedaan heeft. Dus die vertrouwt het allemaal wel en zal er niet moeilijk over doen.
2.9	2F: Dat is een hele goede vraag. Ik ben me even af aan het vragen waarom hij [Engineer] er überhaupt is, en dat wil nog niet zeggen dat ik het gerechtvaardigd vind dat hij [Engineer] er ook is, maar ik denk dat dit tweeledig is. De eerste reden is dat de Engineer kennis meeneemt over de inhoud van het project en dat de Employer dat niet per se heeft [QUOTE2F27]. Dat is belangrijk. Daarmee zou hij natuurlijk nog steeds adviseur kunnen zijn van de Employer, dat besef ik me. Maar de tweede reden is denk ik dat FIDIC op een of andere manier heeft bedacht dat ze een toch iets neutralere partij in dat Contract willen hebben. Een partij die als een soort arbiter alvast kan optreden, en de belangen van beide partijen kan behartigen. En dat dat dus zou kunnen bijdragen aan het wel slagen van de doelen van het project [QUOTE2F28]. Dat denk ik dat de belangrijkste reden is. Maar uiteindelijk is het een soort andere insteek, een andere kijk op de manier waarop je een contract gaat beheersen en dat dit dan een goed idee is, dat dit dan inderdaad een betere manier is om je doelen te bereiken in plaats van alleen maar twee partijen en misschien een adviseur bij de klant. Dat is het idee, gewoon altijd een onafhankelijke partij in het contract. En dat benadruk ik ook altijd als wij de Engineer rol op ons nemen. De Contractor wijst je ook echt weleens erop dat jij de onafhankelijke partij bent, en dat je ook zo moet handelen. Ik denk dat het echt wel een goed idee is om zo'n onafhankelijke partij in het contract te hebben.

3. Indien bekend met UAVgc	
Vraag	**Antwoord**
3.1	2F: nou, het is misschien wel eens goed om ook zo'n derde partij erin te zetten, om een Engineer toe te wijzen binnen de UAVgc, die gewoon een onafhankelijkere rol heeft dan wat je nu hebt. De voordelen daarvan, dat zouden de lessen kunnen zijn. "We hebben bij FIDIC een onafhankelijke partij, dat heeft twee voordelen RWS: die Engineer neemt de kennis en kunde mee, dus je hebt zelf minder kennis nodig". Het tweede is dat je

3.1	niet te veel alles moet vastleggen in vastgegoten procedures zoals SCB. SCB is wel echt sterk procedureel, al die stapjes die je moet doorlopen... Misschien moet je wat meer vrijheid gegund worden. Dat zou dus kunnen door die Engineer in te schakelen, die vanuit zijn rol kan zeggen: "Wat is nou nodig op dit project, en hoe gaan we dat met elkaar doen?", i.p.v. zeggen: "Nee we passen SCB toe en daar valt niks aan te veranderen". De vrijheid in de YB wordt ook wel gewaardeerd, zowel door de Contractor als de Employer. SV: Denk je dat de Nederlandse bouw sector volwassen genoeg is voor die vrijheid? 2F: Ik weet niet of ik dat kan beantwoorden. Ik zou zeggen van wel. In NL zijn we denk ik wel minstens net zo ver als in het buitenland met onze FIDIC contracten. Dus ja dat lijkt me wel duidelijk. SV: Als we dan kijken naar het feit dat de bouw wel de op één na gevaarlijkste sector is, dat zal dan internationaal ook wel hetzelfde beeld zijn. Moeten we dat dan voor lief nemen? 2F: nou nee maar dat wil niet zeggen dat als je los gaat van een formele structuur, dat je daarmee dingen wat meer los laat als het over veiligheid of over risico's gaat. Sterker nog, als je alles geformaliseerd hebt, of veel in ieder geval, dan ontstaat er toch gewoon een stukje schijn veiligheid die je voor jezelf inbouwd [QUOTE2F29]. Het is natuurlijk gewoon allemaal bedoeld om ervoor te zorgen dat je "het controleert". Nou, op een gegeven moment wordt het voor een IPM team zoiets van: "We moeten dit doen, we moeten dat doen, en als we dat allemaal gedaan hebben, dan hebben wij het in ieder geval netjes uitgevoerd, we komen niet meer buiten, en alles gaat dan veilig want we hebben toch gewoon die formulieren voor elkaar en de procedures toch gevolgd?" Het is echt schijn veiligheid waarin je jezelf waant [met SCB]. Ik denk dat juist wanneer je het vrijer laat, dat je veel meer gedwongen wordt, en dat je ook echt moet gaan kijken wat er daadwerkelijk gebeurd, wat spreken we nu precies met elkaar af, wat voor soort project is het, wat is dan nodig om dit project veilig en met een beheersing van de risico's te kunnen uitvoeren. Je wordt dan zelf meer gedwongen om het te regelen wanneer het niet allemaal voor je is uitgezet in stapjes en processen. Dus is denk niet dat er met meer vrijheid een concessie wordt gedaan op het gebied van veiligheid.
3.2	-Zie 3.1-

C.7 Interview report interviewee 3U

Relevant quotes that are used in the data analysis are highlighted and coded [QUOTE3U#].

0. Algemeen	
Vraag	**Antwoord**
0.1	3U: [redacted]

1. OG & ON	
Vraag	**Antwoord**
1.1	3U: Dat zijn dus eigenlijk gewoon alle IPM rollen: project leider (PL), contract manager (CM), omgevingsmanager (OM), en technisch manager (TM). Project beheersing (PB) zit er dan ook nog wel eens bij, maar dit verschilt per OG. En dan heb je vaak nog een backoffice (BO), maar dit hangt ook af van de organisatie van de OG waar die onder valt. Bij het project in [redacted] hadden we ook nog een contract begeleider (CB). Er waren dan verschillende relaties tussen die teams, die teken ik er ook even in.

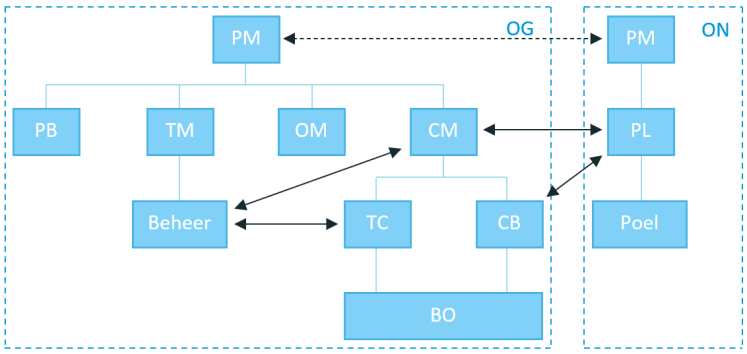

Figure C.1: Project organisation described by interviewee 3U.

Het hangt sterk af van de OG welke deskundigheid dan nog ingehuurd moet worden, maar dat is nodig op het moment dat ze de mensen niet hebben die een bepaalde taak moeten uitvoeren.

De communicatie ging in dit geval [redacted] op twee manieren, je had gewoon de CB die had de dagelijkse afstemming met de ON, dus als zij dingen in de uitvoering tegen kwamen dan konden ze dat beter samen afstemmen omdat die CB meer uitvoeringservaring heeft dan de CM. Tijdens de voortgang overleggen waren dan samen met de ON, CM (OG) en TC (OG). Die laatste twee partijen zorgen dat het hele procesmatige vanuit de UAVgc, dus eigenlijk het naleven van VS2, dat dat geborgd wordt. De verantwoordelijkheid van de CB is gewoon dat wanneer er buiten uitdagingen zijn waar ze tegenaanlopen, om die dan gewoon op te lossen. Eigenlijk is het een extra rol die we hebben toegevoegd [CB] omdat je bij de UAVgc merkt dat als we volledig het contract aanhouden en we tegen de aannemer zeggen “joh het is allemaal jullie feestje en verantwoordelijkheid”, dan krijg

1.1	je gewoon gezeik. Dan zegt die aannemer weer dat ze niet gehoord worden door die OG, dus we hebben er een rol tussenin gezet die meer affiniteit heeft met de uitvoering om gewoon te kijken hoe we buiten dingen pragmatisch op kunnen lossen, i.p.v. dingen heel ver laten escaleren. SV: Kom je dat vaker tegen dan die struggle van de ON er is? 3U: Het is eerder een standpunt wat ze innemen. Waar ik het over heb zijn allemaal middelgrote opdrachten van 6/7 miljoen euro. Dus het zijn niet de RWS projecten, dat moet je je even realiseren. Een afsluitdijk, zeesluis IJmuiden, alle projecten die de media halen zijn vele malen groter. De mensen vanuit de aannemer die op dit soort projecten zitten komen voornamelijk uit de RAW en bestek kant [UAV]. Ze nemen dan ook automatisch een beetje die houding aan, ze willen dat de OG dingen besluit terwijl dat officieel helemaal niet hoeft. Daarom hebben we die rol [CB] ertussen gezet om dat gat op te vullen, terwijl het niet contractueel verplicht is. Als je het niet doet dan gebeurd er helemaal niks.
1.2	3U: In dit geval was het vooral de CB, ikzelf [CM] en de TC kwamen wel eens in de buurt van de bouwplaats voor voortgang overleggen. Maar dat was dan niet om buiten te kijken [QUOTE3U1]. Misschien dat er wel eens iemand meegenomen werd als waarnemer bij een SBC toets, maar dat is dan echt incidenteel. De OM kwam er wel regelmatig, ook om gewoon dingen af te stemmen vanuit de communicatie met de omgeving, van welke input je daar voor nodig hebt. In het eerste deelproject hadden we een zelfde soort structuur [zoals getekend], maar daar was de TM van de gemeente nog wel actiever betrokken. Die zat toen ook bij de bouwvergaderingen, maar dat voegde weinig waarde toe dus toen is dat ook maar gestopt.

2. Risicomanagement binnen de UAVgc	
Vraag	**Antwoord**
2.1	3U: De ISO9001 is een norm voor kwaliteitsmanagement. In principe moet vanuit de ISO9001 de aannemer zijn eigen bedrijfsplan of kwaliteitsplan schrijven, waar veiligheid een onderdeel van is. Ik ga er dan vanuit, maar ik weet niet of het feitelijk juist is, dat hun eigen risicomanagement volgt uit hun eigen kwaliteitssysteem wat dan ISO9001 gecertificeerd is. Dus de ISO9001 is een bepaald handboek of je iemand mag certificeren op basis van hun kwaliteitssysteem. Of er dan een directe relatie is met risicomanagement in die zin dat daar waarschijnlijk beschreven staat hoe je dat gaat doen [je risicomanagement], maar in feite is het allemaal een beetje voor de bühne. Als je een kwaliteitssysteem hebt dat ISO9001 gecertificeerd is en waar iets staan over risicomanagement, maar je doet het vervolgens niet, maar volgens de certificering doe je het wel, ja dan is het voor de bühne en heeft het helemaal geen zin.
2.2	3U: Dat staat beschreven in het V&G plan van de ON, maar het risicomanagement wordt meestal uitgevoerd door hun manager projectbeheersing of proces manager [QUOTE3U2], afhankelijk van hoe ze het zelf intern willen noemen. Je hebt altijd V&G verantwoordelijke in de uitvoeringsfase [QUOTE3U3], dat is meestal een uitvoerder, maar dat verschilt een beetje per project en staat omschreven in het V&G plan. Wat er vervolgens in de uitvoering mee gebeurd, tja, daar wordt weinig op getoetst. Vanuit SCB wordt er vaak wel een keer gekeken naar veiligheid, maar verder is veiligheid primair de verantwoordelijkheid van de ON die daar dan bepaalde campagnes voor heeft om ook intern het veiligheid bewustzijn bij haar medewerkers te vergroten [QUOTE3U4]. Ik denk dat de grootste uitdaging is dat er vaak heel veel internationale mensen buiten werken. Dan gaat het dus met name om het begrijpen wat er daadwerkelijk omschreven staat wat die mensen dan vaak niet snappen of begrijpen. Het gaat niet zo zeer om normen, misschien alleen de Arbo normen. Onveilig als in dodelijk of dodelijk mogelijk, dat is

2.2 internationaal overal wel hetzelfde. Je kan een net iets ander beeld hebben van wat we met z'n alle normaal vinden, maar dat je een helm moet dragen of dat je je moet zekeren wanneer je ergens de hoogte in gaat, dat is overal hetzelfde. Ik kan me wel voorstellen dat ze in het buitenland andere keuzes maken door bijvoorbeeld het weer of iets dergelijks. Cultuur speelt hier dan ook echt zeker wel een rol in. Het verschil zit hem dus niet in het feit dat er andere regels zijn, maar vooral dat het andere culturen zijn: dus andere normen en waarden vanuit het land van herkomst.

SV: Dus even terugkomende op het risicomanagement, die worden beheerst of bekeken door een V&G coordinator uitvoering, en een proces manager, beiden aan de ON kant?

3U: Ja, en vanuit de OG wordt er af en toe wel eens getoetst vanuit een SCB toets. Je hebt sowieso verplichten dat wanneer je een onveilige situatie ziet dat je mensen erop aanspreekt. Je kan mensen er wel op aanspreken, maar als die mensen er verder niks mee doen dan kan je er als OG verder niks mee. Je kan wel zeggen van "Ik leg het werk stil"....

SV: Maar waar ligt dan de formele verantwoordelijkheid?

3U: De formele verantwoordelijkheid.. Als jij iets ziet, maar dat is hoe de hele keten werkt, dus ook vanuit je VCA, als ik buiten zie dat er iets onveiligs gebeurd, ook als passant, dan moet ik er iemand op aan spreken formeel gezien. Je kan verder alleen niks doen. Als ik zeg "ik vind dat je moet stoppen", als passant zijnde, dan heb je geen mandaat. Op je werk is dat echter anders, dan kan je iemand dwingen om iets aan te passen, maar ja als mensen dat niet doen dan zal je in je lijn omhoog moeten, het moeten escaleren, en dan kan je wel zeggen "Ik heb dit geconstateerd, dat moet opgelost worden, anders moet je het werk stilleggen". Dan ligt de verantwoordelijkheid nog steeds bij de ON om het werk stil te leggen. Ik bedoel, als die persoon het niet aan wil passen, dan kan je er weinig aan doen. Dus degene die die medewerker betaald, die heeft daar invloed op. Als OG kan je wel zeggen "ik leg het werk stil", maar dat is best wel rigoureus.

2.3 SV: Wie doet dit dan, dat zullen dan ook die V&G coordinator uitvoering en de proces manager zijn.

3U: Dat verschilt per project, soms worden er ook echt wel risico sessies georganiseerd om dat te actualiseren [QUOTE3U5], maar ik denk toch echt wel dat dat nog veel beter kan. Vanuit de proces eisen moet je ieder voortgangsrapportage het risicodossier actualiseren, dat gebeurd ontzettend passief bij die aannemers vind ik [QUOTE3U6]. Dan zie je die voortgangsrapportage en dan denk ik altijd bij mezelf: hoe kan dit nou nogsteeds allemaal hetzelfde zijn, iedere maand zie ik zowat het zelfde risicodossier. Er veranderd echt bijna niks gedurende het project in het algemene project risico dossier. Het veiligheidsrisico dossier, is denk ik niet eens een apart risico dossier, ik heb het idee dat dat zelfs maar 1 keer gemaakt wordt als onderdeel van het V&G plan [QUOTE3U7], en wat daar dan vervolgens mee gebeurd... ik heb oprecht geen idee eigenlijk. Ze [aannemer] zullen nooit heel snel zeggen dat een bepaald veiligheidsrisico nou zo groot is dat het dan in de top 5 komt van het risico dossier die dan vervolgens weer in de voortgangsrapportage staan. Dus eigenlijk is dat best wel een black box voor een OG [QUOTE3U8].

2.4 3U: Nee, te weinig denk ik. Maar je moet wel onderscheid maken tussen welke risico's er zijn. Dus echt uitvoeringsrisico's die liggen primair in het proces bij de ON, maar je hebt ook project risico's die echt impact kunnen hebben op het project. Bijvoorbeeld een verontreiniging van de grond, tegenvaller hier, tegenvaller daar. Daar heb je wel allerlei vormen voor om dat actiever in te zetten in je project, als je een soort van alliantievorm of gezamenlijke risico pot, dan kan je dat soort project risico's beter beheersen. Als je

2.4 het hebt over die uitvoeringswerkzaamheden, dan is dat al primair de verantwoordelijkheid van de ON vanuit de geïntegreerde contractvorm, dus er valt dan al snel minder uit te halen. Als je echt in zon allianntie vorm werkt dan kan je zeggen van “Als we dit allemaal oplossen dan hebben we een risico pot met dit budget”, maar die ON hebben vaak helemaal geen geld zitten in zo’n risico pot, het overkomt hen gewoon. Risico’s in de uitvoeringsfase zien ze eigenlijk niet eens, of althans niet in de vorm dat ze dan hoog in het risico dossier staan. Dus wat er dan mee gebeurd, niet zo heel veel denk ik.

SV: Denk je dat het goed is dat alleen de top 5 van het risico dossier besproken wordt met de OG, of zouden dit er meer moeten zijn?

3U: Dat ligt eraan hoe je het met elkaar wil beheersen. Dat je een top 5 bespreekt is eigenlijk om te kijken van hoe kunnen we daar dan beheersmaatregelen voor regelen. Omdat het dan eigenlijk heel beperkt wordt ingevuld heeft dit bespreken eigenlijk ook heel weinig waarde, maar het heeft ook geen waarde om heel vaak een heel risico dossier van 20 tot 50 risico’s door te akkeren. Dus ik vraag me af of dat dan het middel is. Wat je eigenlijk wil is dat er meer geproken wordt over veiligheid, en dan met name de risico’s met betrekking to veiligheid in de uitvoeringsfase. Vaak hoor je dan zoiets van "ja dat is gewoon standaard, dat doen we altijd al, dus het is wel veilig". Dat soort antwoorden hoor je dan heel snel [QUOTE3U9]. Dus dan is de vraag, is het bespreken van die risico’s het juiste middel om te bewerkstellingen wat je zou willen bereiken? En ik geloof niet dat het doorlopen van een risico dossier, al is dat dan langer, daar een bijdrage aan levert. Je moet dan denk ik toch op zoek naar een ander mechanisme om dat te bewerkstelligen.

SV: Aan wat voor ander mechanisme zit je dan te denken?

3U: Die aannemers hebben natuurlijk ook allemaal van die project start ups, maar ook dat land schijnbaar ook allemaal niet, dus wat de oplossing is... Ik weet het eigenlijk niet. TenneT bijvoorbeeld, die zitten heel scherp op dat veiligheid omdat hoogspanning heel veel gevaarlijker is dan andere dingen. Maar dat zit ik toch aan iets te denken waarmee je een soort bewustwording creëert. We hebben niet voor niets het spreekwoord “gevaar zit in een klein hoekje”, omdat het zo routinematig is, is het risico dat je iets vergeet wordt dan steeds groter. Ik weet niet wat de verandering zou moeten zijn, maar je moet iets wezenlijks veranderen in de hele keten wil je iets bereiken dat impact maakt.

2.5 3U: Het is inderdaad een neventaak, dus alles wat mensen erbij doen dat gaat al een stukje minder goed. Wat TenneT bijvoorbeeld heel goed doet, is dat ze op ieder werk wel een veiligheidsdeskundige rond hebben lopen. Afhankelijk van de werkzaamheden is deze er dan permanent of op bepaalde dagen. Bij sommige werkzaamheden is het verplicht dat deze persoon erbij is. TenneT heeft het dus beter geregeld dan veel andere OG’s, ze schatten die risico’s groter in. Er valt dus veel te verbeteren omtrent die deeltaak. De vraag is alleen: wat gaat die persoon doen? De hele dag rondlopen om te kijken of iedereen veilig werkt, dat is waarschijnlijk niet de oplossing want dat is bijna niet te doen. Dan moet er bij alles wat er uitgevoerd wordt iemand bijstaan die beoordeeld of het veilig gebeurd. Dat wordt meer een soort van schooljuf situatie, en dat draagt niks bij aan eigen verantwoordelijkheid nemen van mensen die buiten werken. Dit is dus inderdaad precies zo’n voorbeeld waarover je echt moet nadenken van: hoe kan je dit op een andere manier invullen om ervoor te zorgen dat je daar meer impact mee maakt, anders dan dat je gewoon een vinkje hebt gehaald. Eigenlijk is dat nu wat er gebeurd he, de vinkjes worden gewoon gezet. Dus er is iemand verantwoordelijk voor dit, voor dit, voor dit, en dit. Zolang er niks gebeurd, gaat het eigenlijk allemaal prima. Ik kan me wel voorstellen, dat zou je eigenlijk iemand uit de praktijk moeten spreken, maar

2.5	als jij verantwoordelijkheid hebt en er gebeurd wel iets zoals een dodelijk ongeluk of een ongeluk waarbij mensen blijvend letsel aan over houden, dan kan ik me voorstellen dat je er ineens heel anders in staat. Je kan dan gewoon vertellen dat je iets naars hebt meegemaakt, en dan ben je daarna scherper op bepaalde dingen. Dat gebeurd heel vaak he, dat er eerst iets moet gebeuren voordat er verandering ontstaat. Zolang dat niet aan de orde is, denk ik dat er niet heel veel gaat veranderen en dat het toch het behalen van vinkjes blijft. Want aanpassingen hier aan kost toch allemaal geld. Ik denk dat de V&G coordinator uitvoering de standaard dingen wel weet, zoals draag PBM's. Als het om spannende dingen gaat, zoals hijwerkzaamheden, dan zijn ze ook wel scherp. Maar dat komt ook deels omdat OG's daar extra scherp op zijn. Ik als OG stel ook 10 vragen extra wanneer het om hijswerkzaamheden gaat dan wanneer er asfalt wordt gestort. Maar of zij [V&G coordinator uitvoering] nou continu scherp hebben van: vandaag gebeurd dit en gebeurd dit veilig?... dat durf ik niet te zeggen maar ik denk het niet.
2.6	3U: De rol zit hem vooral in het input leveren voor het risico dossier vanuit OG perspectief. Risico's agenderen in overleggen als wij [OG] ze zien, terwijl ze niet hoog in het risico dossier staan terwijl wij wel willen dat er wat mee gebeurd. En dan bedoel ik natuurlijk het beheersen ervan, niet het alleen opnemen in het risico dossier, want dan gebeurd er nog niks mee. Verder is de rol van de OG beperkt aangezien de uitvoeringsrisico's bij de ON liggen. Het enige wat je kan doen is wanneer je risico's signaleert, dat je gaat toetsen. Maar de invloed van de OG is verder beperkt. SV: Je zegt dat als je risico's signaleert, dan ga je toetsen, maar wat zou het moment zijn dat je ze signaleert als je zelf niet op de uitvoering aanwezig bent? 3U: nou gewoon op basis van planning en het weten welke werkzaamheden er zijn. Dat is het enige waarop je kan toetsen, aangezien de OG niet op het werk aanwezig is op basis van de UAVgc. Je kan niet zien wat er buiten gebeurd, en dat is ook het idee achter de contractvorm, de verantwoordelijkheid ligt bij de ON. Je kan wel logisch nadenk van: wat komt er op ons af de komende tijd, en wat zou ik als OG graag beheerst willen zijn? Dat is een individueel, individueel klink misschien beperkt, maar dat is vanuit het CM team vanuit de OG wat ervaringen, lessons learned vanuit andere projecten zijn. Je weet niet wat je niet weet, dus als er iets is waarvan jij je nooit gerealiseerd had dat dat een risico zou kunnen zijn, dan ga jij daar ook niet op toetsen.
2.7	3U: Op een gegeven moment wanneer het dan onder druk van tijd en geld staat, dat is een consequentie is van het reactief bijhouden van het risico dossier, dan ga ik kijken naar de risico's die voor de OG van belang zijn. En daarover ga ik dan het gesprek aan. Ik ga gewoon aan de ON vragen hoe ze die risico's beheersen. Daar heb je dan gesprekken over in een voortgangsoverleg. Ik denk dat dat ook effectiever is dan een risico dossier doorakkeren waar toch niet veel mee wordt gedaan. Dus het kan onder druk komen te staan aan de zijde van de ON, maar wanneer ik een bepaald risico belangrijk vind, dan breng ik dat ter sprake, ook al staat het risico dossier door gebrek aan tijd of budget misschien stil. Wat voor de OG de belangrijkste risico's zijn, die zul je altijd moeten blijven agenderen. Buiten is het de verantwoordelijkheid van de ON. Ik vraag gewoon aan de ON: "hoe heb je dit gedaan?" Dat is natuurlijk wel de omgekeerde wereld vergeleken met waarin de ON eigenlijk aan zou moeten tonen dat de risico's beheerst zijn. Dat doen ze dan normaal dus met hun rapportages, maar die is dan nog maar een 6 van de 10. Je zal dan dus zelf als OG zelf meer moeten nadenken over de risico's om daar toch enig comfort bij te houden [QUOTE3U10]. Als je op een gegeven moment denk: "ze maken er een zooitje van, het zal allemaal wel…" Je hebt toch ergens wel een verantwoordelijkheidsgevoel als OG. Je zal dan dus zelf de vragen moeten stellen [QUOTE3U11]. Je zoekt naar een andere manier om hetzelfde te bewerkstelligen.

2.7 SV: Dat is natuurlijk jouw houding als je bij een OG zit. Denk je dat er bepaalde mensen anders in staan?

3U: Ja absoluut, mensen zeggen gewoon dat het een feestje van de ON is. Dat mogen ze [ON] dan zelf weten, dat gebeurd ook. Dan gebeurd er dus eigenlijk niks met de risico's meer [QUOTE3U12].

2.8 SV: als we bijvoorbeeld kijken naar het ongeluk in Alphen aan de Rijn, dan zien we dat die ON's hebben gezegd: de kans dat die kranen omvallen van het ponton is nihil, dus de maatregel die we implementeren is dat er langzaam en voorzichtig gewerkt wordt. Terwijl een betere maatregel bijvoorbeeld is een hijsplan en ponton balans plan. Stel je signaleert dit als ON, en je weet dat je je zaken eigenlijk niet op orde hebt of niet beheerst, waarom zou je de werkzaamheden dan stilleggen als je zelf die invloed hebt als ON, wetende dat je dan een boete krijgt of je werkzaamheden uitlopen?

3U: Die ON heeft de afweging gewoon gemaakt om het niet te vertellen aan de OG, en dat is het probleem. Mensen nemen veel dingen aan. Die ON heeft dus eigenlijk gezegd, als wij dit dan nu constateren en delen met de OG dan krijgen we een boeten want dan zullen we de werkzaamheden moeten uitstellen. Ik denk dat je eigenlijk zou moeten voorleggen aan de OG zo van: "we constateren nu dit", en dat kan allerlei redenen hebben. In dit specifieke geval hebben zij zelf de keuze gemaakt om het risico te nemen. Dat is misschien nog wel erger. En eigenlijk is dat stiekem wel het aard van het beestje om het zo te zeggen, alle aannemers zijn heel opportuun. Maar daar gaat de OG niks aan veranderen, dus dat de mentaliteit daar is daar kan de OG niks mee doen. Dat gaat ook niet veranderen. Het verschilt wel per ON hoor, maar er zitten echt cowboys tussen [QUOTE3U13]. Dat je denkt van: "dit kan allemaal net wel, net niet", dat het echt een grijs gebied is. Geld heeft daar dan misschien nog weinig mee te maken, het is meer dat het gewoon opportuun is. Het is alsof de mentaliteit is dat alles mogelijk is, terwijl dat niet zo is. Maar we kunnen die mentaliteit niet zomaar veranderen.

SV: Dus het ligt meer aan de cultuur bij de aannemers?

3U: Als je het zo framed, dat zij zelf die afweging maken zo van: "we hebben dit al 10 keer gedaan dus die 11 e keer zal het ook wel goed gaan", dan is dat denk ik wel een cultuur dingetje ja.

2.9 3U: Ja slecht vind ik, want ze zeggen gewoon: "ja dat hebben we gewoon bij die partij neergelegd en dat staan in hun contract ". En dat is het dan eigenlijk wel.

SV: En 'hun contract', het contract tussen ON en onderaannemer, die onderaannemer wordt ingehuurd voor een deel van het werk. Hoe worden dan die raakvlakken beheerst?

3U: De ON zegt dan: "dat staat in hun contract, dat is daar belegd, zij zijn daar verantwoordelijk voor". De OG kan niet verantwoordelijk worden gehouden voor een partij die de ON inschakelt natuurlijk. Iedereen vindt dat het allemaal wel geborgd is, en dat iedereen alles weet van elkaar, maar daar gaat ook echt van alles mis.

2.10 3U: Ik weet niet of vertrouwen het juiste woord is. Het zou wel kunnen, en zeker als het allemaal dochterondernemingen zijn, maar ook daarvoor geld natuurlijk dat je er niet zonder meer van uit kan gaan dat bepaalde dingen goed gaan. Het gaat dus allemaal goed totdat het fout gaat. Of het dan vertrouwen is, of goed van vertrouwen, of hoe je het ook wil noemen, het gaat goed zolang het goed gaat. Dat is meer de mentaliteit, en als het dan wel fout gaat dan is er gewoon gezeik [QUOTE3U14]. Maar daarvoor geld ook dat bij die onderaannemer tot op de cent wordt uitgeknepen en scherpe tarieven moeten aanbieden. Dus ook dat is een risico.

2.11	3U: in principe maakt de ON een V&G plan voor de ontwerpfase en voor de uitvoeringsfase, dat is een verplichting. Dus deels zou dat daar wel geborgd moeten zijn. Risico's die mensen zien in het ontwerp, en hoe die worden overgedragen naar de uitvoering.... In het ontwerp zitten vaak natuurlijk zelf geen risico's, in de uitvoering van het ontwerp wel. Ook daar is het natuurlijk heel erg afhankelijk van tot in hoeverre er vanaf de voorkant al iets uit is gewerkt. Maar ik denk dat ontwerpers, gewoon in z'n algemeenheid, beperkt gevoel hebben bij de risico's die hun ontwerpkeuzes als gevolg hebben voor de uitvoering. Risico's die wel met de uitvoering te maken hebben, maar vooral met het inpassen in de omgeving en hun raakvlakken, zijn niet per se risico's die gerelateerd zijn aan veiligheid. Ik denk dat het gat tussen ontwerpers en uitvoering, los van of dat collega's zijn of niet, die missen vaak een gevoel van: "hoe zit dit er nou uit buiten?", wat zijn de hoogtes waar we op aan moeten sluiten, wat zijn de uitdagingen, dat zijn meer uitdagingen met betrekking tot het inpassen van het ontwerp. Daar gaat van alles mis, dat sluit dan gewoon niet aan. Maar wat jouw ontwerp keuze betekent voor de uitvoering, en of dat dan de veiligere optie is voor de mensen die dat moeten doen, dat realiseren heel veel ontwerpers zich niet. SV: is een bouwteam dan een oplossing? 3U: Nee. Ik denk wel dat het beter wordt, want je gaat al meer vanuit de uitvoering meedenken in het ontwerp. Maar zolang je niet gaat nadenken over het ontwerp van bijvoorbeeld een brug, waarin je 1 variant vanaf de wal kan inhijsen, of vanaf een ponton, dan kan je daadwerkelijk die afweging maken. Je kan dat dan dus pas doen wanneer je in je ontwerp bepaalde keuzes maakt op basis van de uitvoeringsmethode. Alleen in de ontwerp fase wordt hier gewoon nog te weinig over nagedacht. Als je daar wel over gaat nadenken, bijvoorbeeld in een bouwteam, dan kan je wel die afweging beter kan maken. Voor de huidige ontwerpers wordt de afweging: "hoe doen we het dan in de uitvoering?" gewoon niet gemaakt. Als daar meer over nagedacht zou worden, of over hoe je het gaat uitvoeren, dan kan je in ieder geval de afweging maken. Je kan dan nadenken over wat de verschillen zijn in kosten tussen verschillende uitvoeringmogelijkheden van jouw ontwerp.
2.12	3U: Dit kan ik eigenlijk niet beoordelen. Ze zijn denk ik sowieso niet ingebouwd, maar dat weet ik niet zeker. Of ze daadwerkelijk gebeuren... Ik kan er eigenlijk weinig over zeggen.

3. Schijnveiligheid	
Vraag	**Antwoord**
3.1	3U: Een SCB toets op veiligheid, op het proces van veiligheid, is natuurlijk heel beperkt. Dat komt omdat je maar een beperkt aantal eisen hebt in de VS2 voor veiligheid. Als de ON dan een plan heeft opgesteld en zegt dat ze werken volgens het plan, en dat ze dat kunnen aantonen met een aantal steekproeven, dan hebben ze het goed gedaan. Dan heb je als OG vastgesteld dat het veilig is. Je kan er ook voor kiezen om een procestoets samen met een product toets uit te voeren. Dan ga je ook echt naar buiten, en dan heb je al een iets beter beeld. In 9 van de 10 gevallen zal je dan nog steeds dezelfde conclusie hebben dat het veilig gebeurd. Eigenlijk hebben ze dan alle processtapjes uitgevoerd. Aan de voorkant kan je alleen wat aan het proces doen. Het proces zou in orde moeten zijn om het werk veilig uitgevoerd te krijgen [QUOTE3U15]. Wat kan je dan als OG dan nog meer doen? Je kan er alleen continu naast gaan staan, maar dat doe en wil je niet aangezien je voor een geïntegreerd contract gekozen hebt. Of het dan schijnveiligheid is, dat weet ik niet, alleen kan je natuurlijk wel op basis van praktijk ervaring afvragen of dan de hele invulling van veiligheid, hoe dat in de UAVgc geborgd is, dat dan niet tot gevolg heeft. Maar dat kan je je natuurlijk van alles afvragen waar een procesdocument de basis is voor een conclusie. Dat kan je je ook afvragen voor de ISO9001, als iemand

3.1	dat certificaat heeft, is dat dan zo dat er kwaliteit wordt geleverd? Als je kijkt naar ISO9001, W+B is gecertificeerd, is alles wat wij opleveren dan kwaliteit? Daar kan je ook je vraagtekens bij zetten. Het zit hem dus niet zo zeer in of de toepassing van SCB de schijnveiligheid is, je moet je afvragen of dan dus het middel dat er gezamenlijk voor gekozen is, namelijk een proces document opstellen of een Project management plan, betekent dat dan dat het goed gaat? Nee dat betekent het niet. Die documenten zijn gewoon een beschrijving van dat het in de praktijk goed zou kunnen gaan als we dit plan volgen. Maar ook dat is garantie tot aan de voordeur. SV: Hoe zou je het dan anders inrichten? 3U: Nou ik weet niet of ik het anders zou inrichten. De vraag is even wat je daar mee zou willen bewerkstelligen. We zitten heel vaak te denken aan middelen, maar je moet vooral denken wat je dan zou willen bewerkstelligen om de gehele keten veiliger te maken. En dan kom je terug op dat gene waarvan ik het antwoord niet wist.. We kunnen allemaal wel weer middelen gebruiken waarmee je uiteindelijk vinkjes haalt, maar alles waar je gewoon vinkjes mee ophaalt is wel echt schijnveiligheid. Dat ben ik met je eens. Want dan denken mensen er vervolgens niks meer mee hoeven te doen. Ik denk dat het toch meer ligt in gedragsverandering. Dan moet je op zoek naar hele andere methoden dan waar we nu inzitten, want dan kan je beter een boek gaan lezen over cultuur verandering of verander management, en hoe je dat uiteindelijk zou kunnen bewerkstelligen.
3.2	3U: of omgevingsveiligheid verplicht mee genomen moet gaan worden, dat vind ik niet eens zo interessant. De discussie die vervolgens ontstaat is ook tot hoe ver omgevingsveiligheid mee moet worden meegenomen. Wat is dan de straal van woningen die je wel en niet meeneemt. Daar ga je discussie over krijgen, los van of je het verplicht stelt of niet. Het gaat meer om invulling geven aan op welke manier het ingevuld moet worden. Je moet denk ik meer gaan kijken naar wat je zelf vindt van veiligheid. Wat ik veilig vindt, vind iemand ander weer overdreven of juist totaal niet veilig. En dan komt het toch terug op het individu. Maar je moet ook even kijken naar het doel, want als je weer vinkjes gaat halen om omgevingsveiligheid maar op orde te hebben, dan zien mensen het weer alleen maar als extra ballast.

4. Toekomstige situatie	
Vraag	**Antwoord**
4.1	3U: Ik denk dat het opzicht wel interessant zou kunnen zijn. Wat ik er lastig aan vind is de inschatting in welke mate dit echt effectief is. Dus ook dit zullen moment opnames blijven. Je kan niet continu hier 24/7 mee bezig zijn. Ik ben nog een beetje twijfelachtig in die zin, is dit nu wezenlijk anders dan het uitvoeren van een audit. Dat ligt dan heel erg aan de frequentie. Het effect kan ik dus moeilijk inschatten. Om dit vervolgens een succes te laten worden, dan is er echt verandering nodig eerst aangezien dit tijd en geld gaat kosten. Mensen moeten hier dus echt voor willen betalen. De OG moet hier voor willen betalen, want die ON gaat het niet betalen. Het wordt dus onderdeel van je aanneemsom. Er valt dan wel wat voor de zeggen aangezien die OG het werk wel graag veilig ziet gebeuren. Maar ik denk dat mensen het toch voornamelijk wel gaan zien als ballast in de uitvoering. “we zijn al druk met dit en dit”. Dat gevoel komt ergens vandaan he, dus je zal wat moeten doen aan de oorzaken van de gevoelens van ballast, tijd, papierwerk, gewoon de standaard dingen die je kan bedenken die worden ervaren als onnodig. “we doen het altijd al zo, dus waarom zou het anders moeten?” Je moet dus echt weten te bewerkstelligen dat je duidelijk maakt wat het op gaat leveren, en dat weet je van te voren niet. Dan krijg je reacties als “Dit is zooo veel extra werk voor minimale effecten”. Je komt dan echt bij ethische discussies zoals het verhaal van de Ford Pinto. Daar kwamen ze achter een fout in het ontwerp, en om dit te gaan herstellen kosten

4.1 het een X bedrag. Toen hebben ze simpelweg een bedrag gehangen aan een mensen leven wanneer het fout zou gaan. Toen was de conclusie vervolgens dat ze het defect niet moesten oplossen, gebaseerd op een monetair bedrag. Dit zelfde verhaal zit dus ook een beetje hier in. Wat gaat het kosten? Wat gaat het opleveren? Als dat opleveren niet significant meer is dan dat wat we nu al hebben, dan gaat dit niet werken denk ik. Mensen gaan het bijvoorbeeld ook bagatelliseren met verkeersslachtoffers. Als we niet met z'n alle onacceptabel gaan vinden dat er iemand komt te overlijden tijdens de uitvoering van een bouwproces, wetende dat absolute veiligheid geen ding is, dan ga je dit niet voor elkaar krijgen. En ook als je getallen gaat gebruiken, dan blijft de vraag bijvoorbeeld: wat is wel acceptabel? Dat is allemaal subjectief.

Bovendien denk ik dat het wel lastig is om het draagvlak te creëren onder bijvoorbeeld het management van bedrijven, omdat ze de noodzaak nog niet van zien. En dan kan je het wel verplichten, maar is het gewoon ballast. Dus je moet ook kijken naar de manier waarop mensen het minder als ballast gaan ervaren. Dan gaat het meer effect hebben.

C.8 Interview report interviewee 4U

Relevant quotes that are used in the data analysis are highlighted and coded [QUOTE4U#].

0. Algemeen	
Vraag	**Antwoord**
0.1	4U: [redacted]

1. OG & ON	
Vraag	**Antwoord**
1.1	4U: Er is eigenlijk niet echt een standaard, want de structuur is toch maatwerk voor ieder uniek project. De IPM rollen zie je wel terug, dus omgevings management, technich management, project beheersing, en contract management. Afhankelijk van de omvang en compleciteit van het project wordt dan gekeken of ieder IPM aspect vertegenwoordigd moet zijn, of dat er dingen eventueel gecombineerd kunnen worden. Als het te combineren valt, dan hoeft niet iedere IPM rol op zichzelf te staan. Bij zowel de OG als ON werkt dit zo, bij mijn projecten althans. Nou wij hangen dan vaak onder zo'n IPM rol als W+B, en dan adviseren we de bepaalde IPM rol. Intern tussen iedere IPM rol wordt er natuurlijk wel informeel gecommuniceerd, in de basis dan. Wat je vaak ziet is dat de IMP teams worden gespiegeld, dus wanneer er een overleg is over de omgeving dan zijn er omgevingsmanagers van zowel de OG als ON aanwezig. Gebruikenlijk is dat in een voortgangsoverleg alle rolhouders wel vertegenwoordigd zijn. Een voorbeeldje: een project in Nieuwegein, daar vertegenwoordig ik samen met een collega de OG. Wij vervullen samen alle IPM rollen of aspecten. Bij de ON zijn dit drie personen, een project manager, technisch manager die het combineert met omgevings manager, en een contract manager die het combineert met de rol manager projectbeheersing. En dat werkt helemaal prima.
1.2	4U: Dit is heel erg project en OG afhankelijk. Je hebt OGs die komen alleen bij oplevering op het werk, wanneer het lintje geknipt moet worden. Je hebt ook OGs die echt wel een vinger aan de pols willen houden en vaak hun eigen beheer behoorlijk nauw aangesloten willen houden bij de uitvoering van het project [QUOTE4U1]. In de basis bij UAVgc is dat de ON in de lead is voor de engineering en de realisatie van het werk. De aanpak is dat er risicogestuurd gekeken wordt naar welke aspecten we dusdanig risicovol vinden. Daarop gaan we dan controleren of de ON deze risico's beheerst. Wie zie je dan op het werk? Vaak wordt dat bij ons als SCB dienstverlener gelegd. Ik zelf pak eigenlijk elke mogelijkheid wel aan om even de bouw op te gaan en te kijken wat er gebeurd, en er een beter gevoel bij te krijgen. Ook qua veiligheid. Dingen die je dan ziet, die meld je dan even en dat wordt vaak wel snel opgelost. SV: Die ON vindt allebei de type OG wel prima? De OG die alleen bij t lintje doorknippen komt, of de OG die vrij actief aan SCB doet? 4U: Nee de ON kan het over het algemeen wel waarderen als de OG zich een aantal keer laat zien. Niet laten zien eigenlijk, gewoon wanneer je betrokken bent bij de realisatie van het werk. Ik denk niet dat je samen een werk kan maken zonder dat je zelf weet als OG wat er buiten gebeurd, dan heb je geen gevoel bij wat er daadwerkelijk

1.2	speelt. Ik ben dus wel voorstander van die actieve OG, ondanks de rolverdeling van de UAVgc.

2. Risicomanagement binnen de UAVgc	
Vraag	**Antwoord**
2.1	4U: de ISO9001 laat zien dat je een kwaliteitsmanagmeent systeem hebt als bedrijf, waarin je je verbeter management op orde hebt. Dus we werken in projecten waar fouten gemaakt worden, dat mag in bepaalde maten, maar er moet ook van geleerd worden. Je moet de controle hebben dat je je verbeterd. Als je jezelf niet verbeterd en je niet leert van je fouten, dan gaat het mis. Dat is ISO9001 voor mij. Wij als W+B hebben dit certificaat, maar bij ON's wordt dit ook verplicht gesteld. Of dat dan direct invloed heeft op het risico proces... Het V&G dossier vind ik sowieso een heel breed palet van "heeft hij al zijn aspecten rondom veiligheid en gezondheid op orde in ontwerp en realisatiefase". Dat V&G dossier is afkomstig van de OG, dus aan de voorkant is het al heel belangrijk dat je geen gekke keuzes maakt. Anders krijgt de ON echt een flinke uitdaging. Maar de ISO9001 heeft dan als enige invloed dat het proces wordt verbeterd wanneer het fout gaat. Als je in de uitvoering toch tegen aspecten aanloopt die daadwerkelijk risicovol zijn, die anders zijn voorzien in het V&G dossier, dan hoop ik wel dat je de loop weet te maken van: "okay het is toch risicovoller dan wat we harden ingeschat", of "onze beheersmaatregelen helpen niet goed genoeg", dan hoop ik wel dat er collectieve maatregelen worden genomen om alsnog die risico's mbt V&G worden beheerst. SV: Je zegt: "dan hoop ik dat..." 4U: Ja als de ON zijn ISO9001 op orde heeft, dan ga ik er ook vanuit dat hij in staat is zijn risico management proces op orde te krijgen. Dat is alleen geen garantie. Dat zeker niet. Want het is en blijft een aannemer, en wat je vaak ziet is dat hij toch tijdens de bouw een soort van oogkleppen op krijgt, en dan ziet hij niet meer wat onveilig is, dan is hij daar blind voor geworden. Dan is het vervolgens goed om als OG op de bouw te komen, of een externe veiligheidsdeskundige op de bouw te laten auditen. Als je dan een welwillende aannemer hebt die goed met zijn ISO9001 aan de slag gaat, dan zul je merken dat ook die aannemer daar voor open staat. Als die aannemer zegt van: "wat kom je hier doen? Ik heb geen zin om te luisteren naar jouw aanbevelingen e.d.", dan weet je ook wel dat hij zijn ISO9001 niet op orde heeft. Maar ISO9001 is wel breder dan alleen risico management.
2.2	4U: De kartrekker binnen de aannemer, dat maakt me niet eens zo veel uit eigenlijk, of het nou de project leider is of iemand anders. Zolang het maar op orde is. In mijns inziens moet het gedragen worden door een heel aannemers team, en niet alleen door 1 iemand die dat dan tijdens de tender bedenkt. SV: Stel dat je niemand aanwijst, denk je dan dat risicomanagement goed uit wordt gevoerd, of dat het ergens tussen wal en schip eindigt? 4U: Ik denk wel dat het dan gedaan wordt want de aannemer heeft er zelf ook gewoon belang bij dat het werk veilig gebeurd. Ten eerste voor de omgeving, maar ook voor zijn eigen personeel. Dus ik zie dat het een soort van gezamelijke effort is voor de aannemer om dat te beheersen. Er zal ergens wel een kartrekker zijn, die het dan in ieder geval een soort van vastlegt, maar ik hoop dat er vanuit uitvoeringsperspectief, maar ook vanuit veiligheidskundige, etc., dat zij allemaal een bijdrage leveren aan het V&G dossier. En dus niet vanuit 1 persoon.
2.3	4U: De gene die het doet is vaak toch wel de manager projectbeheersing omdat risico-management toch vaak een beetje onder zijn paraplu geschoven [QUOTE4U2]. Die

2.3 is dus degene die het daadwerkelijk in bv een excel bijhoudt, in een systeem. Maar toch nog even teruggrijpend op de vorige vraag: ik hoop wel dat hij daar ondersteuning in krijgt van verschillende mensen.

SV: Maar verantwoordelijk zijn is natuurlijk verschillend zijn dan iets alleen uitvoeren.

4U: Ja dat klopt. Kijk, ik heb er niet zo veel aan dat ik weet dat Pietje of Jantje verantworodelijk is. Ik heb er wat aan dat er door het hele aannemers team wordt bijgehouden. Dat vind ik het belangrijkste. Maakt me dan niet zo veel uit of het dan de manager project beheersing is, of iemand anders zoals een werkvoorbereider.

SV: Je zegt dat je hoopt dat dat team dat dan bij houdt, maar gebeurd dat in de praktijk dan ook genoeg?

4U: Vaak wel, of althans, in mijn beleving wel. Het is in ieder geval onderdeel van het voortgangsoverleg die ik elke 4 weken heb met een aannemer. Dan worden vaak wel bijvoorbeeld de top 5 risico's afgegaan. In mijn beleving moeten die risico's in de top 5 dan wel een afspiegeling zijn van de risico's van dat moment. Je ziet heel vaak dat er een top 5 is, en dat blijft dan heel lang diezelfde top 5. Terwijl wanneer je verder gaat, dan is het logisch dat risico's fluctueren qua ranking [QUOTE4U3].

SV: Dus dat bijhouden van die top 5, of het gehele risico dossier, dat gebeurd best wel passief dan?

4U: Nee, in de basis gebeurd dat best wel actief. Soms moet je als OG wel echt even een kritische vraag stellen waarmee je ze dan wel aan het denken zet. Dan realiseren ze zich dat ze het risico dossier weer moeten bijwerken [QUOTE4U4].

SV: maar heeft het bijwerken van het risico dossier dan ook daadwerkelijk invloed op het risico? Want je kan het dossier wel bijwerken, en dan staat het leuk op papier, maar gebeurd daar dan ook iets mee?

4U: Dat is een terechte vraag. Het is ook goed om te controleren of de beheersmaatregelen bij de risico's, dat die worden uitgevoerd. En dat kun je volgensmij aleen maar als je redelijk dicht samenwerkt met de aanenemer als OG zijnde. Als je teveel op afstand zit dan heb je weinig gevoel bij die beheersmaatregelen en of ze daadwerkelijk worden uitgevoerd.

2.4 4U: Het daadwerkelijk up to date houden van het dossier heeft niet altijd even veel prioriteit. Soms ben je gewoon met een project bezig en dan vraagt de OG zich vaak af of het dossier wel actueel is. Dan beseft de aannemer weer dat ze er iets aan moeten doen . Dus nee, het heeft niet altijd prioriteit. Maar dat heeft ook niet het doel per se. Je hebt niks aan alleen aan alleen een actueel dossier. Het is vooral belangrijk dat ze het in de uitvoering daadwerkleijk beheersen. Dat gebeurd wel, dat heeft wel altijd prio, een aannemer zal toch altijd met de risico's bezig zijn om die te beheersen.

2.5 4U: Dat weet ik niet, ik vind dat wel echt afhankelijk van de omvang en complexiteit van project. Ik kan me best voorstellen dat je voor een Blankenburg verbinding of een ander groot project dat je daar dus iemand fulltime op hebt. Op een kleinere klus vind ik dat niet per se nodig. In de vraagspecificatie vragen we natuurlijk of er iemand is die dit coordineerd. Ik denk dat je niet zo snel en eenvoudig extra beheerst wanneer je voorschrijft dat iemand dit als fulltime functie moet hebben. Een aannemer maakt zelf de afweging hoeveel tijd hij nodig acht om die rol te vervullen. Dan zou ik daar dus tijdens de uitvoering op toetsen zo van: "heeft die coordinator dat werk nou goed in de vingers?", dan kan je kijken of hij al die beheersmaartegelen goed uitvoert en voldoende controleert. Als je dan merkt dat dat niet het geval is, dat het niet goed wordt uitgevoerd,

2.5 dan kun je hem er wel op wijzen. Als je je maatregelen niet beheerst, dan ben je wel aan de beurt en dan zul je een verbetering moeten laten zien.

SV: En hoe toets je dat dan?

4U: Dat kun je in een proces toets doen. Dan ga je een audit uitvoeren. Dat is een beetje een formele SCB toets. Je kunt ook in een voortgangsoverleg, wanneer je het over veiligheid hebt, kun je het gewoon als onderwerp aanhalen. En dan gewoon in het gesprek maar eens iets meer de diepte in duiken. Maar vaak zie je toch dat een formele audit, waar dan een bevinding wordt in vastgesteld, dat dat meer zwaarte toekent aan de bevinding.

2.6 SV: je hebt al gezegd dat je vaak het gesprek aan gaat, en dat je vraagt of de aannemer bepaalde risico's beheerst. Zijn er verder nog dingen?

4U: Ik denk dat je echt samen dus ook af en toe een soort van de benen op tafel moet zetten om te kijken wat voor risicos je nog ziet. Dan kan je vervolgens bekijken wiens verantwoordelijkheid dat is, van de OG of ON. Risico sessies dus eigenlijk [QUOTE4U5]. Gewoon het gesprek in de bouwvergaderingen voeren. Audits kan je gebruiken om te toetsen. De OG heeft dus eigenlijk nog best wel een grote rol, tijdens de realisatie. Maar de grootste invloed heb je als OG tijdens de contractvoorbereiding. De keuzes die daar worden gemaakt dat zijn een soort randvoorwaarde waarbinnen de ON het werk moet realiseren.

2.7 4U: Als het onder druk staat van tijd, dan zul je inderdaad wel scherp moeten blijven. Wordt er nog wel gedaan aan alle beheersmaatregelen die nodig zijn voor V&G. Dus inderdaad, als tijd begint te knellen, dan zie je dat wel ten kostte gaan van dergelijke risico beheersmaatregelen. Je moet er dus gewoon scherp op zijn. Het moet veilig worden uitgevoerd, en anders gaat het niet. Soms moet je dan wel je poot stijf houden als OG [QUOTE4U6].

SV: En dan? Heb je dan als OG het mandaat om af te dwingen dat het vervolgens wel beheerst wordt?

4U: Je hebt altijd de mogelijkheid om het werk stil te leggen. Als jij het echt niet veilig vindt, dan heb je dat mandaat. Maar voordat dat gebeurd zijn er wel wat andere stappen, eerst maar eens in een goed overleg gaan bijvoorbeeld om te kijken of de aannemer zelf tot die conclusie komt. Qua geld, hij neemt het werk aan voor een bepaald bedrag, en daarin moet hij ook gewoon de risico's die hij ziet in het werk afprijzen. Het kan niet zo zijn dat tie zegt "joh ik ga het voor een lager bedrag doen want ik ga geen veiligheid in rekening brengen". Als tie dat heeft gedaan dan heeft dan loopt tie een flinke scheur in zn broek op.

2.8 4U: Die aannemer moet het gewoon doen zoals hij dat bij zijn inschrijving heeft aangeboden. Die aannemer moet en wil natuurlijk winst pakken op zo'n klus, maar vaak zie je dat bij de UAVgc contracten dat er gegund wordt op kwaliteit. Dus dan is het niet alleen maar laagste prijs van inschrijving. Geld is wel belangrijk, maar hij heeft meestal niet voor de laagste prijs het werk hoeven aannemen. Die druk is wat minder denk ik, dan dat je in algemene zin schetst met deze vraag. Als de aannemer een 10 beloofd qua veiligheid, dan zal die dat ook op die manier moeten uitvoeren. Hij kan dan niet zeggen dat tie het wat minder doet en maar een 6 gaat halen. Je kan de aannemer dan houden aan zijn plannen, namelijk dat hij een 10 gaat halen qua veiligheidsscore. Dan moet hij dat gewoon waarmaken. Want dat is het contract. Een consensus zou mogelijk kunnen zijn, maar dan mag het niet ten kosten gaan van veiligheid. Althans, dat zou ik niet toestaan.

Ik zit nu in een project, en er moet nog een VTW worden uitgevoerd. Wat

2.8 de aannemer moet doen, is bekend. Hoe en wanneer de aannemer dat moet doen, en dan hoe in de vorm van veiligheid, dat staat nog niet vast. Er zijn verschillende opties: naast een rijdende afzetting, de rijbaan kan worden afgesloten, en nog iets. Daarmee valt eigenlijk te draaien aan een knop van veiligheid. JE voelt dat wel aankomen, hoe veiliger het werk uit gevoerd wordt, hoe duurder de VTW voor de OG. Dan merk je een soort spanningsveld. Je kan het werk uitvoeren en een 9 voor veiligheid scoren voor bedrag X, en je kan een 6 voor veiligheid scoren voor minder dan X. En die afweging moet gemaakt worden. Mijn advies zou zijn om voor de veilige oplossing te kiezen.

2.9 4U: Dat is echt aan de hoofdaannemer, maar voor mij, als ik de OG vertegenwoordig, dan is het allemaal hetzelfde. Ik weet natuurlijk wel dat er onderaannemers in worden gezet, en ik hoop zo min mogelijk onderaannemers, ik hou het het liefst zo compact mogelijk. Maar de onderaannemer die werkt voor de ON die moet het werk ook beheerst uitvoeren. Dus hoe worden die gecontroleerd door de ON? In het werk zie je toch vaak dat bepaalde keuringen dan worden opgevraagd. Die worden aangetoond door de ON, dat het werk goed is uitgevoerd. Dus een hoofdaannemer zou prima een dergelijke keurig bij een onderaannemer kunnen leggen. Sterker nog: als wij vragen als OG, bijvoorbeeld een fietstunnel die gecontroleerd dient te worden, dan zijn dat verplichten die de hoofdaannemer die de verplichtingen doorlegt naar de onderaannemer.

SV: Je zegt: “ik hou het graag zo compact mogelijk”, wat is daar de reden van?

4U: Omdat je merkt dat wanneer er meerdere partijen aansluiten, dan zie je toch vaak dat er weer meer raakvlakken ontstaan. EN als er dan vervolgens weer een onderaannemer onder hangt, dan ontstaat er een raakvlak in het raakvlak. Dus daarom hou ik het graag zo compact mogelijk, maar ik heb er tegelijkertijd weinig invloed op want de hoofdaannemer bepaald. Ik denk dat de ON het zelf ook zo compact mogelijk houdt, alleen soms ontkomt hij er niet aan. Maar dan is dat een mooi onderwerp voor een audit, om te kijken of en hoe hij raakvlakken beheerst.

2.10 4U: Dat zou best kunnen. Uiteindelijk moet hij het werk opleveren, en dan moet het werk voldoen aan de eisen. Als een bepaald deel van het werk door een onderaannemer is uitgevoerd, zou dat niet uit moeten maken. Het werk moet voldoen aan het contract uiteindeliujk. Dat zal de hoofdaannemer moeten aantonen, dat het werk voldoet. Mogelijk krijgt hij ondersteuning van van een onderaannemer. Maar als hij een bepaald deel voor het werk tijdens de uitvoering voor lief neemt dat hij het wel vertrouwd, zonder tijdens de uitvoering te controleren, dan is dat zijn risico. Als achteraf blijkt dat de onderaannemer er een potje van heeft gemaakt, dan is dat het probleem van de hoofdaannemer. En dan een probleem richting de OG, want de ON zal er dan voor moeten zorgen dat het wordt hersteld. Dus dit is ook weer een soort van risico beheersing zo van: “is dit een onderaannemer met wie ik al 20 jaar samen werk, en ik weet precies wat hij doet”, dan zal er wat minder gecontroleerd worden vergeleken met de situatie wanneer het een nieuwe onderaannemer is.

SV: Denk je dat dat de goede houding is? Dat je er dan wat minder strak op zit?

4U: Ja, dat denk ik wel. Als je 20 jaar een vriendin hebt dan vertrouw je die toch ook? Je hoeft niet alles te controleren, dat doen wij als OG ook absoluut niet. Risicovolle werkzaamheden zou ik dan bijvoorbeeld wel controleren.

2.11 4U: Jazeker gaat hier kennis verloren. Vaak zie je dat hoe groter de projecten worden, dat die fases echt opgeknipt worden. Dan leveren we als ingenieursbureau een bepaald contract op, maar daar gaat nog wel eens wat kennis verloren. Ontwerpkeuzes moeten dan bijvoorbeeld wel goed worden vastgelegd, dat is echt belangrijk. Dat gaat steeds beter, maar het kan absoluut nog steeds veel beter dan wat nu gebeurd.

2.12 4U: Ik hoop dat de hoofdaannemer dit soort controle mogelijkheden wel uitvoert en dat

2.12	hij die beheerst. En ik denk ook wel dat die controle plaatsvind, ik kan me niet voorstellen dat dat niet gebeurd want anders zou er gigantisch veel misgaan. Ik denk niet dat je twee onderaannemers blind kan vertrouwen, zonder daar een rol in te spelen als hoofdaannemer. Ik zou ook nooit dit soort aspecten aan een onderaannemer laten, de hoofdaannemer staat gewoon boven hem op de ladder dus die moet dat gewoon doet. Dus je moet altijd bij de hoofdaannemer aankloppen voor dit soort dingen, ook al doet de onderaannemers iets fout. Het is aan de hoofdaannemer om vervolgens goed door de onderaannemer uit te laten voeren.

3. Schijnveiligheid	
Vraag	**Antwoord**
3.1	4U: SCB kan heel erg op afstand worden toegepast, maar het kan ook meer een mix zijn in de zin van dat je processen toetst, en ook gewoon veel op het werk komt. Dan weet je echt wat er in een project gebeurd. Ik ben voorstander van dat laatste, mocht je het nog niet doorhebben, waarbij je niet alleen maar op afstand blijft. Je houdt dan echt een vinger aan de pols. Je kruipt wat dichter tegen de aannemer aan om bepaalde dingen af te stemmen. Maar tegelijkertijd laat je de verantwoordelijkheden wel zoals ze zijn. SCB is niet een soort van vinkje he, dat een OG gewoon zet. Dus die quote, die klopt niet helemaal. Zo denk een OG niet. SCB is echt een soort van methodiek om te kunnen kijken of de aannemer het werk wel allemaal beheerst. Dat geeft alleen geen garanties. En het kan ook geen garanties geven. Er kan altijd iets mis gaan, that's life. Er zijn altijd risico's. Als je als OG op afstand blijft, dan is de vraag of je wel goed hebt kunnen toetsen. Dus dan zeg ik: kruip gewoon dichter tegen die aannemer aan om een beter gevoel te krijgen voor wat er daadwerkelijk gebeurd buiten. Daar wordt je zelf als OG ook een stuk geruster op.
3.2	4U: Een aannemer moet al gauw met zijn V&G dossier aankomen als het werk gegund is. Dan kun je niet meer heel lang accepteren als OG dat de aannemer zegt van "die omgevingsveiligheid, daar kom ik later wel op terug". Dan moet je die aannemer gewoon zo snel mogelijk die omgevingsveiligheid laten borgen, planmatig. De vraagspecificatie omtrent het V&G dossier, en ook de fase waarin we verwachten van de aannemer dat hij dat V&G dossier indient, dat we dat allemaal wel geborgd hebben. Dus ik denk dat hier wel genoeg focus op ligt.

4. Toekomstige situatie	
Vraag	**Antwoord**
4.1	4U: Wie bedoel je met een onafhankelijke partij? SV: een partij die niet betrokken is bij dit project aan de zijde van de OG of ON. 4U: Maar wie gaat zn hand daar voor in het vuur steken? Eigenlijk zegt die partij dan "ik ben onafhankelijk en ik zal het wel even regelen", maar die kan dat risico toch niet plaatsvervangend dragen? SV: Maar nu ga je er al vanuit dat de aannemer op die onafhankelijke partij gaat leunen, terwijl het dient als een extra controle mechanisme voor dat proces van risicomanagement.

4.1 4U: Maar SCB lijkt me dan een vergelijkbare tool. Maar het ligt er dan natuurlijk wel aan hoe je SCB gebruikt als OG. Ik denk dat je het kunt dekken met SCB inderdaad, mits je het juist uitvoert. Ik denk dat W+B vaak al die onafhankelijke partij is, die dan wel betaald wordt door de OG maar wel soort van onafhankelijk is. Want het kan ook zijn dat een RHDHV een contract opstelt, dat de gemeente dat contract op de markt zet, en dat ze dan W+B inzet als SCB partij. Dus dan hebben we geen voorkennis of wat dan ook. Dat gebeurd ook. Het controleren kan je ook met SCB d.m.v. audits, of bouwteamoverleggen. Daar mee kan je dan ook bijsturen. En het is inderdaad belangrijk dat het niet alleen op papier goed werkt, maar ook buiten tijdens de uitvoering. De aannemer is in de basis ook verantwoordelijk dat hij zelf die risico's waar hij invloed op heeft, dat hij die beheerst. Ik vind het dan een beetje vreemd om te zeggen dat jouw onafhankelijke partij dan kan zeggen dat de aannemer mee moet werken. Die aannemer moet dat gewoon zelf uitvoeren.

SV: Maar nu denk jij natuurlijk sterk binnen het UAVgc kader, waar de aannemer dat inderdaad zelf uitvoert. Maar als je dat idee los laat. Loslaten hoe het nu werkt.

4U: Dat vind ik lastig, want de voorwaarde die onder een project hangen, dat is gewoon de basis van waar de taken en verantwoordelijkheden liggen. Dus dan kan ik dat lastig loslaten, het is moeilijk voor te stellen. Het is in het belang van de OG dat de ON de risico's beheerst.

SV: Okay ik ga de vraag anders stellen. Die type OG die we eerder beschreven als de OG die alleen komt om het lintje door te knippen en SCB amper toepast, denk je dat die type OG niet meer zouden mogen voorkomen?

4U: Ik weet niet of het afgeschaft zou moeten worden, of niet meer zou moeten mogen voorkomen, maar ik denk wel absoluut dat er iets misgaat wanneer er maar beperkt SCB toegepast wordt.

Over die verantwoordelijkheidsverdeling, tussen onderaannemers is dat zeker een goed punt, dat raakvlakmanagement moet wel op orde zijn. Maar dat is nu ook een risico, en dat probeert een aannemer zeker te beheersen.