



Norwegian University of  
Science and Technology

# Implementation of HSE Management Practices at Construction Sites in Developing Countries

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Submission date: June 2016

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## **Project Assignment**

The objective is to investigate and evaluate HSE methods implemented by the Client to ensure good safety results in construction projects in a developing country. The work will focus on the following areas:

- Management of safety in work with severe accident potential
- Management of HSE compliance through observations of Contractor
- Initiatives to ensure employee HSE engagement

Main activities:

1. Define relevant research questions and research processes to respond to the assignment
2. Review of relevant literature within the management of safety on construction sites and on national cultural differences of significance to the management of safety
3. Review Statkraft's and the Project's expectations to the HSE activities within the identified areas and how these have been defined in methods for the management of HSE on construction sites
4. Execute empirical studies of a construction project regarding relevant HSE activities and results thereof and effect of prevailing frame conditions
5. Compile the findings from the literature and the empirical studies
6. Assess current methods and recommend changes to improve the results

## **Preface**

The research presented in this project is written during the spring semester of 2016. It is the master's thesis for the MSc program Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU). The specialization for the master is health, safety and environment (HSE). The project is the final product in the subject TIØ4925 Safety, Health and Environment Master's Thesis.

The master's thesis is written in collaboration with Statkraft. Statkraft is interested in investigating and evaluating HSE methods implemented at one of their hydropower construction projects in Albania.

Frist of all, I would like to thank my supervisor, Urban Kjellén, for his supportive supervision and sharing of his professional and academic knowledge. He has provided me with good assistance in structuring my master's thesis and organizing my work.

I would like to thank Statkraft for providing me with this great opportunity to conduct my research in collaboration with one of their construction projects in Albania. These past months of writing my master's thesis have been highly educational with interesting discoveries, which I hope will be valuable to Statkraft. I would especially like to thank Jan Arild Berget, VP HSE in Statkraft International Hydropower, for his support and interest in my work. I would also like to thank Wayne Warr and the rest of the site team at the Moglice Hydropower Project for helping me collecting my field data and making my stay at the project a memorable experience.

Trondheim, 10.06.2016



Ane Hassel

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Ane Hassel

## **Abstract**

The objective of this master's thesis was to investigate and evaluate HSE management practices implemented by Statkraft in a construction project in a developing country where the frame conditions are different from the Western countries where they have been developed. To evaluate the HSE methods, a case study approach was utilized by using one of Statkraft's construction projects, the Moglice Hydropower Project, in Albania as a case.

The HSE methods assessed were 1) management of safety in work with severe accident potential, 2) management of HSE compliance by the Client's site team through inspections of Contractor's work and 3) initiatives to ensure employee HSE engagement. For the management of safety in hazardous work, road transportation, tunnelling and lifting operations were selected as hazardous work cases. Of the initiatives to ensure employee HSE engagement, JSAs, RUOs and toolbox talks were addressed.

The HSE methods have been evaluated by following the principles of evaluation research. In the evaluation, the level of implementation, immediate effect, intermediate effect and long-term effect was assessed whenever possible. To evaluate the level of implementation, the Client's requirements in the contractual documents and in the Contractor' and the Project's own procedures served as evaluation criteria.

The mini- audit carried out of Contractor's management of safety in hazardous work showed that some of the requirements have not been implemented in the project. From behavioural sampling performed on the hazardous work cases, it was discovered that safety rules were not always complied with and that the supervision and enforcement schemes were considered insufficient. The evaluation of the Client's site team's approach for carrying out safety inspections showed that the Client's site team has failed in terms of implementing the Client's requirements in their written safety management system and in the project. Due to a low level of implementation of medial actions, it is concluded that the immediate effect of the safety inspections is low. From the evaluation of Contractor's initiatives to ensure employee HSE engagement, it became apparent that there is a solely top- down communication between managers and workers and that engagement of workers in HSE issues in the project is almost non- existing.

The gaps identified in the evaluation were discussed in light of external and internal factors influencing the implementation of the safety management system. It became apparent that internal factors had a larger influence on the gaps identified than external factors and that

the level of implementation and the quality of the execution to a large extent were depending on individuals. Of the internal influencing factors, management support, personal motivation, appropriate supervision, enforcement scheme, personal competence and program evaluation stood out. Of the external factors, national culture seemed to have an influence on the workers' participation in HSE matters. Albania's economic situation also seemed to influence the quality of both the Client's and Contractor's safety inspections, as there is a lack of experienced and qualified HSE personnel in the country.

A further analysis of how external and internal factors influenced the HSE methods showed that external factors in developing countries such as national regulations and authority handling, national culture and national economic wealth, often seem to make the internal factors such as management commitment and safety prevention and control systems more prominent. When implementing safety management practices at construction sites in developing countries, the establishment of training programs and strict supervision is even more important as the workforce often consists of unskilled workers. As developing countries are often characterized by high power distance and masculinity, lifesaving safe rules and incentives for RUOs and safe behaviour should be established.

## Sammendrag

Hensikten med denne masteroppgaven var å undersøke og evaluere HMS-metoder implementert av Statkraft for å forsikre gode sikkerhetsresultater på en byggeplass i et utviklingsland, der rammebetingelsene er annerledes enn der de opprinnelig ble utviklet. For å gjennomføre dette, har det blitt benyttet et casestudie-forskningsdesign der et av Statkraft sine prosjekter, Moglice HPP, i Albania ble benyttet som caseprosjekt.

HMS-metodene som ble evaluert er 1) sikkerhetsledelse i arbeid med stort ulykkespotensial, 2) forsikring av etterlevelse gjennom inspeksjoner av entreprenør og 3) initiativer for å forsikre arbeidernes medvirkning i HMS-arbeidet. I evalueringen av sikkerhetsledelse i arbeidsaktiviteter med stort ulykkespotensial ble transport, tunnelarbeid og løfteoperasjoner benyttet som caser. Av initiativene for å forsikre arbeidernes medvirkning i HMS arbeidet, ble evalueringen begrenset til å gjelde sikker jobb analyse (SJA), rapportering av uønskede hendelser (RUH) og HMS-møter ”på gulvet” (toolbox talks).

I evalueringen av HMS-metodene har prinsippene for program evaluering blitt benyttet. Praksisenes grad av implementasjon, umiddelbar effekt, mellomliggende effekt og langtidseffekt har blitt evaluert. For å vurdere HMS-metodenes grad av implementasjon har byggherrens krav i kontraktdokumentene og entreprenørens og prosjektets interne prosedyrer blitt benyttet som evalueringskriterier.

Mini-revisjonen av entreprenørens ledelse av sikkerhet i arbeid med stort ulykkes potensiale har avdekket at visse krav ikke har blitt implementert på prosjektet. På bakgrunn av observasjoner av adferd (behavioural sampling), ble det avdekket at sikkerhetsregler ikke alltid ble fulgt og at håndhevelsen av sikkerhetsregler ikke var tilstrekkelig. Evalueringen av prosjektteamets sikkerhetsinspeksjoner viser at de ikke har lykkes med å implementere byggherrens krav i deres interne sikkerhetsledelsessystemer. Grunnet lav grad av implementering av korrigerende tiltak, konkluderes det med at den umiddelbare effekten fra sikkerhetsinspeksjoner er lav. Evalueringen av entreprenørens initiativer for å forsikre arbeidernes HMS-medvirkning viste at det er en utelukkende ovenifra-og-ned-kommunikasjon mellom ledelsen og arbeidere og at arbeidernes medvirkning i HMS-saker er så godt som ikke-eksisterende på prosjektet.

Gapene identifisert i evalueringen ble diskutert i lys av interne og eksterne faktorer som påvirker implementeringen av et sikkerhetsledelsessystem. Det fremgikk at interne faktorer hadde større innflytelse på funnene enn eksterne faktorer og at graden av implementering samt kvaliteten på utførelsen i en stor grad avhenger av individer. Av de

interne faktorene var ledelsesengasjement, personlig motivasjon, overvåking, håndheving av regler, personlig kompetanse og evaluering av sikkerhetsledelsessystemet spesielt viktige. Av de eksterne faktorene virket nasjonal kultur å ha en innvirkning på arbeidernes medvirkning i HMS. I tillegg så Albanias økonomiske situasjon ut til å påvirke resultatet i en stor grad, ettersom det er en stor mangel på erfarne og kvalifiserte HMS-arbeidere i landet.

En videre analyse av interne og eksterne faktorer som påvirket HMS-metodene avdekket at eksterne faktorer slik som nasjonale reguleringer og håndheving av myndigheter, nasjonal kultur og økonomisk velstand ofte gjør at interne faktorer som ledelsesengasjement og kontrollsystemer blir mer gjeldende. Ved implementering av HMS-ledelsespraksiser på byggeplasser i utviklingsland viser det seg at etablering av treningsprogrammer og streng overvåking gjennom inspeksjoner er enda viktigere enn i industrialiserte land på grunn av en stor andel av ufaglærte arbeidere. Ettersom utviklingsland ofte kjennetegnes av høy maksavstand og maskulinitet, burde det etableres livreddende sikkerhetsregler og incentiver for rapportering av uønskede hendelser og sikker adferd.



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## **Abbreviations**

HSE	Health, Safety and the Environment
WHO	World Health Organization
RUO	Reporting of Unwanted Occurrences
LTI	Lost Time Injury
TRI	Total Recordable Injuries
SMS	Safety Management System
TMTP	Traffic Management and Transportation Plan
PPE	Personal Protective Equipment
RAMS	Risk Assessment and Method Statement
TBM	Tunnel Boring Machine
HPP	Hydro Power Project
ISO	The International Organization for Standardization
JSA	Job Safety Analysis
ILO	International Labour Organisation

# 1 Introduction

The objective of this master's thesis is to investigate and evaluate HSE management practices implemented by the Client and the Contractor to ensure good safety results in a construction project in a developing country where the frame conditions are different from in which they were developed.

Due to an early phase of economic development, developing countries tend to invest in large infrastructure projects to produce electricity (Kjellén, 2016b). Compared to other industries, the construction industry is one of the riskiest businesses to work (Albrechtsen, Wasilkiewicz, & Tinmannsvik, 2015). According to the International Labour Organisation (ILO), the construction industry accounts for approximately 30- 40 % of the world's fatal injuries, but only accounts for 7 % of the world's employment. In developing countries, it is assumed that the risk associated with construction is 3 to 6 times greater than in other industries (Gürcanli & Müngen, 2013). It is assumed that 98 % of the world's future population growth will occur in developing countries which will put pressure on the output and the employment in the construction industry (Murie, 2007).

The HSE management practices to be investigated and evaluated in this master's thesis are selected due to Statkraft's concerns for the management practices in the particular project and Statkraft's experiences from in- depth investigations of fatal accidents in construction projects.

Statkraft has a large and detailed accident database, which allows for filtering out some work activities that statistically and historically have been more accident-prone. Between 2006 and 2014, Statkraft recorded 112 serious injuries (Berget, 2015). By performing an analysis of these injuries, it is apparent that 80 % have come from six different types of work activities as shown in

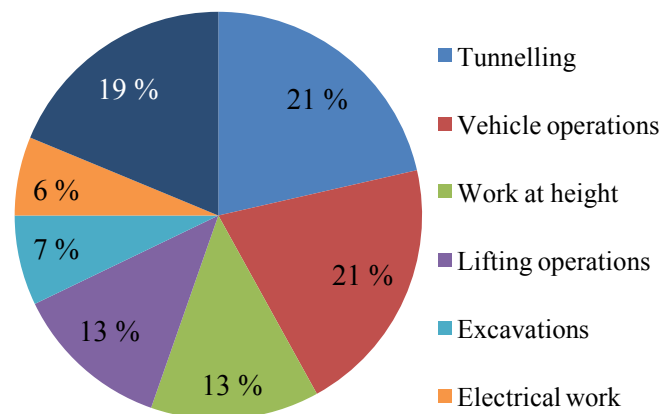


Figure 1 Distribution of severe injuries occurred at the Client's company sorted by work activity (N=112) (Berget, 2015)

Figure 1. This allows the possibility to decrease the number of severe accidents by focusing on the management of safety in certain work activities that are considered more hazardous. On this basis, the Statkraft is interested in evaluating the Contractor's management of safety in work with severe accident potential.

Next, Statkraft is interested in investigating and evaluating how they as a Client work to achieve HSE compliance in the hazardous work activities through inspections of Contractor's work. From previous projects, they have experienced that their Site teams often do not have any systematic approach in their work and that their methods of work do not differ from the Contractor's. They have experienced that the findings from the inspections are too narrow and concentrate on technical and human errors, which are easily observable. Often, the remedial actions proposed from the inspections are often limited to correction of deviations. In addition, it is an issue that remedial actions are not implemented.

Evaluation of initiatives to ensure employee engagement was added to the master's thesis on Statkraft's request. Statkraft has developed a system for the reporting of unwanted occurrences (RUOs) with the main intention of engaging workers in HSE matters. However, the monthly reports received from the project have shown a poor RUO- rate. Therefore, Statkraft is interested in investigating Contractor's engagement of workers in HSE issues further.

### ***1.1 Research Questions***

To answer the project assignment, an analytic model based on evaluation research was developed (Chapter 4.2). Based on this, the following research questions have been defined:

1. Which factors may influence the implementation of a safety management system at a construction site in a developing country?
2. To what extent have the Client's requirements to the studied HSE methods been implemented in the project?
3. What are the immediate, intermediate and long-term effects of the assessed HSE methods?
4. Are there any gaps between the Client's requirements and expectations to the implementation of the HSE methods and how this actually has been executed?
5. How may identified gaps be explained in light of prevailing frame conditions (ref. question 1)?
6. Which considerations should be taken into account when implementing HSE methods in a constructions site in a developing country?
7. Based on an overall analysis, how can the selected HSE methods be improved to increase the overall safety on the studied site?



## ***1.2 Limitations***

This master's thesis is limited to the construction of the Moglice Hydropower Project. For the assessment of the HSE practices, only the construction phase of the project has been taken into consideration. Data collection was performed for a period of three weeks and the findings in this report only represents a snapshot of the project.

For the evaluation of Contractor's management of safety in hazardous work, road transportation, tunnelling and lifting operations has been selected as hazardous work cases. For the evaluation of the Client's management of HSE compliance through observations of Contractor, it has been chosen to focus on the follow- up of Contractor through safety inspections. For the third part of the assignment regarding initiatives to ensure employee HSE engagement, RUOs, toolbox talks and job safety analysis (JSA) have been addressed. It became evident in the collection of field data that the RUO- system and JSAs had not been implemented in the project. Consequently, this part of the assignment related to employee engagement became less extensive than originally intended and it was decided to put an extra focus on the first and second part of the assignment.

Since the majority of the construction workers in the project were of Albanian nationality, the analysis of influencing factors is limited to Albanian workers.

## ***1.3 Scientific Research Approach***

The main objective of the master's thesis is to investigate and evaluate HSE management practices as implemented by the Client and Contractor to ensure good safety results on a construction site in a developing country. For the evaluation, a case study approach has been utilized to develop a deeper understanding of the case assessed. According to Baxter & Jack (2008), a case study is an approach to research which exploits a phenomenon within its context using a variety of data sources. For the case study performed in this master's thesis, a mixed method research approach using both qualitative data (interviews, observations, document reviews) and quantitative data (questionnaire) have been utilised.

A case study research design should be considered when you want to cover contextual conditions because you believe they are relevant to the phenomenon studied or the boundaries are not clear between the phenomenon and context (Yin, 2013). In this master's thesis, we are interested in examining the influence of prevailing frame conditions on the HSE methods.

## 2 Case Description

This master's thesis is written in collaboration with Statkraft, hereafter referred to as the Client. Statkraft is Europe's largest producer of renewable energy and an international hydropower company. The company has 4200 employees in more than 20 countries (Statkraft, 2016).

### 2.1 Introduction to the Case Project

The project company, Devoll Hydropower, is 100 % owned by Statkraft and is located in the Devoll Valley in the Southeast of Albania by the Devoll River. The project has identified three potential hydropower plant developments, Banja, Kokel and Moglice, with an estimated construction time of six years. The plans for developing the Devoll River and the construction of Banja initially began in the 1980s by the Albanian authorities, but the project was abandoned in 1995. As of today, the construction of the Banja and the Moglice hydropower plants are ongoing, while Kokel will be subject for re-evaluation in 2017. It is expected that the completed project will increase the Albanian electricity production by almost 17 % (Linnerud, 2016; Statkraft, 2014).

The master's thesis is limited to the construction of the Moglice hydropower plant. Table 1 summarises some key facts about the project. As of February 2016, approximately 15 % of the total construction work was completed. The remaining construction work consists of the dam, spillway, intake, the power station, all electromechanical equipment and approximately 80 % of the tunnel work. Principle Contactor for the work is a Turkish construction company, Limak-AGE Joint venture, from now on referred to as the Contractor (Linnerud, 2016).

*Table 1 Salient features of the Moglice hydropower plant (Devoll, 2013)*

Type of project	Greenfield
Location	Devoll Valley, South- East Albania
Construction period	2014-2019
Maximum gross head	300 m
Nationality of project and contractor management	International and Albanian management in the Client's project team. Turkish management for the Principle Contractor.
Nationality of workers	Approximately 80 % Albanian and 20 % Turkish
Number of employees (as of March 2016)	592 for Civil contractor and 194 for subcontractors

Design discharge	65 m <sup>3</sup> /s
Installed capacity	184,4 MW
Average production	474 GWh/year
Powerhouse location	Underground
Contract strategy	Six main contractors, Civil contractor appointed as Principle Contractor.
Tunnels	1400 m
Site access roads	50 km

## 2.2 Client's Main HSE Concerns

Hydropower construction projects generally consist of a large proportion of civil works, followed by installation of electrical and mechanical equipment and hydraulic steelworks. In Figure 2, the distribution of fatalities in the Client's company is displayed sorted by incident type. The statistics are based on experience from nine Greenfield projects in South- east Europe, Asia and South America with an accumulated construction period of 30 years.

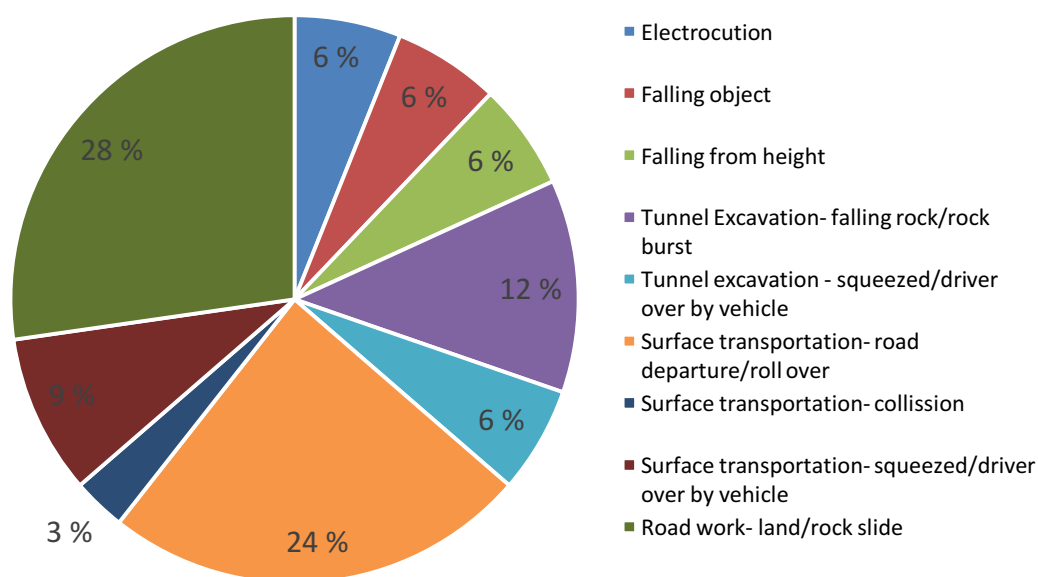


Figure 2 Fatalities from hydropower construction projects (N=33)

The fatal accidents are dominated by road transportation (N=12), where road departure constitutes the largest proportion of the traffic accidents. As can be seen from the figure, road works (N=9) also represents an activity with a large share of fatalities in the Client's company. The third largest constitution of fatal accidents are from tunnelling (N= 6), where four of the fatal accidents are due to falling rock and two from workers being squeezed or driven over by a heavy mobile machinery.

### 2.3 Client's Approach for Safety Management in Construction

The Client has developed a project management system called "PROMAS IH". It is a systematic approach to organize, plan, control and manage the Company's value chain (Kjellén, 2011). Management of HSE in construction projects is an integrated part in all of the project phases in PROMAS IH. Figure 3 from PROMAS IH illustrates these main phases in the Client's value chain.

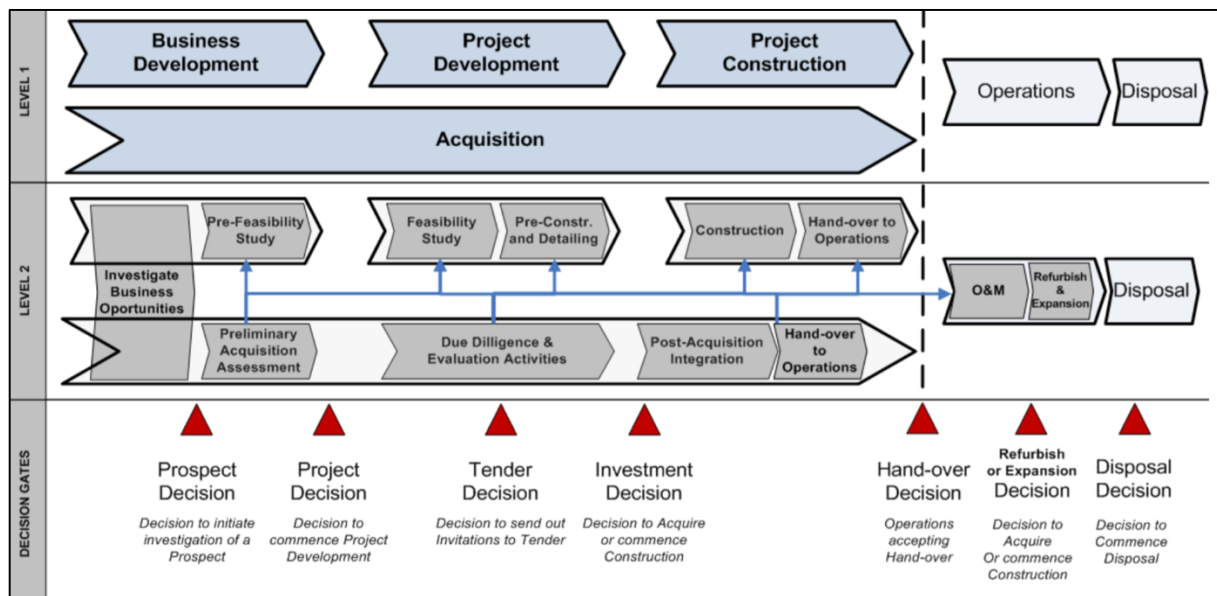


Figure 3 Business processes in Statkraft's value chain (Statkraft, 2015)

For managing health and safety in construction, the Client has developed two documents that are central to this master's thesis:

1. Specification for Contractor's Management of HSE at Construction Sites
2. Management of HSE in Field Investigation and in Manufacture and Construction of Plant

The first document is directed towards the Contractor's management of HSE during construction and is included as a part of the contract between the Client and the Contractor. In the specifications, the Client requires the Contractor to establish a HSE program for the works, based on the guidelines in OHSAS 18001:2007 and additional Client requirements. In addition, documented safety procedures shall be in place for all potential hazardous activities, based on risk assessment. The document also lists general requirements regardless of work activity, such as risk assessments, method statements, job training, supervision, toolbox talks etc. (Statkraft, 2012). The majority of the requirements are functional requirements. More detailed requirements are posed towards specific types of work, based on the Client's experience in earlier projects. A key issue in the specifications is that one

Contractor, usually the Civil Contractor, is appointed as the Principle Contractor. The duties of the Principle Contractor are to have the overall responsibility for coordinating the work at site so that the provisions in the Contractor's HSE program are complied with.

The second document is directed towards the Client's project site organisation. The procedure describes the principles and practices for managing health, safety and environment (HSE) in field investigations and in manufacture and construction of hydropower plants.

Before site establishment, the project shall establish an organisation for the management of HSE with a qualified HSE manager. The Client's HSE organisation in the project will be referred to as the Client's site team throughout this master's thesis, while the Client's HSE team at the head office in Oslo will be referred to as the Client's HSE team. During construction, the Client's site team's duties are to carry out HSE inspections at site, include HSE issues at construction management meetings, follow up the environmental management, follow up of emergency response and carry out audits of the implementation of the safety management program.

In the procedure directed towards the Client's site team, it is required that they establish a HSE management program that describes the requirements, responsibilities and routines for following up on the contractors on HSE in construction. The procedure poses requirements towards the follow up on HSE through inspections, which have been further elaborated in Chapter 7.2 where the Client's approach for follow up on HSE compliance through inspections has been evaluated.

#### ***2.4 Principle Contractor's Approach to Safety Management in Construction***

To fulfil the requirements posed by the Client, the Contractor has established their own HSE team. Their duties are to carry out and document risk assessments, obtain required authority permits, carry out audits of the subcontractors, perform HSE inspections and ensure that the safety management system required is implemented in the project.

The Contractor has established a health, safety and environmental (HSE) program for the works. In addition, the Contractor has developed documented HSE procedures and method statements for potential hazardous work activities. For the hazardous work cases focus of this thesis, the content of these documents has been described more detailed in Chapter 7.

According to the HSE program, toolbox talks shall be carried out to ensure that all personnel are aware of specific hazards in their work area. In addition to the general HSE induction training, job specific training is to be provided depending on the risk assessments

and method statements. The HSE program also states that all the activities carried out by the Contractor and Sub Contractors shall be closely monitored by site supervisors and engineers, as well as the HSE team to ensure compliance with HSE rules.

The Contractor's HSE team carries out daily site inspections. HSE Supervisors are present on site where work is being performed and records hazardous situations for all work activities going on at that area. The majority of the Contractors HSE inspectors have not experience in working with HSE from previous employment. However, according to the Contractor's HSE team, all the HSE inspectors are given training by professional companies in scaffolding, first aid, rigging, lifting operations etc. Contractor's supervision of the selected hazardous work cases for this fieldwork has been described in more detail in Chapter 7.1.

### 3 Literature Basis for the Selection of Method

#### 3.1 Evaluation Research

For the evaluation of the HSE methods implemented by the Client and the Contractor, the principles of evaluation research have been utilized. There is no commonly agreed definition of evaluation research, sometimes referred to as program evaluation. The common denominator is that it refers to systematic application of social research procedures to evaluate the effectiveness of a program and to provide feedback to improve the program (Clarke & Dawson, 1999).

Interventions in the management of health and safety are often implemented with a lack of knowledge about their effectiveness (Shannon, Robson, & Guastello, 1999). In order to evaluate a safety management program, the level of implementation, immediate effect and final outcome should be measured (Shannon et al., 1999).

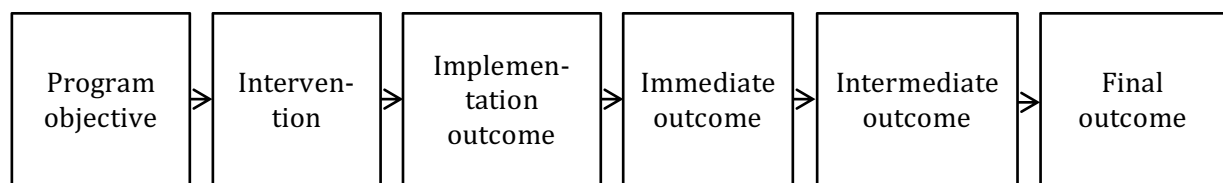


Figure 4 Systematic overview of the relationship between program objectives, intervention and outcomes (Shannon et al., 1999)

The measurement of the final outcome of the intervention must be appropriate to the intervention's objective (Shannon et al., 1999). For instance, when the overall objective of the HSE methods is directed towards injury prevention, a natural measure for the final outcome would be the frequency of injuries.

A safety program is only as effective as its degree of implementation. Measurements of the implementation of a program is especially interesting if no effect is observed (Shannon et al., 1999). Even if an intervention seems implemented as planned, evidence of this should be documented. However, if the level of implementation is poor, a comprehensive evaluation may not be worth pursuing (Verbeek, Hulshof, van Dijk, & Kroon, 1992). To determine if the safety management system in place is adequate to protect the health and safety of workers, it has to be subject of regular audits. A gap analysis is a process where a company's actual compliance and performance is compared to the requirements in the company's standards. It is often spoken of as "the space between where we are and where we want to be" (Lutchman, Maharaj, & Ghanem, 2012).

According to Shannon et al. (1999), the immediate outcome of a safety program is the increase of knowledge. Intermediate outcomes, such as measures of behaviour, should be measured even when the final outcome is measured by using injury rate. The intermediate outcomes should be exploited to reveal the relationship between an intervention and the final outcome (Shannon et al., 1999). For instance, if one finds that a project experiences few injuries after an intervention involving increased frequency of safety inspections, but that the measures identified in the safety inspections have not been implemented, it would be unlikely that the safety inspections has improved the safety performance.

### ***3.2 Actions Research***

As discussed later in Chapter 9.2, some changes in the HSE methods took place during the collection of field data, which had some implications on the outcome of the evaluation of them. These changes and their possible effects are here discussed from the perspective of action research.

The Hawthorne effect, sometimes referred to as the observer effect, describes the type of phenomenon in which individuals modify or improve their behaviour in response to their awareness of being observed (Fox, Brennan, & Chasen, 2008). The phenomenon was discovered during experiments conducted at the Western Electric Company in the 1920s, where the aim of the experiment was to investigate how physical factors such as illumination, influenced worker productivity. The experiment concluded that phenomena of paying attention to the workers was responsible for the increase in productivity, rather than the level of illumination as expected (Smith & Coombs, 2003).

In traditional social research, the term ecological validity concerns whether the findings from the research are valid for people's everyday settings. The perception is that the more natural the setting, the more ecologic valid are the results (Bryman, 2015). In more recent times, this research paradigm has been challenged (Smith & Coombs, 2003). According to Hayes and Stratton (2013), it is naive to assume that the activities performed by the researcher will not influence the behaviour of the subjects. Therefore, action research takes the idea that the presence of and observer will always affect behaviour. A researcher within action research will therefore deliberately act as a change agent within the given situation and incorporate the effects of these actions in the outcome of the study (Hayes & Stratton, 2013). In action research, the real world is the researcher's laboratory and the actions researcher attempts to achieve a positive change within the unique research situation, rather than achieving replicable results (Smith & Coombs, 2003).



## 4 Method

### *4.1 Work Flow for Solving the Project Assignment*

Figure 5 shows the method used for solving the project assignment and the resulting work flow. In the development of the method, it was emphasized that:

1. The method was to be based on evaluation research
2. The workflow and the resulting structure of the report was to be based on a traditional structure for research reports
3. Theory, empirical findings from the field study and evaluations shall be separated as far as possible

The process started with an introduction to the construction project used as a case study for this thesis and a document review of Statkraft's specifications for managing safety in the construction phase.

Next, a literature review on evaluation research, action research and on the HSE methods was performed to develop a method for solving the task and familiarize the reader with relevant literature on the HSE methods. A literature review was also performed on internal and external factors influencing the implementation of a safety management system.

The collection of field data was performed during a period of 19 days at one of the Client's construction projects in Albania. Document reviews, observations, interviews, a survey and mini-audits were used to collect field data. The collection of field data has been further described in Chapter 4.3.

Based on the results from the field study, the HSE methods were evaluated and the findings were discussed in light of the existing frame conditions in Albania representing a developing country. Further, the method utilised in this master's thesis was discussed. Based on the principles of action research, it has been discussed whether the evaluation of the HSE methods itself had any effect on safety in the project during the time of observation. Finally, recommendations for the Client and the Contractor on how the HSE methods can be improved to increase the overall safety performance on site have been proposed by the author.

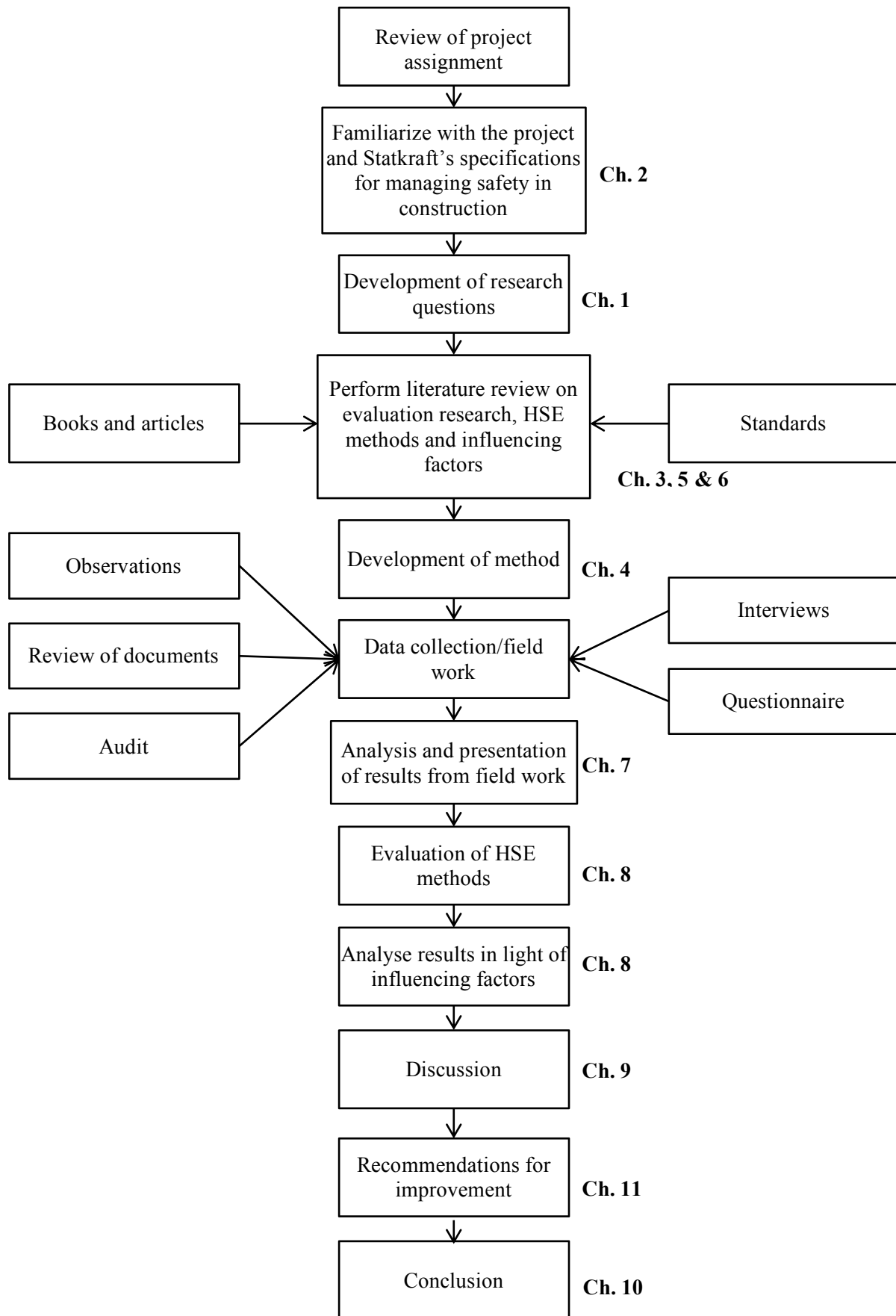


Figure 5 Systematic approach for solving the project task

## 4.2 Analytic Model for the Empirical Part of the Master's thesis

The analytic model for evaluating the HSE methods in the case project is shown in Figure 6. The model is based on the principles of evaluation research presented in Chapter 3.1 and research questions 2 and 3 defined in Chapter 1.1.

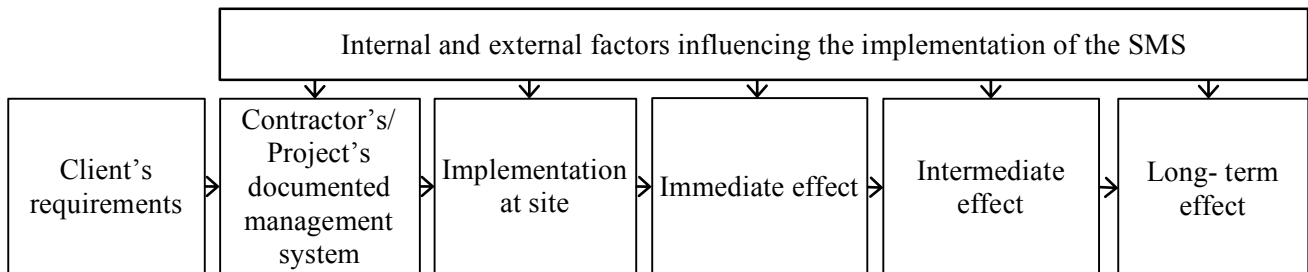


Figure 6 Analytic model for the evaluation of the HSE methods

Prior to the evaluation of the HSE methods, an analysis of internal and external factors influencing the implementation of the safety management system was performed. In able to obtain a more nuanced analysis, it was decided to utilise both findings from the literature review as well as field data from the project and thereby violate the principle of separating theory and empirical findings.

The evaluation of the HSE methods has followed the horizontal steps in Figure 6. First, the Client's requirements were defined for each of the HSE methods. Next, a review of how these requirements were translated into the Contractor or the Project's documented safety management system was performed. To evaluate the level of implementation a site, the Client's requirements and the requirements in the Contractor's management system were used as success criteria in a mini- audit. For the evaluation of the Site team's safety inspection, success criteria identified in the literature were also utilized.

The immediate and intermediate effects of the HSE methods were assessed whenever possible. To evaluate the immediate effect of the Client's site team's follow up on Contractor through inspections, an analysis of the status of the observations recorded was performed to assess whether remedial actions had been implemented. To evaluate the immediate effect of the remedial actions suggested, the remedial actions were evaluated by using Van Court Hare's hierarchy of level of feedback. To evaluate the immediate effect of Contractor's initiatives to ensure employee HSE engagement, the number of toolbox talks was used as a measure.

According to Shannon et al. (1999), behaviour should be measured to evaluate the intermediate outcomes. For the hazardous work cases, behavioural sampling was performed to

evaluate the intermediate effect of Contractor’s management of safety in work with severe accident potential. To evaluate the intermediate effect of the Client’s site team’s follow up on Contractor through inspections, a statistical analysis of the number of deviations recorded on a monthly basis was carried out.

Finally, the long-term effects of the HSE methods in the project were evaluated in an overall assessment by reviewing the project’s accident statistics and by carrying out a questionnaire.

### 4.3 Collection of Field Data

Data collection was performed at the Moglice HPP in Albania between the 28<sup>th</sup> of February and 19<sup>th</sup> of March 2016. Table 2, Table 3 and

Table 4 shows an overview of the different types of field data used to evaluate the HSE methods. In the following chapter, a description of the method for obtaining each type of field data has been given.

*Table 2 Overview of activities/field data used for the evaluation of Contractor’s management of hazardous work*

<b>Hazardous work activity</b>	<b>Client’s requirements</b>	<b>Contractor’s documented management system</b>	<b>Implementation</b>	<b>Intermediate effect</b>	<b>Long term effect (Chapter 7.4)</b>
<b>Case 1: Road transportation</b>	Review of specifications for Contractor’s HSE requirements	Review of Contractors HSE program and Traffic Management and Transportation Plan	Mini- audit to assess the level of implementation of the Traffic Management and Transportation Plan	Behavioural sampling on selected elements from the Clients requirements on road transportation safety	Review road transportation accident statistics
<b>Case 2: Tunnelling</b>	Review of specifications for Contractor’s HSE requirements	Review of Contractors HSE program, Tunnel Construction Health and Safety Plan and Method Statement	Mini- audit to assess the level of implementation of the Tunnel Construction Health and Safety Plan and Method Statement	Behavioural sampling on selected elements from the Clients requirements on management of safety in tunnelling	Review accident Statistics in tunnelling
<b>Case 3: Lifting operations</b>	Review of specifications for Contractor’s HSE	Review of Contractors HSE program, lifting equipment	Mini- audit to assess the level of implementation of the lifting equipment	Behavioural sampling on selected elements from the Clients	Review accident statistics on lifting operations

<b>Hazardous work activity</b>	<b>Client's requirements</b>	<b>Contractor's documented management system</b>	<b>Implementation</b>	<b>Intermediate effect</b>	<b>Long term effect (Chapter 7.4)</b>
	requirements	procedure and lift plan procedure	procedure and lift plan procedure	requirements on management of safety in lifting operations	

*Table 3 Overview of activities/field data used for the evaluation of Client's safety inspections*

	<b>Client's requirements</b>	<b>Contractor's documented management system</b>	<b>Implementation</b>	<b>Immediate effect</b>	<b>Intermediate effect</b>	<b>Long term effect</b>
<b>Client's follow up on Contractor through inspections</b>	Review of specifications for the Client's management of HSE	Review of the Client's site team's HSE management program and inspection plan	Mini- audit to assess the level of implementation of the Client's requirements	Document review: analysis of recorded deviations from inspections	Document review: Statistical analysis of monthly deviations recoded from inspections	Document review: HSE statistics

*Table 4 Overview of activities/field data used for the evaluation of Contractor's initiatives to ensure employees' HSE engagement*

	<b>Client's requirements</b>	<b>Contractor's documented management system</b>	<b>Implementation</b>	<b>Immediate effect</b>	<b>Intermediate effect</b>	<b>Long term effect</b>
<b>Employee HSE engagement</b>	Review of specifications for Contractor's HSE requirements	Review of Contractors HSE program	Mini- audit to assess the level of implementation of initiatives to ensure employee HSE engagement	Document review to assess the number of toolbox talks, RUOs and JSAs	-	Questionnaire on employee HSE engagement

Field data were also gathered for the analysis of internal and external influencing factors by use of interviews, a questionnaire, literature review as well as own observations.

### **4.3.1 Interviews**

For the interviews, a semi-structured approach was utilised where the interview subjects were sampled due to their direct relevance to the research questions. The interviews were performed in English, at times with a translator for the non-English speaking workers.

Because the author both worked and stayed at the project for three weeks, some of the information received is based on conversation rather than structured interviews.

During the interviews, notes were taken by the interviewer. It was decided not to use a tape recorder due to fact that many of the interviewees were from the Contractor’s company and the student was perceived as a representative from the Client. Due to privacy concerns, the interviewees have been divided into groups when being referred to in the text. An overview of the interview subjects are presented in Table 5.

*Table 5 Interviews and conversations within data collection*

<b>Company</b>	<b>Title of employee</b>
The Client	Head HSE manager
The Client	HSE coordinator
The Client	Project HSE manager
The Client	HSE officer
The Client	HSE officer
The Client	Project manager
The Contractor	HSE manager
The Contractor	Deputy HSE manager
The Contractor	Lead HSE inspector/administrator
The Contractor	HSE inspector
The Contractor	Tunnel engineer
The Contractor	Transportation manager
The Contractor	Crane operator
The Contractor	Construction manager
Consultant	Geologist
Consultant	Tunnel engineer

### **4.3.2 Observational Data**

To evaluate the intermediate effect of the HSE methods required by the Client, observations were performed on the hazardous work cases selected to evaluate Contractor’s management of hazardous work. The observations were performed in collaboration with the Contractor and the Client’s site team.

To conduct the observations, a technique called behavioural sampling was utilised to observe deviations from the accepted work practices. According to Kjellén (2000), measurements of HSE performance through the use of behavioural sampling includes the following steps:

1. Identification of critical behaviour

2. Selection of behaviour and establishment of behavioural sampling checklist
3. Inspection of the workplace at randomly selected intervals
4. Plotting the safety performance index in a control chart as a percentage of observed items that are considered correct or safe

Kjellén (2000) stresses that the selected items have to be easily observable and that the distinction between safe and unsafe behaviour must be clear. The items for the behavioural sampling checklist were taken from the various HSE procedures and method statements for the hazardous work and the code of practice “Safe Work in Tunnelling”, which the Contractor is obliged to follow.

For the behavioural sampling on road transportation, a total of 29 drivers were controlled on speed, use of seat belt and cell phone use while a total of 14 vehicles and drivers were inspected on technical equipment and driver’s license. In tunnelling, the checklist focused on the hazard of moving machinery and rock fall. During behavioural sampling, visits were made to the tunnels on 27 occasions. For work performed at the face of the tunnel, the work was observed for approximately 10 minutes. For the behavioural sampling on lifting operations, 14 lifting operations were witnessed on site. Of the 14 lifting operations, nine were witnessed at the tunnel-boring machine (TBM) assembling and five at the cement factory. For the lifting operations taking place at the cement factory, use of ropes to control the load, workers do not walk under the load and crane operator not leaving the cabin were not included in the behavioural sampling since the load was not lifted more than one meter from the ground and was controlled by a remote control.

### 4.3.3 Document Reviews

The purpose of the document review was to establish the Client’s requirements and to map the Contractor and Project’s approach to the HSE methods. In addition, the documents were used to establish criteria for the mini- audit to evaluate the implementation of Contractor’s management of safety in the hazardous work cases. The documents reviewed have been listed in Table 6 along with a description of the purpose of the review.

*Table 6 Review of documentation*

<b>Name of document</b>	<b>Owned by</b>	<b>Purpose of review</b>
Management of HSE in Field Investigations and in Manufacture and Construction of Plant	The Client	To establish the Client’s own requirements towards their site team on the follow up on Contractor during construction
Specification for	The Client	To establish the Client’s requirements to Contractor in

<b>Name of document</b>	<b>Owned by</b>	<b>Purpose of review</b>
Contractors Management of HSE at Construction Sites		terms of management of safety in hazardous work and employee HSE engagement
Contract- Civil Works	The Principle Contractor	To establish the Client requirements towards the Contractor's SMS and HSE program
Health, Safety and Environmental (HSE) Program	The Principle Contractor	To identify Contractor's requirements towards their management of HSE
Traffic Management and Transportation Plan	The Principle Contractor	To identify the requirements to ensure that the risk involved in road transportation are identified and controlled
RAMS - Underground Excavation Work by Drill and Blast	The Principle Contractor	To identify the method and sequence of drilling and blasting works and the equipment and personnel to be used for the works for the evaluation of Contractor's management of safety tunnelling
Drill and Blast Tunnel Construction Health and Safety and Emergency Rescue Plan	The Principle Contractor	To identify standards, procedures, responsibilities and precautions to be taken during tunnel construction for the evaluation of contractors management of safety tunnelling
Safe Working In Tunnelling	The Principle Contractor	For input to the behavioural sampling checklist in tunnelling
Method Statement- TBM Assembling Work	The Principle Contractor	To identify the process, procedure and steps for assembling the TBM for the evaluation of contractors management of safety in lifting operations
Lift Plan Procedure	The Principle Contractor	To identify the requirements for managing and controlling lifting operations for the evaluation of contractors management of safety in lifting operations
Lifting Equipment and Plant procedure	The Principle Contractor	To identify the methods for the use and inspection of all work machines and their equipment for the evaluation of contractors management of safety in lifting operations
Inspection Protocols	The Client	To evaluate the level of implementation of the Client's site team's follow up on the Contractor through safety inspections
Moglice HPP Event Report	The Client	To evaluate the long-term effect of the HSE methods by reviewing accident statistics
Moglice Observation Tracker	The Client	To evaluate the level of implementation and short-term effect of the Client's site teams follow up on the Contractor through safety inspections
Training Matrix	The Principle Contractor	To evaluate the Contractor's job specific training in the hazardous work cases tunnelling and lifting operations
Tool- box talk records	The Principle Contractor	To evaluate the Contractor's engagement of workers by the use of toolbox talks



#### **4.3.4 Survey**

A questionnaire was issued to Contractors construction workers with the intention of:

1. Assessing the long-term effect of Contractor's management of safety
2. Assessing the long-term effect of the initiatives to ensure employee HSE engagement.
3. To gather information on internal factors influencing the implementation of the safety management system

The questionnaire was translated and distributed in English, Albanian and Turkish. Since some of the workers had limited literacy skills, it was desirable to design the questionnaire to be as easy as possible. Due to concerns for privacy, the questionnaire was distributed in paper form and was 100 % anonymous. The questionnaire was issued to approximately 200 workers with 104 respondents, giving a respondent rate of 52 %. Of 104 respondents, 94 were valid.

According to Balbach (1999), a structured questionnaire is difficult to design for case study evaluation, due to the fact that the interviewer does not know enough about the case or the appropriate questions or answers. With this in mind and guidance from the author's supervisor, it was decided not to distribute a self-made questionnaire, but rather use an existing questionnaire on the subject as a basis. The questionnaire issued was based on a safety climate measure proposed by Dedobbeleer and Béland (1991) for construction sites. According to Dedobbeleer & Béland (1991), specific questions on workers' perception of management's safety commitment and workers' involvement and responsibility to safety should be assessed in surveys measuring safety climate. Questions regarding the frequency of health and safety consulting and reporting of hazardous situations were added to the questionnaire by the author.

To determine the level of management commitment, management's attitudes toward safety practices and workers' safety, the supervisors' behaviour, safety instructions and proper equipment were used as indicators. As an indicator of workers' engagement, toolbox talks, perceived control, perception of risk-taking and likelihood of injuries, reporting of hazards and consultation on safety matters were concerned in the questionnaire.

#### **4.3.5 Audit**

When assessing the level of implementation of the HSE methods, mini- audits were carried out. The audits performed in the assessment did not fulfil the formal requirements for an audit, but were based on the principles of audits. According to the ISO 19011:2011 Guidelines for auditing management systems, an audit is a "systematic, independent and

documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled” (ISO, 2011). According to the ISO 9001 for quality management systems, one of the main purposes for carrying out an internal audit is to check whether the management system has been effectively implemented and maintained. The audit technique consists of the collection of different types of field data in which triangulation (the process of drawing information from three independent sources such as interviews, observations and documentation) should be utilised in order to gather reliable audit evidence (ISO, 2015b).

#### ***4.4 Ethical Considerations***

Before the research began, a confidentiality agreement was signed with the case company, obliging the student to maintain confidentiality on issues that might endanger the company. During data collection, no personal information such as name, personal security number or other personal characteristics were stored.

During the fieldwork in Albania, some ethical considerations emerged. The first consideration that appeared was related to the author’s role as a researcher. Despite the fact that the author tried to present herself as a student researcher, the author was to some extent perceived as a representative from the Client. Therefore, it was at several occasions important to emphasize that the research was purely an academic exercise that was supposed to reveal useful information and understanding to both the Client and the Contractor. However, because the author lived and worked at the project and spent a lot of time with the research subjects, the situation became more intimate and trust was earned. After a while, some of the subjects even began to express their discontent.

On a few occasions during the interviews and conversations, the author experienced that some of the interview subjects both from the Client and the Contractor did not want to answer some of the questions due to fear of criticizing their management. This came as a bit of a surprise to the author, who subsequently adjusted some of the questions to avoid the discomfort of the interview subjects.

During the evaluation of the implementation of the HSE management practices, it was particular important to have a gentle approach, as some may have experienced that they were checked if they were doing their job properly. Especially in the case of the construction workers, who were clearly anxious when the Client’s managers approached them, it was important to start the conversation by stating that they had not done anything wrong and that the questions or observations did not pose any consequences to them.

## **5 Literature Review on HSE Methods**

In this master's thesis, a distinction has been made between the term Safety Management and Management of Safety. While the first term concerns the systematic and structured approach to management occupational risk, management of safety also includes elements such as quality assurance. All of the assessed HSE methods in this thesis are elements of management of safety.

### ***5.1 Work with Severe Accident Potential/Hazardous Work***

An accident is defined as an acute, unwanted and unplanned event or chain of events that leads to loss of human life, or injury on health, environment or other assets/values (Rausand & Utne, 2011). In this master's thesis, we are only concerned with accidents involving people.

According to Rausand (2013), it is often useful to classify the consequences of an accident according to severity class. Since this master's thesis focuses on work with severe accident potential, we are interested in management of safety in work in which accidents may result in fatalities or permanent disability.

A hazard is a potential source of harm to people, material assets or the environment. For the majority of accidents, the hazard is a source of energy. How critical the hazard is, is depending on the amount of energy involved; the higher the amount of energy involved, the higher is the potential for causing harm (Kjellén, 2011). Therefore, work with severe accident potential is usually work involving high-energy contents.

The Norwegian Labour Inspection Authority have analysed the fatalities which have occurred in the Norwegian construction industry between 2011 and 2013 by accident type. Of the fatalities recorded (N=35), the most common types of fatal accidents were squeezed between objects (26 %), falling from heights (23 %), being hit by object (11 %) and collision/being hit (11 %) (Arbeidstilsynet, 2015). Although no classification has been made of fatal accidents in terms of work activities, it is apparent that the accident types listed all involved large amounts of energy.

#### **5.1.1 Management of safety in Work with Severe Accident Potential**

In this subsection, literature on management of safety in work with severe accident potential will first be presented. Next, literature on the management of safety in the work activities selected as hazardous work cases for this master's thesis will be addressed.

For the construction industry, energy is a necessary input factor and many activities such as transportation, lifting and tunnelling are characterized by high energy contents. According to Kjellén (2011), it is only when we lose control of the energy flow the accident occurs. In other words, one of the aspects of management of safety in hazardous work is about controlling the energy flow. The “energy model” is a useful tool when it comes to preventing harm from work involving high-energy contents. In able to accomplish accident prevention, we can either eliminate the energy source, establish barriers between the energy source and people, or make people less vulnerable from the energy flow (Haddon, 1980).

When it comes to management of safety in work with severe accident potential/hazardous work, the literature is limited. However, some literature exists on safety management in construction. Therefore, it was the author’s assignment to extract the relevant parts on safety management in hazardous work from the literature.

The international energy company, Statoil, has developed a compliance and leadership model that describes how they lead and manage work tasks to achieve the best possible results. The model is divided into two parts and has been sketched in Figure 7 (Statoil, 2016):

1. A six step action pattern describing the responsibilities of the person or team responsible for the tasks
2. Leadership required to perform the work

The six steps have been sketched in the upper part of the figure, while leadership activities are sketched in the low part of Figure 7.

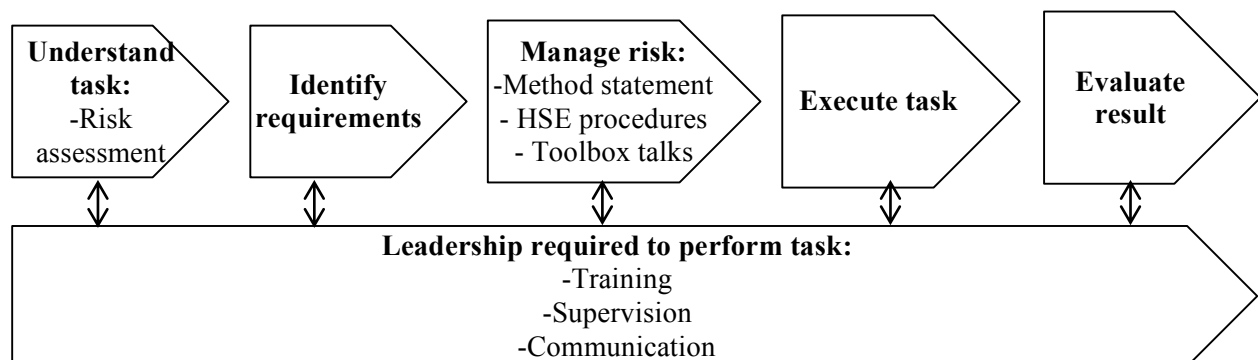


Figure 7 Compliance and leadership model (Statoil, 2016)

In Figure 7, the elements relevant for the empirical part of this master thesis regarding management of safety in hazardous work have been placed in the compliance and leadership model. By performing a literature search on management of safety in construction, it is apparent that particular hazardous construction work requires more emphasis on adequate training and competence, supervision and planning through defining safe methods and safety procedures to perform the work (BSC, 2004; Lingard & Rowlinson, 2005; O’Connor,

Loomis, Runyan, dal Santo, & Schulman, 2005; SWA, 2014). In the following subsections, risk assessments, safety procedures, method statement, information, training and supervision have been described with their associated prerequisite and limitations.

#### **5.1.1.1 Risk assessment**

For managers, one of the most important tasks is to identify and understand the hazards associated with the works to be performed. Once the hazards have been identified, risk-reducing measures may be put in place to reduce the risk. A risk assessment is the joint process of identifying hazards, analysing risk and evaluating risk. If we in addition identify and implement risk reducing measures, we conduct a risk management process (Rausand, 2013). The International Risk Governance Council (IRGC) identifies 23 deficits in risk governance divided into two clusters: assessing and understanding risk (A) and managing risk (B). While the first cluster addresses difficulties in gathering/interpreting knowledge about the risk and the evaluation of the severity of the risk, the latter addresses deficiencies in the preparation and implementation of risk reducing measures (IRGC, 2009).

#### **5.1.1.2 Safety Procedures**

For risks that are considered not tolerable from the risk assessment, safety procedures should be developed to eliminate or control the hazards identified (BSC, 2004). A health and safety procedure sets out the steps to be followed for the work activity. The procedure should be in writing to provide clarity and to demonstrate compliance (Comcare, 2016). Designing HSE procedures to reduce the risk is only a part of the challenge. Another issue is the real world implementation, as little will be accomplished if safety procedures are not implemented and enforced. Especially if the policies are voluntary, there must exist a system for follow up (IRGC, 2009).

#### **5.1.1.3 Method Statement**

Method statements are one of the elements assessed in this master's thesis that is outside the range of Safety Management, as a method statements is not just a safety document.

Method statements are produced when works with a foreseeable high hazard content are to be undertaken. A method statement is a written sequence of work, which should be followed by the operator in order to complete the task safely (Perry, 2003). It should list the type of material, type of plant and machinery, the type of tools and the actual process of the works to be undertaken (Lingard & Rowlinson, 2005) .

In the construction industry, the term risk assessment and method statement (RAMS), is often used. In the RAMS, the risk assessment is included as an appendix with the method statement. An important aspect of the method statement is that the result from the risk assessment should be implemented (Kjellén, 2016a).

According to Lingard & Rowlinson (2005), method statements are often produced to impress the Client in the tendering process and then filed away in the office never to be seen again. It is the person responsible for the hazardous work is best placed to carry out the method statement. However, workers should be consulted in the preparation of the method statement (SWA, 2014). It is important that the content of the method statement is clearly communicated to those performing the work (Lingard & Rowlinson, 2005).

#### **5.1.1.4 Safety Training**

Given the hazardous conditions in the construction industry, adequate safety training is necessary (O'Connor et al., 2005). To provide basic knowledge about hazards that are likely to be encountered at the construction workplace, workplace specific induction training should be provided. Task specific training may be given to ensure that the workers have the required training when undertaking a specific work activity (SWA, 2014). A training matrix may be required to assure that all personnel are properly trained (Lutchman et al., 2012).

Compared to other industries, the construction industry does not have a good record of investing in training of their employees (Lingard & Rowlinson, 2005). According to Lingard & Rowlinson (2005), training is often considered as a cost rather than as an investment in human resources. From experiences made by Lingard & Rowlinson (2005), training is often assumed to have the desired effect without any measurement of the actual outcome of the training. For this reason, it is important that the outcome of the training is measured against the training objectives. Research suggests that training does not automatically translate into behaviour change at the work place. According to Holton (1996), the transfer of learning is influenced by three factors: motivation to transfer, the transfer climate and the transfer design. Motivation to transfer concerns the individuals' expectations of the benefits gained from the transfer of training.

#### **5.1.1.5 Communication**

Informing workers about hazards plays an important role in shaping peoples' hazard awareness and safety behaviour (Lingard & Rowlinson, 2005). Relevant information about the nature of the work, the nature of the risks and control measures implemented must be

provided to protect all personnel from risks arising from the work. A way to provide information is through toolbox talks before construction work is carried out. Topics covered, attendees and feedback received from the toolbox talks should be recorded (SWA, 2014).

Research shows that safety meetings are often driven by management and do not produce much engagement with workers. Analyses of scripts from safety orientation meetings shows that workers only spent 0-2 % of the time talking. Researchers agree that toolbox talks have a potential for becoming more engaging by carrying out less “hear and see activities”. Instead, toolbox talks should include hands on practice and asking open-ended questions (Olson et al., 2016).

#### **5.1.1.6 Supervision**

Works involving high risk require higher levels of supervision. Supervisors should ensure compliance with defined safety rules and that work is carried out in accordance with the method statement (SWA, 2014). For violations of rules, there should be a written disciplinary policy with description of the punitive actions. It is important to stress that recognition should be given to workers following the rules to reinforce good behaviour (OHSZ, 2002). Supervision through safety inspections has been further described in Chapter 5.2.

### **5.1.2 Road Transportation**

In road transportation, the hazards are related to the kinetic energy of the moving vehicles. As mentioned in Chapter 5.1, the criticality of the hazards are depending on the amount of energy involved. It is a saying that “speed kills”; if the speed of the moving vehicle increases from 50 to 100 km/h, the amount of energy quadruples.

Fatalities in road transportation made up 36 % of the fatal accidents, and thereby the largest proportion of all fatalities in Statkraft. Traffic accidents constitutes to between 20 and 40 % of all occupation related fatalities in most in industrialized countries and thus represent a major concern among employees (Fort et al., 2010). In the construction industry, the most frequent cause of fatal accidents are falls from height, followed by accidents involving vehicles and heavy equipment (EU-OSHA, 2004).

The risk of transportation varies grossly between countries. Over 90 % of all road fatalities occur in low and middle-income countries, which have less of half of the world’s number of vehicle (Asirt, 2016). In comparison, statistics on traffic related deaths for Albania and Norway have been collected from the World Health Organization (WHO) and has been presented in Figure 19.

Table 7 Statistics on traffic related deaths for Norway and Albania (WHO, 2013)

Country	Road fatalities per 100,000 inhabitants per year	Road fatalities per 100,000 motor vehicles	Estimated total fatalities per year	Year
Norway	3.8	5.2	192	2013
Albania	15.1	107.2	478	2013

While the death rate in developed countries has been falling for several decades although traffic volumes have increased, death rates are high in developing countries, despite low levels of motorisation. According to WHO (2013), the highest road traffic fatality rates are in middle- income countries. It is expected that the number of road traffic fatalities will continue increasing in developing countries due to the economic growth and rapid increasing level of motorisation (Hassel, 2015; Mumford, 2007).

From a study of fatal traffic accidents in the Turkish construction industry, traffic accidents involving collisions with pedestrians were the leading cause of fatalities (66 %). Fatalities resulting from people being crashed into or run over on site accounts for approximately 19.5 % of all fatalities. Another critical issue mentioned in the study was the traffic accidents without any collision due to loss of control. Such accidents constituted to 12 % of all fatal cases (Müngen & Gürcanli, 2005). According to Müngen & Gürcanli (2005), it is a particular hazardous if the driver loses control near slopes if the vehicles are driving in a rough terrain and the road is curved. These types of hazards were more prominent in dam construction zones such as hydropower projects. Müngen & Gürcanli (2005) states that it is critical to locate warnings signs and make the drivers aware of the speed limit in such areas.

When managing road transportation safety, there are three key areas to consider (HSE, 2013):

- Safe site (design and activity): Segregation of pedestrian and vehicles, safe traffic routes, visibility of hazards, speed control, traffic signs, sufficient lightning and special precautions during activities such as reversing and signalling
- Vehicle: Regular maintenance of vehicles and inspections of vehicles
- Safe driver: Ensure competence of drivers, training of drivers and checks of driver's fitness

The ISO 39001:2012 specifies requirements for road traffic safety (RTS) management systems to help organisations reduce the accident risk from road transportation. The standard poses requirements towards the development of a RTS policy and objectives and provides guidelines for the planning of activities to realize the goals defined. The standard is applicable



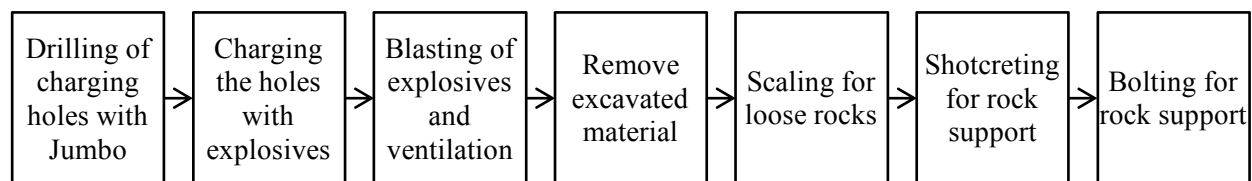
to both public and private organisations and may be integrated into other management systems such as the ISO 9001:2015 and ISO 14001:2004 (ISO, 2012).

### 5.1.3 Tunnelling

By utilising the hazard checklist, it is apparent that there are numerous hazards associated with tunnelling; rock fall, moving vehicles, contact with or between moving parts of machinery, fire (explosion) and contact with electric conductors (Kjellén, 2011)

As stated in Chapter 2.2, 18 % of the fatal accidents in Statkraft occurred in tunnelling. Of the fatalities in tunnelling, 66 % of the fatalities were due to rock fall in tunnelling, while the remaining 33 % resulted from workers being squeezed or driver over by moving machinery. In the project used as a case study in this master's thesis, tunnelling is considered as one of the riskiest activities due to the large amount of tunnel work in the project (approximately 14 km).

In Figure 8, the method of tunnelling have been briefly sketched to make the reader more familiar with the drill and blast sequence and thus in a better position to understand the evaluation of Contractor's management of safety in tunnelling in Chapter 7.1.4 .



*Figure 8 Steps in the tunnelling drill and blast sequence*

A jumbo is used to drill holes in the face of the tunnel. After the holes have been drilled, they are filled with explosives. After the blasting of the explosives, dust and gases are sucked out via a ventilation duct in the ceiling of the tunnel. Next, the excavated material (the muck), is removed by using a scoop tram to dump the excavated material into a truck. Scaling refers to the process of removing the loose rocks from the roof and walls in the tunnel by using a hydraulic breaker to dislodge the fractured materials. Next, the tunnel walls and ceiling is shotcreted to prevent loose rocks for falling down. Finally, the shotcreted area is rock bolted. This is performed by using the jumbo to drill 2-6 m long holes for steel rods (MineralsEd, 2016).

For safety management in tunnelling, the Norwegian Labour Inspection Authority has defined requirements towards rock work. Examples of requirements from the regulations concerning the performance of work in tunnelling are (NLIA, 2015):

- The use of risk assessment and HSE plan for rock work

- Supervision by the employer in all workplaces and geological inspections
- A system for keeping record of those who are deployed underground
- An underground transportation system
- Personal lamps when working underground
- Ensuring that nobody occupies the danger zone during drilling
- Training in the use of first aid and resuscitation equipment
- Medical examinations of workers

#### **5.1.4 Lifting Operations**

We will here focus on lifting of heavy loads involving the use of crane. There are numerous hazards associated with the lift, the potential energy of lifting a load above the ground being the most obvious.

As stated in Chapter 2.2, 6 % of the fatal accidents in Statkraft were in conjunction with falling objects. Lifting operations are associated with a large percentage of fatalities in construction. Estimates suggests that cranes somehow are involved with up to 1/3 of all construction fatalities (Neitzel, Seixas, & Ren, 2001).

Lifting operations may involve high risk if they are not planned and executed properly. Typical failures in lifting operations are related to (ABB, 2016): incompetent persons involved in the lifting operations, poor state of lifting equipment, incorrect use of lifting equipment, lack of accurate information about the load characteristics, bad weather conditions and poor slinging of the guide rope.

The Norwegian Labour Inspection Authority defines requirements regarding the performance of work, use of work equipment and related technical requirements to assure that works with lifting equipment are carried out in a safety manner. For safety management in lifting operations, requirements are defined towards (NLIA, 2015):

- The strength and stability of lifting equipment
- Marking of lifting equipment with the maximum safe working load
- Installation of lifting equipment to prevent people from being exposed to the risk of being stroked by the load or hit by the falling load
- Planning and supervision of lifting operations
- Restrictions for carrying out lifting operations during unsafe weather conditions
- Definition of measures to ensure that people do not enter the area below the suspended loads

## 5.2 Management of Compliance through Safety Inspections

Companies should have a risk-based approach to their safety inspections. This means that depending on the risk assessments, safety inspections must concentrate on particular high risk issues and hazardous work to provide the most benefit in reducing the overall risk (Khan, Sadiq, & Haddara, 2004).

In construction projects, each tier in the organization has a stake in ensuring that safety is preserved. Therefore, each element of the organization should conduct inspections that focus on issues of concern at their respective levels. For instance, the Client should verify that requirements from the Contractor's safety management system is enforced by the Construction manager and the field engineer should inspect their work area (Hislop, 1999). In the evaluation of management of HSE compliance through observations of Contractor in Chapter 7.2, we are interested in the Client's daily safety inspections of the hazardous work cases.

According to Kjellén (2000), a safety inspection involves checking that safety standards has been implemented and give feedback on the deviations identified for correction. Based on the literature on safety inspections from Kjellén (2000), an overview of an inspection system has been sketched in Figure 9.

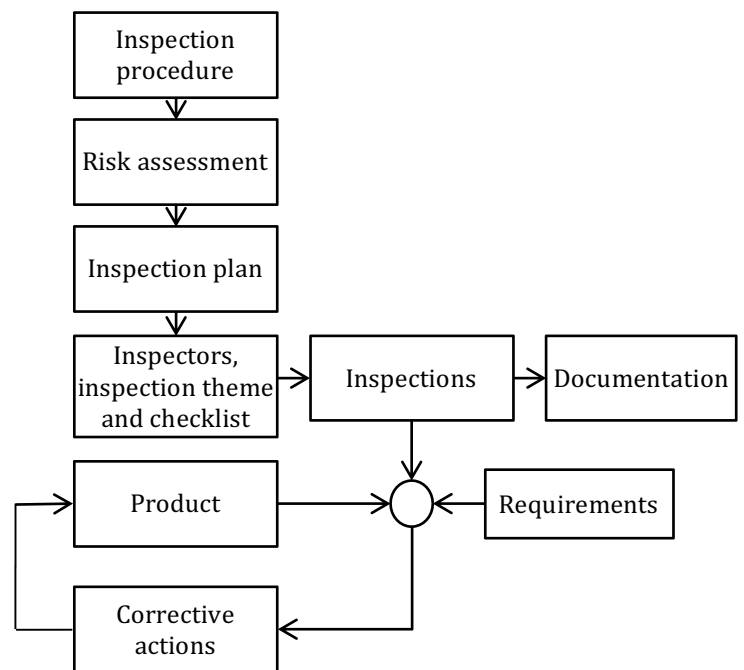


Figure 9 Overview of an inspection system (Kjellén, 2000)

Safety inspections may be carried out in a number of ways and by various people; regular inspections carried out by a supervisor or manager in conjunction with a health and safety representative, routine inspection of the whole workplace, inspection of a particular aspect of HSE such as machinery or inspections carried out by plant operators or vehicle drivers before work is started (Lingard & Rowlinson, 2005).

During inspections, some common system should be followed to assure that everything relevant has been covered (Holt, 2008). Theme specific checklists customised to the needs of the workplace should be developed to secure a reliable and comprehensive

mapping of deviations (Kjellén, 2000; Holt, 2008; Lingard & Rowlinson, 2005). Kjellén (2000) states that inspections without a predefined theme, only focus on a few type of deviations. According to Kjellén (2000), the limited scope is explained by humans limited capacity to be attentive to many different items simultaneously. A too narrow scope violates Ashby’s law of requisite variety, which states that “for an analyst to gain control over a system, he must be able to take at least as many distinct actions, i.e. as great a variety of countermeasures, as the observed system can exhibit” (Kjellén, 2000). Only exceptionally are deviations related to work methods or shortcomings in design or routines identified in safety inspections (Kjellén & Hovden, 1993).

According to Ferrett (2006), checklists should be structured using the “four Ps”; premises, plant and substances, procedures and people. This is in accordance with the MTO-model, which claims that humans, technology and the organisation are equally important when analysing accidents (Sklet, 2002).

The inspection must be documented to ensure a timely implementation of remedial actions. This report should include a description of the deviation and hazards, the measures that has been decided, who is responsible for the implementation and due date for actions as a minimum (Kjellén, 2000).

Holt (2008) stresses that inspections should be based on a positive approach. Too often inspections have a negative implication associated with fault-findings. Inspections must seek to establish what is well done as well as what is not (Holt, 2008).

Van Court Hare’s hierarchy of feedback indicates the degree to which organisations learn from their experience. The hierarchy was originally developed based on experiences made from the traditional industry and military organisations. Kjellén (2000) has reformulated the hierarchy to make it applicable for accident prevention. The reformulation and the description of the different levels of feedback have been described in Table 8.

*Table 8 Comparison between Van Court Hare’s and Kjellén’s hierarchy of feedback (Kjellén, 2000)*

<b>System hierarchy</b>	<b>Kjellén</b>
0	No remedial action
1	Correction of deviation. The deviation may reoccur.
2	Changes in design, work procedures etc. at the workplace at the accident/incident
3	Changes in supervision or technical and administrative system at management level.
4	Changes in the safety management system and norms of the

System hierarchy	Kjellén
company. The changes will affect the entire company.	

In light of Van Court Hare’s hierarchy of feedback, feedback from safety inspections are so-called first order of feedback; deviations are corrected and may reoccur (Kjellén, 2000).

The following success criteria for safety inspection have been established from the literature and has been used in the evaluation of the Client’s site team’s approach to safety inspections in Chapter 7.2 (Holt, 2008; Kjellén, 2000; Kurkova, 2012):

- There is an inspection procedure.
- All site areas are covered during inspections.
- There is an inspection plan.
- Themes for inspections are defined.
- There is a limited number of themes to be checked during one inspection.
- Theme specific checklists are established.
- Checklist items are possible to observe or assess.
- The inspection team has a risk based approach to inspections.
- The inspection team has the necessary qualifications.
- Inspections cover all aspects of the MTO model.
- Findings from inspections are registered in an inspection protocol.
- Actions are proposed based on findings from inspection.
- Actions are adequate, feasible and comprehensive.
- Remedial actions are implemented.
- Inspections are based on a positive approach.

### ***5.3 Employee HSE Engagement***

In the literature, the concepts “worker consultation” and “worker participation” are two key concepts. The International Organization for Standardization defines participation as the “involvement of workers in the decision-making process in the OH&S management system” and consultation as “the process by which the organization seeks the views of the workers before it makes a decision” (ISO, 2015a). According to Cameron, Hare, Duff, and Maloney (2006), the term “worker engagement” is where workers have the opportunity to influence management’s decision regarding safety.

The benefits that arises from employee engagement will strongly depend on the level of practice. Many researchers have studied the link between employee engagement and safety outcomes and concluded that worker engagement can result in increased safety performance (Lunt, Simon, Bennett, & Hopkinson, 2008). A study undertaken by Harter, Schmidt, Killham, and Agrawal (2009) concluded that the top 25 % companies have 25 % less safety incidents than the bottom 25 %, in terms of safety engagement. Engaged workers are more motivated to work safety and become more focused on improving processes and creating better products (Lunt et al., 2008).

In the literature, a distinction is made between measuring the process of worker engagement and measuring the benefits of worker engagement. While the first type is easily addressed, for instance by the number of tool box talks, the latter is less straightforward (Lunt et al., 2008). Shearn (2004) proposes the following measures of employee HSE engagement:

- The number of recorded or reported accidents
- The perceived level of effectiveness on improving HSE matters
- Perceived or measured levels of workers' awareness of HSE issues
- The perceived level of safety
- The propensity to implement safety initiatives

As of January 2016, The International Organization for Standardization is developing a new standard for safety management; the ISO 45001. Compared to the OHSAS18001, which is currently adapted by the Client, more detailed requirements and clauses on the subject of worker engagement are introduced. In the new standard, worker engagement is introduced as an aim of the OH&S management system, as a success factor for implementation and as a management responsibility (ISO, 2015a).

### **5.3.1 Approaches for Involving Workers in Health and Safety in Construction**

Cameron et al. (2006) distinguishes between traditional approaches to employee engagement and alternative forms of participation and consultation. While traditional approaches are enshrined in legislation regarding the consultation with workers, alternative forms are now being promoted as valid forms of worker involvement in HSE. These are termed “direct” approaches and can be divided into to the approaches shown in Figure 10. Due to a low level of unionisation in the construction industry, indirect approaches have not had the desired effect (Cameron et al., 2006).

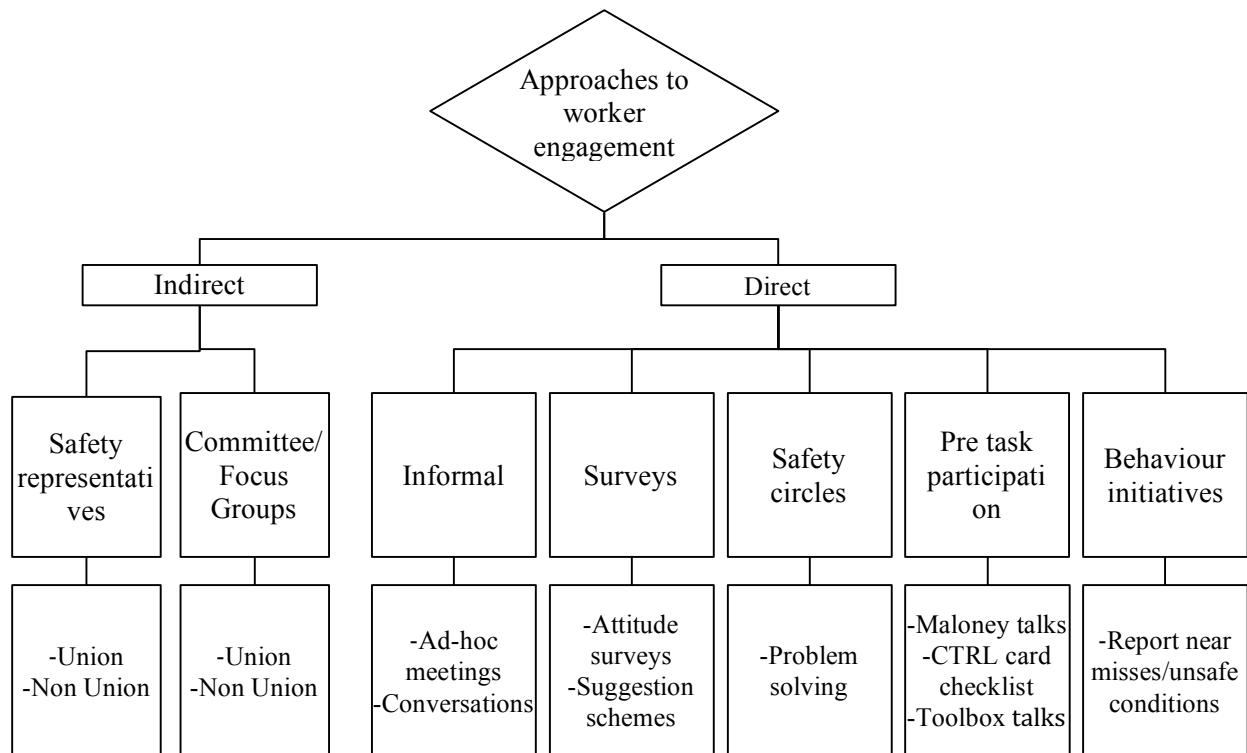


Figure 10 Different approaches to involving workers in HSE (Cameron et al., 2006)

In the construction industry, the most common approach to worker involvement are hazard identification, risk assessments, accident investigations, design of equipment and selection personal protective equipment (PPE) and equipment. In regards of communication, the most common approach is HSE training, induction training, toolbox talks, HSE meetings, notice boards and newsletters (Lancaster, McAllister, & Alder, 2001).

In the evaluation of Contractor's initiatives in to ensure employee HSE engagement in Chapter 7.3, engaging workers through JSAs, RUOs and toolbox talks have been addressed. Toolbox talks as a means on safety management in hazardous works were dealt with in Chapter 5.1. In the following subsections, engagement of workers thorough near miss reporting and JSAs will be treated.

### 5.3.1.1 Near Miss Reporting

According to the classification presented by Cameron et al., (2006), near miss reporting belongs to the elements of behaviour initiatives. A near miss accident is an incident where injury was avoided due to pure chance (Kjellén, 2000). From the literature, it appears that near miss reporting serves two main purposes; 1) improvement in safety management by learning from the occurrences and 2) strengthen the safety culture by motivating workers to participate in the process of identifying and analysing incidents (Jones, Kirchsteiger, & Bjerke, 1999).

An incentive program will reward workers for reporting injuries, near misses and hazards and thereby encourage workers' involvement in the safety management system (Pourmehraban, 2013). However, experiences made by Kjellén (2000), shows that incentives should be carefully analysed to avoid incentives that may encourage near misses to go unreported.

According to Kjellén (2000), near miss reporting may have a counterproductive effect if the attention is directed from important safety problems to minor ones and generate too much information, which exceeds management's capacity. Therefore, criteria on what should be reported should be established to help in making priorities and establishing focus on the vital near misses (Kjellén, 2000).

Van Der Schaaf and Kanse (2004) identified factors that hinder the reporting of near misses:

- Fear of disciplinary actions as a result of a "blame culture" where people are punished for committing errors
- Risk acceptance in a macho culture where incidents are perceived as a part of the job
- Perceived attitudes of management not taking notice
- Practical reasons such as time restraints or too difficult

According to Kjellén & Hovden (1993), near miss reporting mainly focus on technological deviations and determining factors. Another issue mentioned was the lack of data on human error, explained by fears of disciplinary actions because anonymity could not be guaranteed.

Reporting of unsafe conditions follows the same principles as those for near misses (Kjellén, 2000). The term reporting of unwanted occurrences (RUOs) was introduced by the Client in 2008. An unwanted occurrence is defined as any near accident, unsafe act or hazardous condition reported by employees. Reports by personnel with the duty to follow up on HSE and reports from regular inspections should not be included (Statkraft, 2013).

### **5.3.1.2 Job Safety Analysis**

The aim of the job safety analysis (JSA) is to identify and evaluate the hazards workers are exposed to when carrying out certain work activities. When carrying out a JSA, the analyse object is the job made up by its sequence of activities. According to Kjellén (2000), jobs that should be subject to JSAs are:

- Jobs with the potential of severe accidents/hazardous works
- Jobs where serious or frequent accidents or near accident has happened



- Jobs with a large amount of work hours
- New or changed jobs with uncertain consequences

Executing the JSA consists of four main steps (Kjellén, 2011):

1. Identifying the basis steps of the job
2. Identifying hazards
3. Analysing the causes
4. Assessment of risk level
5. Developing measures to reduce the risk

Kjellén (2011) stresses that the group performing the JSA should include the operators with experience in performing the work.

#### ***5.4 Summary of Literature Review on HSE Methods***

The following conclusions from the literature review will be used in the evaluation of the HSE methods in Chapter 8, the discussion in Chapter 9 and the recommendations in Chapter 11:

- Although it may seem obvious, it is important to note that works involving high risk require more intensive supervision and training.
- Research shows that safety meetings are often driven by management and do not produce much engagement with workers.
- When managing road transportation safety, the three areas to consider are safe site, vehicle and safe driver.
- In rough terrain, such as dam construction zones, roll overs and road departure are more common than collisions in rough terrain. It is critical to locate warnings signs and make the drivers aware of the speed limit in such areas.
- The ISO 39001:2012 specifies requirements for road traffic safety (RTS) management systems to help organisations reduce the accident risk from road transportation.
- Of Statkraft's fatal accidents in tunnelling, 66 % of the fatalities were due to rock fall in tunnelling, while the remaining 33 % resulted from workers being squeezed or driver over by moving machinery.
- Poor state of lifting equipment is one of the typical failures in lifting operations.
- Companies should have a risk-based approach to their safety inspections.
- Theme specific checklists customized to the needs of the workplace should be developed to secure a reliable and comprehensive mapping of deviations.

- Focus on human factors, technology and organization are equally important when performing inspections.
- Feedback from safety inspections are so-called first order of feedback and the deviations may reoccur.
- Inspections should be based on a positive approach.
- Engaged workers are more motivated to work safety and become more focused on improving processes and creating better products.
- An incentive program should be established to encourage and rewards workers for reporting injuries, near misses and hazards.
- Criteria on what should be reported should be established to help in making priorities and establishing focus on the vital near misses.
- Fear of disciplinary actions as a result of a “blame culture”, is one of the factors, which hinders the reporting of near misses.
- The group performing the JSA should include the operators with experience in performing the work.

## 6 Factors Influencing the Safety Management System Required by the Client

In this chapter, the following research question has been answered: “Which factors may influence the implementation of a safety management system at a construction site in a developing country?” In able to perform a more nuanced analysis, the analysis of influencing factors will consist of both findings from the literature review as well as using field data from the project.

According to Aksorn and Hadikusumo (2008), factors that influence the implementation of a safety program needs to be studied in order to gain an effective safety program. From their studies of Thai construction projects, they identify four dimensions divided in to 16 critical success factors influencing the implementation of a safety program. The factors influencing the implementation of a safety program has been summarised in Table 9.

*Table 9 Components and sub-components influencing the implementation of a safety management system (Aksorn & Hadikusumo, 2008)*

<b>Dimensions of influencing factors</b>	<b>Sub-component</b>
<b>Worker involvement</b>	Positive group norms
	Personal attitude
	Personal motivation
	Continuing participation of employees
<b>Safety prevention and control system</b>	Effective enforcement scheme
	Appropriate supervision
	Personal competency
	Program evaluation
	Equipment acquisition and maintenance
	Safety education and training
<b>Safety arrangement</b>	Good communication
	Delegation of authority and responsibility
	Sufficient resource allocation
<b>Management commitment</b>	Management support
	Teamwork
	Clear and realistic goals

In his evaluation of approaches taken by an Indian and a Filipino construction project, Kjellén (2012) distinguishes between internal and external factors influencing safety

performance. External influencing factors are the frame conditions in which management does not have direct control (Kjellén, 2016b).

In the next subsections, factors influencing the implementation of the safety management system required by the Client has been analysed using the classification proposed by Aksorn & Hadikusumo (2008) and Kjellén (2012) as sketched in Figure 11.

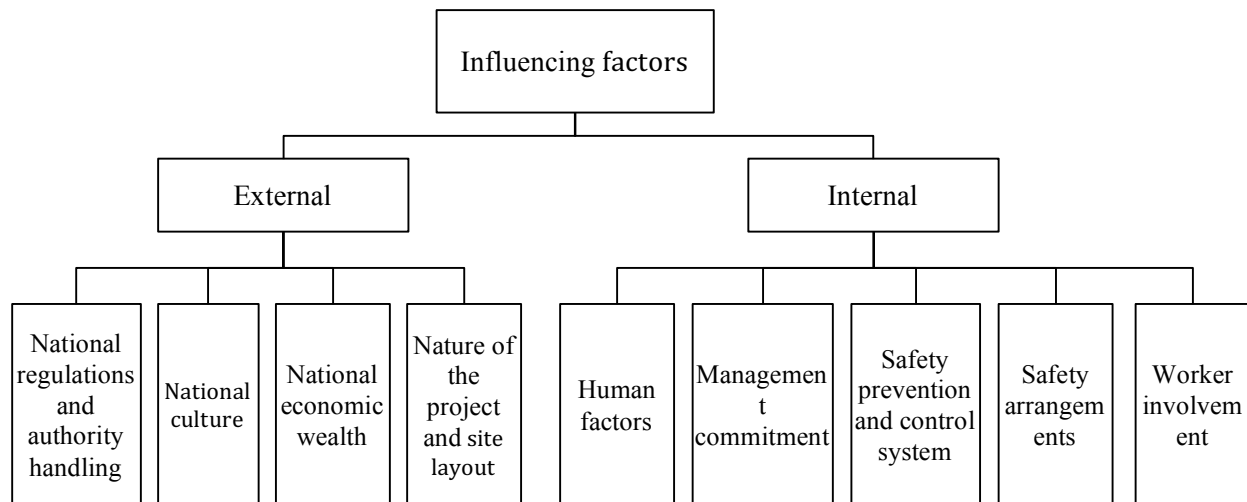


Figure 11 Internal and external factors influencing the implementation of a safety management system (Kjellén, 2012; Aksorn & Hadikusumo, 2008)

As a part of the contract between the Client and Contractor, the Contractor is obliged to employ local construction workers. The majority of the Contractor’s workers are Albanian, while the majority of engineers and management are Turkish. Because the majority of Contractor’s workforce is Albanian, the economic and cultural analysis as well as the analysis of human factors in the following section will focus on Albanian workers.

In Chapter 8.4, the significance of the influencing factors has been discussed by analysing the result presented in Chapter 7 in light of the influencing factors discussed in the following chapter.

## 6.1 External Factors

### 6.1.1 National Regulations and Authority Handling

Even though developing countries may have a comprehensive safety legislation, the level of enforcement may be low due to a lack of resources (Kjellén, 2016). Since Albania strive to become a member of the EU, the Albanian HSE legislation is based on the European standard. However, the national legislation on HSE in Albania is general and do not provide any detailed requirements towards specific types of work (RAA, 2009).

Since 2015, risk assessments are to be carried out for potential hazardous situations and are considered as legal documents (RAA, 2009). From interviews with the Client's site team, risk assessments are considered more essential than method statements, due to the fact that failure in implementing measures from the risk assessment may cause legal prosecutions in case of an incident.

Due to the fact that the Devoll HPP is the biggest construction project in Albania since 2007, the Albanian government have enforced the legislation to some extent by carrying out labour inspections and audits. According to the Client's site team, the involvement of the government has mainly been after the occurrence of accidents. The governmental follow up is therefore considered mostly reactive. However, information gathered from the Client's site team shows that in Albania, one could easily pay them to look the other way due to the high level of corruption in the country.

According to the Contractor's HSE team, the requirements posed by the Client are much stricter than the one imposed by the Government. On this ground, it is assumed that the level of safety is not affected by the absence of comprehensive governmental regulation.

### **6.1.2 National Economic Wealth**

It is a big concern among investors in emerging markets whether the economic situation in the country will allow for an implementation of a safety management system (Kjellén, 2012).

In comparison, the purchase power in Albania is about 6 times less than in Norway (TWB, 2016). Especially in Albania where the competition between companies are tough, management of companies usually see safety as an extra expense and workers are therefore not familiar with following safety rules from previous employment. According to Contractor's HSE team, workers not being used to work with high standards of HSE is one of the main issues influencing safety in the project. A challenge mentioned by the Client's site team is to convince both management and workers that working safe does not take more time.

There is a big lack of qualified HSE personnel in Albania, the reason being a lack of construction projects in the country due to Albania's economic situation. While the Client's site team have some experience from working with HSE, most of Contractor's HSE supervisors have no formal qualifications or experience from working with HSE. A big concern mentioned by the Client's site team is the establishment of a new large project in Albania, The Trans Adriatic Pipeline (TAP). The TAP's route through Albania will be approximately 215 km onshore and 37 km offshore. It is a worry in the Project that the project

in the nearest future will experience a large turnover of the most qualified HSE personnel to the TAP project, which offers better pay.

As of January 2016, Albania has an unemployment of 17, 7 % (TE, 2016). According to the Client's Site team, an unskilled construction worker in the project earn approximately 330 \$ every month, which is approximately 1.5 times more than the average salary in Albania. Due to the high level of unemployment in Albania and the relatively high salary in the project, most of the workers are worried about losing their job. From conversation with the Client's Site team, the turnover that has taken place in the projects is due to workers being thrown off the project. Based on information received from the Client's Site team, workers often feel pressured to complete the work tasks in an effective way, rather than safe just to keep their jobs. However, the fact that the project has not experienced a big turnover is considered as a positive influencing factor for the implementation of the safety management system.

According to Messenger and Ray (2013), workers in developing countries tend to work longer hours than in developed countries. Workers in developing countries receive a lower hourly rate, and therefore need to work longer hours in order to manage. The construction workers at Moglice HPP works 11 hours shift and have one day off every two weeks. However, according to one of Contractor's tunnel engineers, the tunnel workers the workers do not work more than eight hours per day because of the natural rotation of the drill and blast work sequence. Since the majority of the transportation being carried out in the project is transportation of the excavated material from the tunnels, truck drivers carry out an average of two transportation assignments every day. In terms of the third work case, lifting operations are not carried out continuously. For this reason, it is not likely that long working hours for the selected cases have a negative influence of the accident risk due to fatigue.

### **6.1.3 National Culture**

When implementing a safety management system, managers should consider differences in workers' natural cultures. Safety relevant aspects such as communication, leadership styles and interaction between supervisors and staff, may be considered in a multicultural workforce (ICAO, 2012).

A popular theory on the topic of natural culture differences is the one by Hofstede (2001). Hofstede (2001) distinguishes four main cultural dimensions: power distance, individualism- collectivism, masculinity- femininity and uncertainty avoidance. Country scores on these dimensions have enabled cultural comparisons between countries. Figure 12 shows a cultural comparison between Norway, Albania and Turkey. In the following

subsection, a cultural analysis of the Project is carried out based on Hofstede's cultural dimension.

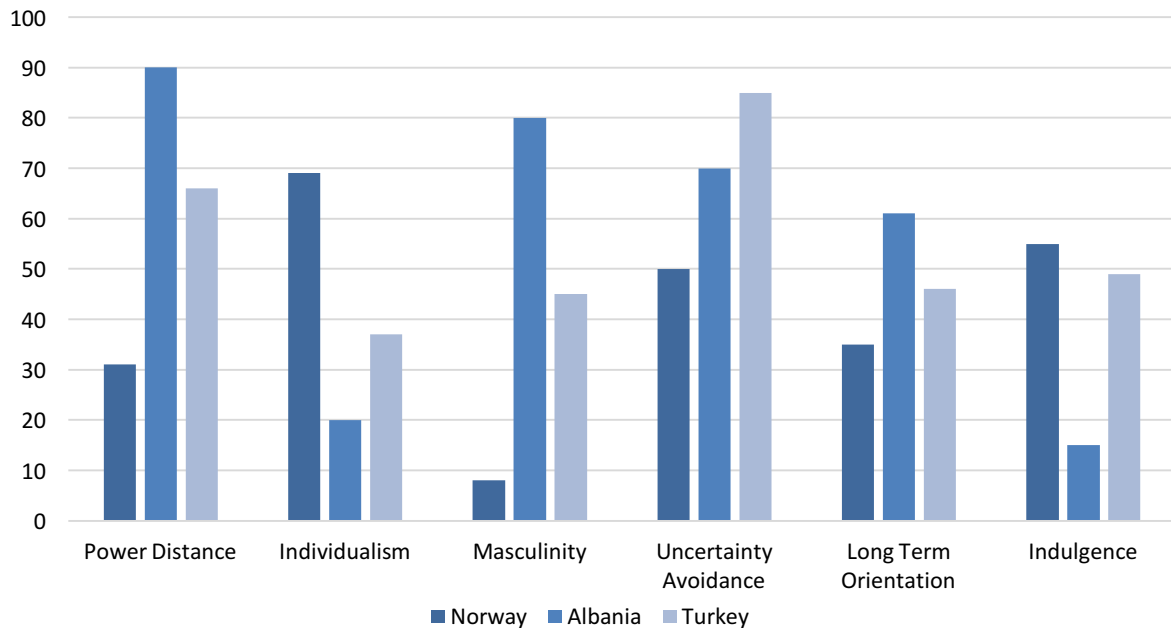


Figure 12 Comparison between Norway, Albania and Turkey based on Hofstede's six cultural dimensions (THC, 2016)

According to Hofstede's (2001) cultural dimensions, Albania is considered to be a hierarchical society, with its very high score of 90 on power distance. In such hierarchical societies, people accept their place that needs no further justification. Subordinates expect to be told what to do and ask no further questions (Hofstede, 2001). According to the Contractor's HSE team, the Albanian workforce does exactly what they are told by the supervisors even if it includes putting themselves at risk. It is in their opinion that *“the combination of the Albanian workforce doing exactly as they are told and a Turkish Construction company, which is extremely concerned about maximizing the production output, is unfortunate.”*

According to Seymen and Bolat (2010), there is a relationship between the dimension of power distance and employees' involvement in safety. Employees coming from cultures with high power distance prefer management establishing safety rules and dictating themselves as commands, in accordance with the hierarchical structure of the organization. Safety management belongs to the management of the company, and their only responsibility is obeying the rules. For companies facing this kind of structure, more efficient safety management can be achieved by a centralized structure, rigid rules and procedures, top down communication and strict supervision (Seymen & Bolat, 2010).

The low score of 20 on individualism indicates that Albania is a collectivistic society. In a collectivistic society, individuals perceive themselves as members of a society rather than as individuals (Seymen & Bolat, 2010). Loyalty to other members of a group, overrides most other societal rules and offence leads to shame and loss of face (THC, 2016). In terms of implementing a system for RUOs, it is from a cultural point of view even more important to strive for creating a no blame culture in a collectivistic society. This was further supported by conversation with the Client's site team, who claimed that it would be an issue if the workers perceived that the intention behind the RUOs was blaming each other. In the literature review, training was considered as one of the key elements in the management of safety in hazardous work. In a collectivistic society, training is most effective when focused at group level (Hofstede, 2001).

Albania receives a very high score of 80 on masculinity and can therefore be considered as an extremely masculine society. A high score of masculinity indicates that the society is driven by competition, achievement and success. As discussed in Chapter 6.2.2, the project has a big potential for improvement in terms of motivating the workforce to work safe, and few incentives are given for safe behaviour. Albania's high score on masculinity is from the author's point of view a positive influencing factor, which emphasizes the possibility to implement incentives for RUOs and working safely.

Albania, with a high score of 70, prefers avoiding uncertainty. According to Hofstede (2001), such societies prefer structure in their organizations, institutions and relationships, and has an emotional need for rules. Hofstede (2001) points out that uncertainty avoidance is not the same as risk avoidance, since people from such cultures often are prepared to engage in risky situations. In regards of safety, workers from such societies feel the necessity to comply with rules and procedures defined by management. This positive influence on safety was also pointed out by the Consultant of the Contractor, who claimed that the tunnel workers did not perform any work unless the tunnel engineer already approved it. The high preference for avoiding uncertainty emphasizes on the possibility to define clear rules on safety, which again can be communicated to the workers.

Seymen and Bolat (2010) performed a study on how national culture differences affect safety culture by using Hofstede's cultural dimensions. Management commitment towards safety, employee's involvement and risk perception were used as dimensions of safety culture. As seen from From Figure 12, the Albanian scores on the cultural dimensions are extremities. This enables the possibility to draw some interesting conclusions regarding the characteristics of organisations in such cultural conditions. In Figure 13, findings from



Seymen and Bolat (2010) have been summarized for organisations facing high power distance, high uncertainty avoidance, collectivism and a high degree of masculinity.

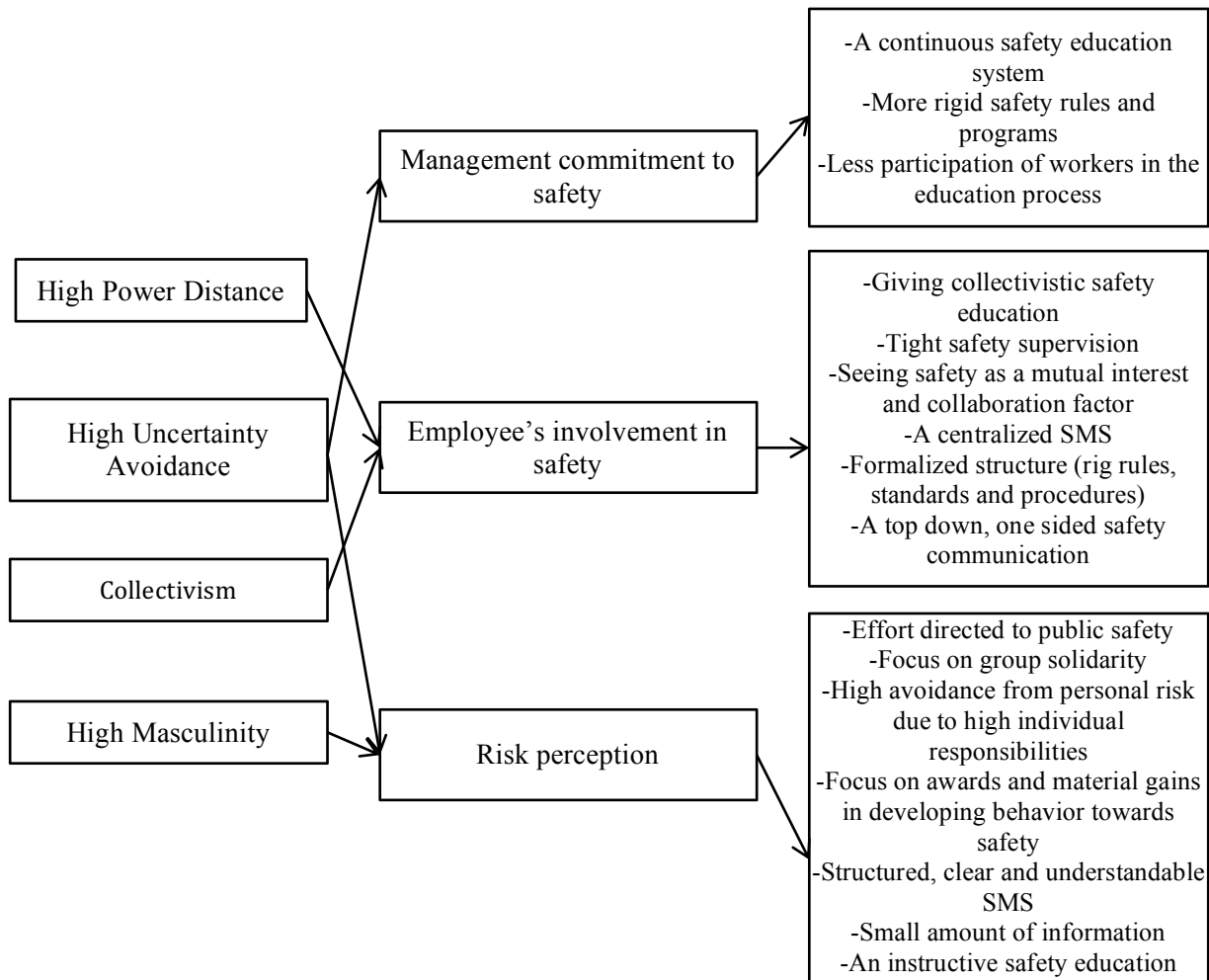


Figure 13 Relationship between national culture dimensions and safety culture/climate dimensions

From Figure 13, it is clear that rigid safety rules, strict supervision and a one sided top-down are characteristics of such organisations.

#### 6.1.4 Nature of Project and Site Layout

The nature of a hydropower project will to a large extent influence the risk associated with the construction. The sites for hydropower developments are often located at remote areas in the mountains, where the difference in height is used to generate power. Early in the project's stage, proper infrastructure may lack due to poorly developed roads and little access to emergency care (Kjellén, 2015). According to Kjellén (2012) site layout differs between projects with differences in elevation, road standard and risk of flooding and landslide.

The Moglice HPP shall have an underground power station, where the major components such as machine hall, penstock and tailrace are located in caverns, rather than

more common methods where the construction is surface based. This causes the project to have a considerable amount of excavation, which is considered as hazardous work.

In regards of health and safety during tunnelling, the Consultant's main concern is the particular large number of tunnel workers present in the tunnels. Unlike Scandinavian construction workers who are trained to execute all the tasks in the drill and blast sequence, Contractor's tunnel workers are divided into work teams, which specialize in only one activity in the work sequence. This leads to many people going in and out of the tunnels all the time, which increases the risk of a worker being run over or squeezed by a vehicle or other tunnel related accidents.

The Moglice HPP is a river valley project. The access roads are carved out of the mountainside, which leads to a big risk of driving off the road as well as landslide, rock fall and road erosion. Especially in periods with a lot of rainfall, the roads are prone of avalanche. The most hazardous event associated with driving at the project roads is driving off the road. This is because of the nature of the mountain roads with steep slopes and almost certain death if the vehicle departs from the road.

## **6.2 *Internal Factors***

### **6.2.1 Human Resources**

The official language in the Project is English. The majority of Contractor's construction workers speak Albanian, while Contractor's engineers and management speak Turkish and English. The method statements are only available in English, while the risk assessments are available in both English and Albanian. According to the Contractor's HSE team, engineers in charge of the work team communicate the content of the method statements to the Albanian workforce. It is in their opinion that language is not considered a barrier for achieving good safety performance in the project, as the project has management to gather personnel with good language skills.

According to the Albanian Institute of Statistics (2011), 76 % of the Albanian population are either Islamic or Christian. According to a representative from the Client's Site team, the majority of both the Albanian and Turkish workforce are very religious, which makes working with health and safety in the project even more difficult. Instead of seeing risk as something statically as the combination of severity and probability, they considered a potential accident as the will of God. The workers have a blind acceptance of injuries due to religious convictions, which is difficult to counter-act.

According to a representative from the Contractor's management, all of the "yellow hats" have finished primary school. In Albania, there is no career available path in construction. Approximately 60 % of the construction workers do not have any experience from construction from before. According to the Contractor's manager, the issue with unexperienced workers was solved by forming working teams with both experienced and unexperienced workers. At all times, a tunnel engineer is present to supervise the work team. The tunnel engineers, which are mainly Turkish, have a have a university degree in Engineering and between 3-5 years of experience.

According to the Client's site team, construction workers in Albania and in developing countries expect to get hurt and believe that being injured is a part of working in construction. The fact that workers expected to be injured was also supported by the questionnaire, which discovered that 23 % and 45 % believed that it was very likely or somewhat likely that they would be injured on the job in the next 12 months' period.

Based on information gathered from the CIA (2016), the literacy in the Albanian population is 97,6 %. Cameron et al. (2006) states that construction workers prefer oral rather than written communication. Construction workers are more inclined to participate in face-to-face oral communication such as pre start meetings. Attempts to engage construction workers in written communication had less effect (Cameron et al., 2006).

### **6.2.2 Worker Involvement**

Workers are more likely to support the activities that they help to create (Aksorn & Hadikusumo, 2008). In the project, involvement of workers is achieved through toolbox talks, training and the establishment of HSE comities. Construction workers are not included in the making of the risk assessments. According to the Contractor's HSE team, this is a conscious decision because of the large scale of the project. The result of the questionnaire presented in Appendix B showed the majority of the workers claim that they are consulted on health and safety issues on a daily or weekly basis, but that a big proportion (24 %) claims that they are never consulted on health and safety matters.

Although workers are in possession of the necessary knowledge and skills to carry out their work in a safe manner, they will not work in a such way unless they are motivated to do so (Aksorn & Hadikusumo, 2008). In motivating workers to work safely, it is in the author's opinion that the project has big a potential for improvement. The current practice on site is to give a little sticker for the helmet, as an intensive for safe behaviour. According to the Contractor's HSE team, the workers are proud of these stickers. Unfortunately, the practice

has not carried out in the large extent as it was originally intended. In the cultural analysis in Chapter 6.1.3, it was stated that Albania as a masculine society is driven by competition achievement and success. It is in the author's opinion that the high score of masculinity enables the opportunity to motivate workers to work safety to a large extent.

### **6.2.3 Safety Prevention and Control System**

Violations of safety rules needs to be encountered with enforcement (Aksorn & Hadikusumo, 2008). For the violation of traffic rules, the Contractor has developed a "yellow card" system. In the scenario of a driver violating the speed, a verbal warning will be given. For the next speed violation, the driver will receive a yellow card and for the third violation, the driver will be taken of the project. Depending on the severity of the violation, the driver can be taken off the project immediately. In theory, the discipline system also applies to any type of safety violation. However, the penalty system is primary used for violations of the speed limit.

Placing the right person on the right job is critical for a successful safety management system (Aksorn & Hadikusumo, 2008). The Contractor's HSE manager is responsible for producing the necessary documentation for the safety management system, such as HSE procedures, method statements and risk assessment. He has 24 years' experience in working with HSE internationally and has acquired several internally recognised certifications and qualifications during his professional career. According to the Client's Site team, the Contractors HSE manager is a tremendous resource for the project and has a big impact on the Contractor's upper management.

A safety management system must be regularly evaluated to determine its success in terms of achieving the defined objectives (Aksorn & Hadikusumo, 2008). To evaluate the safety management system, monthly reports with key performance indicators are used. According to the Contractor's HSE team, reviews of the safety management system and internal audits are carried out to identify areas of improvement.

To gain a successful safety program, all employees must be given education and training to ensure that they possess the necessary knowledge and skills to perform their work in a safe manner (Aksorn & Hadikusumo, 2008). It is obvious that Contractor has a strong focus and takes big pride in their HSE training. To enter the construction site, all employees and visitors must receive HSE induction training from the HSE department. In addition, both operators, foreman and managers receives job specific training according to the HSE training program.

#### **6.2.4 Safety Arrangements**

In able to bring unsafe working practices and hazardous situations to management's attention, the communication line between the management and workforce has to be open (Aksorn & Hadikusumo, 2008). According to the Contractor's HSE team, there is an open communication line between the construction workers and the HSE department and the site supervisors. Observations during data collection shows that the door to the HSE department is always open. According to the Contractor's HSE team, construction workers are encouraged by their supervisor to report hazards on a daily basis. From the questionnaire issues to Contractor's workers, 66 % of the respondents claim that they always alert supervisors if they see a hazardous situation on the job site.

One individual cannot implement a successful safety management system and safety related responsibilities must be transferred to employees at lower level of authority (Aksorn & Hadikusumo, 2008). From interviews with the Contractor's HSE team, it was told that workers and foremen are made aware of their safety related responsibilities through toolbox talks and safety meetings. When addressing engineers with HSE issues during data collection, the author was told on one occasion to address the HSE department and "*that it was not their job*". From the questionnaire distributed, only ¼ think that supervisors and management do as much as possible to make the job safe. On the issue of how much emphasis the foreman place on safety practices, 28 % and 23 % says that the foremen seldom mention danger and safety practices and that he never mentions danger or safety practices, respectively.

The implementation of a successful safety management system cannot be achieved without adequate resources. Resources required may include sufficient staff, money, time and tools (Aksorn & Hadikusumo, 2008). According to the Contractor's HSE team, the safety management system required by the Client has a significant cost for the Contractor. However, it was in their perception that the stakeholders were willing to accept this cost and that it had never happened that the HSE department did not get what they asked for if it was considered reasonable. Conversation with both the Contractor and Client's HSE team shows that it is in their opinion that adequate resources are provided to carry out safety relevant activities in the project, both with respect to staff and financial support for safety equipment. From the questionnaire issued, the majority of the respondents confirmed this statement, by stating that proper equipment for their task were available at their job site. However, a problem

mentioned by the Contractor's HSE team was that procurement processes of safety equipment could take up to between three and four months, which could be frustrating.

According to the Contractor's HSE team, a big HSE department has been established after a hard struggle with management and that the "*HSE department at this project is bigger than in all the other company's projects put together*". Observations and conversations on site show that the Contractor has established a large HSE department. However, the majority of the HSE inspectors are previous firefighters and police officers, and have no experience with HSE from before.

### **6.2.5 Management Commitment**

In the literature, it is a common agreement that management plays an important role in the implementation of an efficient safety management system (Kjellén, 2012; Aksorn & Hadikusumo, 2008; (Fernández-Muñiz, Montes-Peón, & Vázquez-Ordás, 2007; Sherif Mohamed, 2002). It is the management of a company who are responsible for translating the safety management program into actions (Aksorn & Hadikusumo, 2008). In the Client's Site team, different perceptions exist on Contractor's management commitment towards safety. According to a representative from the Client's Site team, management commitment towards HSE does exist neither at site nor in Ankara where the top management of the Contractor is located. According to other representatives, Contractor's management are committed to safety for the most part. However, when they are behind schedule, safety does not matter as much as production and they are willing to do shortcuts in expense of safety. For instances, there were cases on site where the foreman ordered workers to perform the work more effectively by overloading the vehicle. If they did not apply, they would be fired. From the questionnaire performed, the majority of workers think that workers' safety practices are very important to the management of the company.

Contractor's upper management participate in weekly safety inspections along with Client's upper management. According to the Contractor's HSE team, individual safety meetings with engineers are held on a daily basis.

As discussed in previous chapters, one of the Contractor's main concerns were that the Construction workers had no experience with working with safety, and therefore "did not know any better". It is in the author's belief that this underlines the need for an effective training program. It is obvious that Contractor has a strong focus and takes big pride in their HSE training. To enter the construction site, all employees and visitors must receive HSE

induction training from the HSE department. In addition, operators, foreman and managers receive job specific training according to the HSE training program.

Management are obliged to follow the same safety rules as everyone else and they are covered by the disciplinary system for safety violations. Observations made on site supports this statements; managers all use the same PEE and follows the same safety rules as anyone else while being on site.

## 7 Results from Field Study

In Chapter 1.1, the following research questions were defined: “*To what extent have the Client’s requirements to the studied HSE methods been implemented in the project? What are the immediate, intermediate and long-term effects of the assessed HSE methods?*”

In this chapter, the research questions has been answered by evaluating the HSE methods by following the steps in Figure 6 presented in Chapter 4.2.

### 7.1 Contractor’s Management of Safety in Work with Severe Accident Potential

For the assessment of Contractor’s management of safety in hazardous work, road transportation, tunnelling and lifting operation has been chosen as hazardous work cases as they are overrepresented in the Client’s fatality statistics and since they were ongoing during the time of data collection. In Table 10, an overview of the approach for evaluating Contractor’s management of safety in the hazardous work has been summarized.

*Table 10 Overview of the activities to evaluate Contractor’s management of safety in the hazardous work cases*

Work activity	Client’s requirements	Contractor’s documented management system	Implementation	Intermediate effect	Long term effect (Chapter 7.4)
<b>Case 1: Road transportation</b>	Review of specifications for Contractor’s HSE requirements	Review of Contractors HSE program and Traffic Management and Transportation Plan	Mini- audit to assess the level of implementation of the Traffic Management and Transportation Plan	Behavioural sampling on selected elements from the Clients requirements on road transportation safety	Review road transportation accident statistics
<b>Case 2: Tunnelling</b>	Review of specifications for Contractor’s HSE requirements	Review of Contractors HSE program, Tunnel Construction Health and Safety Plan and Method Statement	Mini- audit to assess the level of implementation of the Tunnel Construction Health and Safety Plan and Method Statement	Behavioural sampling on selected elements from the Clients requirements on management of safety in tunnelling	Review accident Statistics in tunnelling
<b>Case 3: Lifting operations</b>	Review of specifications for Contractor’s HSE requirements	Review of Contractors HSE program, lifting equipment procedure and lift plan procedure	Mini- audit to assess the level of implementation of the lifting equipment procedure and lift plan procedure	Behavioural sampling on selected elements from the Clients requirements on management of safety in lifting operations	Review accident statistics on lifting operations



### 7.1.1 Case 1: Road Transportation

#### 7.1.2 Client's Requirements

In Chapter 7.11 in the contractual documents, the Client requires that the Contractor establish a Transportation Management Plan for the works. The requirements posed by the Client have been divided into the categories Driver, Vehicle, Road and Management in accordance with Haddon's framework for injury prevention (Haddon, 1980). Table 11 lists examples of requirements posed by the Client that has been assessed further in the following chapter.

*Table 11 Client's requirement to Contractor's management of safety in road transportation that has been addressed in this study*

Category	Number	Requirement
Driver	1	Qualification requirements to driver
	2	Drivers HSE training
	3	Regular toolbox meetings on the subject of transportation for all personnel
Vehicle	5	Establish routines for maintenance of vehicles
Road	6	Establish specifications for construction roads such as road width, road side barriers, protection against soil slide and installation of traffic signs
Management	7	The establishment and enforcement of traffic safety rules such as traffic controls and rules regarding driving at night
	8	Requirements towards monitoring of weather conditions
	9	The Contractor shall carry out risk assessment for critical operations within its scope of work which could lead to accident such as transportation

#### 7.1.3 Contractor's Management of Road Transportation Safety

The Contractor has established a Traffic Management and Transportation Plan (TMTP), which defines the Contractor's approach for fulfilling the requirements posed by the Client. The elements in the TMTP have been listed in the next subsections where an assessment of the level of implementation of the requirements has been made.

Of the requirements posed by the Client, the TMTP Plan does not cover rules regarding driving at night. The Contractor has not documented a specific risk assessment for road transportation as required. However, road transportation is mentioned in the risk assessments for the specific works involving road transportation.

### 7.1.3.1 Implementation at Site and Immediate Effect

#### 7.1.3.1.1 Compliance with the Traffic Management and Transportation Plan

To assess the level of implementation and immediate effect of Contractor's management of safety in road transportation, it was decided to carry out mini- audit of the TMTP. The result of the mini- audit on road transportation safety are presented in Table 12, Table 13, Table 14 and Table 15 sorted by Haddon's Framework.

Table 12 Compliance with the TMTP and HSE program – Driver dimension

Client's requirement no.	Contractor's requirement	Evaluation of implementation /Immediate effect	Comment
2	All drivers are in possession of a valid driver's licence	Good	When hired by the Contractor, the personnel department controls that the driver is in possession of a valid driver's licence.
2	Qualification requirements for fitness and medical examination have been established and enforced	Good	All of Contractor's employees go through a medical examination when hired. However, a problem raised by the site doctor is that the Client and Engineering's personnel do not go through the same medical checks.
4	Toolbox talks on the subject of transportation safety shall be delivered to all drivers	Fair	From records received from the Contractor, only seven toolbox talks have been transmitted since November 2016 and March 2016.
3	Drivers shall receive driver HSE training	Poor	There are no training of drivers in the project
-	All drivers wear safety footwear and hi-visibility clothing	Good	Observations made during the execution of the mini- audit shows that all drivers wear safety footwear and hi- visibility clothing

Table 13 Compliance with the TMTP and HSE program - Vehicle dimension

Client's requirement no.	Contractor's requirement	Evaluation of implementation /Immediate effect	Comment
5	All vehicles are maintained in accordance with the manufacturer's recommendations	Good	The Contractor has a procedure in place to keep track of when the vehicles are due for service. When a vehicle is due for service, the maintenance manager is alerted and the vehicles are called into service. At site, a workshop is established where wearing parts are replaced.
5	Daily inspections on the vehicles are performed	Poor	The vehicle visual inspection form that is required to be filled out by the driver on a

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation of implementation /Immediate effect</b>	<b>Comment</b>
	each day		daily basis is not in use in the project. According to Contractor's management, it was too comprehensive to organise it. Instead, each driver fills out a daily working report where technical deviations are noted.

*Table 14 Compliance with the TMTP and HSE program - Road dimension*

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation of implementation /Immediate effect</b>	<b>Comment</b>
1	Hard barriers or soil embankments shall be provided on the open edges of roads where there is a high potential for vehicles sliding over the edge	Fair	Hard barriers are provided on all public roads. On the temporary constructions roads, soil embankments are provided on approximately 80 % of the roads.
1	On curves/bends, reflective chevrons will be added to the barrier as an additional visual warning indicator	Good	From observations made while examining the project's site roads, reflective chevrons are added on curves/bends on all roads.
1	Site temporary roads will not be less than 3 m wide for single lane, and 6 m wide for double lane	Good	From observations made while examining the project's site roads, approximately all site temporary roads are wider than 3 m.
1	Warning signs are placed to inform persons of potential hazards	Good	Of the roads that were inspected, warning signs were placed on all public roads and all construction roads.
1	To prevent localised flooding of roads, drainage ditches will be performed approximately 1 metres from the road where reasonably practicable	Good	Drainage ditches are present most places on public roads, and everywhere on unpaved road to prevent flooding of the road. According to the Client's HSE management team, drainage ditches are necessary to avoid road erosion during heavy rainfall.

Table 15 Compliance with the TMTP and HSE program – Management dimension

Client's requirement no.	Contractor's requirement	Evaluation of implementation /Immediate effect	Comment
8	There is a documented risk assessment	Fair	There is no separate documented risk assessment for transportation. However, some risk assessments specific for the execution of a particular work, includes elements of road transportation.
7	Weather monitoring and restrictions in use of landslide prone roads in adverse weather.	Good	The Contractor has a weather station that monitors the weather conditions such as temperature, humidity, rain and wind speed. In cases of poor weather conditions, the main road through the valley will be closed off for all traffic.
6	The Contractor enforce safety traffic rules such as speed limit, use of seat belts and restrictions against driving in the phone	Fair	According to the Contractor's HSE teams, the HSE inspectors strive to perform speed and seat belt control on a daily basis. However, the Contractor has not documented these traffic controls.  A violation system has been established where drivers can receive two warnings before being kicked off the project.

From the mini audit, it is apparent that the requirements towards the standard of the roads have been implemented in accordance with Client's requirements. However, the mini audit discovered that daily inspections are not performed on the vehicles and that a daily working report is filled out instead. From conversation with the professional drivers, it became known that the daily working reports were only available in Turkish, while the majority of the drivers were Albanian.

### 7.1.3.2 Intermediate Effect

Behaviour sampling was performed to evaluate the intermediate effect of the Contractor's management of road transportation safety. The results presented below are the percentage of safe behaviour where 100 % equals to safe behaviour in all observations.

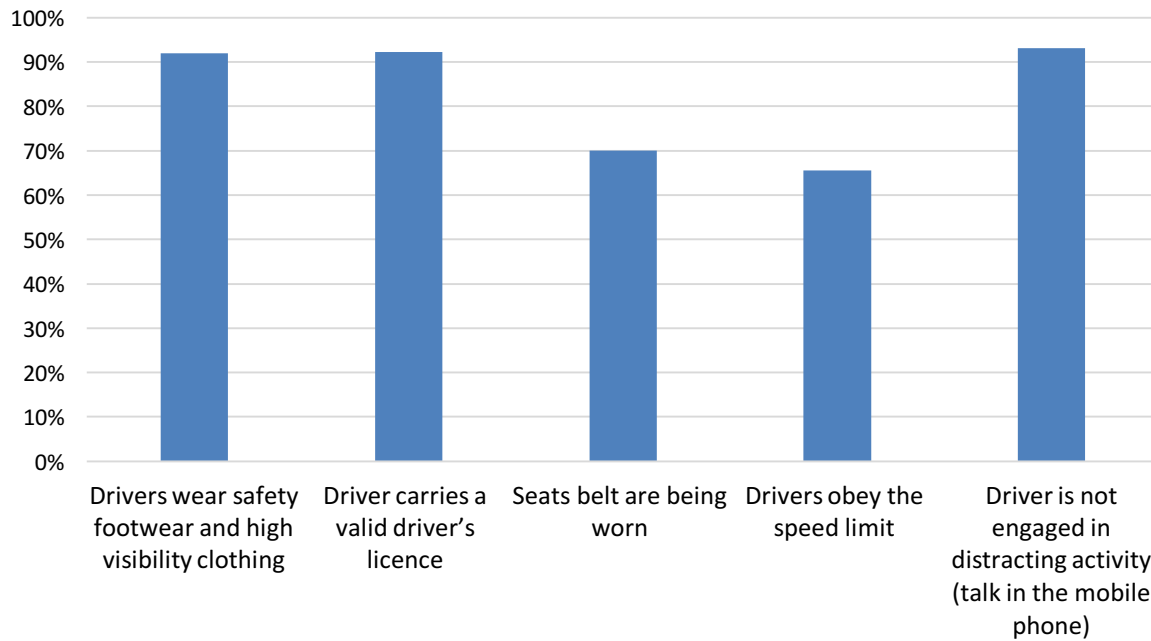


Figure 14 Percentage of safe behaviour from behavioural sampling on road transportation safety 1

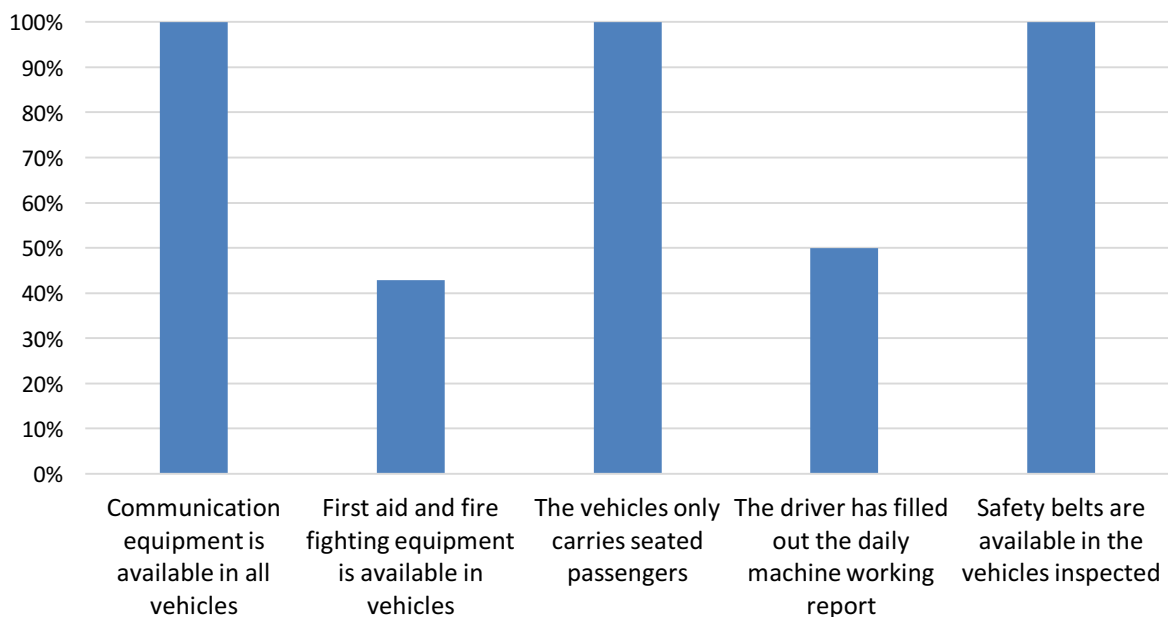


Figure 15 Percentage of safe behaviour from behavioural sampling on road transportation safety 2

The behavioural sampling on transportation safety shows that the main deviations were related to safety equipment in the vehicles, where only 43 % of the checked vehicles had both first aid kit and fire extinguisher. A bigger concern is however the large amount of speeding taking place at the site roads. From the behavioural sampling, only 66 % of the vehicles that were checked during speed control followed the speed limit. Another concern is related to the use of seat belts, as it turned out that seat belts are worn by all passengers in

only 70 % of the cases. However, a technical inspection of the vehicles discovered that all vehicles have seat belts installed.

### 7.1.3.3 Summary of Contractor’s Management of Safety in Road Transportation

In Table 16, the result from the field study of Contractor’s management of safety in road transportation has been summarised.

*Table 16 Summary of Contractor’s management of safety in road transportation*

Requirements	Client’s Requirements no.	Implementation and immediate effect	Intermediate effect
Specifications for construction roads	6	Good	-
Maintenance of vehicles	5	Good	Good
Daily inspections of vehicles	5	Poor	Poor
Safety equipment in vehicles	-	-	Poor
Enforcement of traffic safety rules	7	Poor	Poor
Training of drivers	2	Poor	-

## 7.1.4 Case 2: Tunnelling by Drill and Blast

### 7.1.4.1 Client’s Requirements

In Chapter 7.12.1 in the contractual documents, the Client requires the Contractor to establish and implement procedures regarding the planning and implementation of HSE measures in tunnelling. The procedure is to be based on relevant standards and IAT guidelines for good tunnelling practices. In Table 17, the Client’s requirements have been divided into requirements regarding tunnelling personnel and safety management in tunnelling.

*Table 17 Client’s requirement towards Contractor’s management of safety in tunnelling*

Category	Number	Requirement
Tunnelling personnel	1	Reflective vest as mandatory PPE in tunnels
	2	Regular toolbox meetings shall be carried out with all personnel
	3	Personal lights shall be provided as an provision for adequate escape in case of fire or other accident
	4	The contractors shall provide HSE training for workers in order to ensure that the work is managed and executed by qualified individuals with adequate skills
Safety management	5	The Contractor shall establish medical facilities for health monitoring
	6	Provisions to avoid work in danger zone at the face shall be established
	7	Safe rock support method for bad rock shall be established
	8	Requirements towards lightning in tunnels shall be defined

Category	Number	Requirement
	9	There shall be a documented risk assessment for tunnelling
	10	The Contractor shall carry out inspections and monitor to ensure compliance with HSE in tunnelling
	11	Access to the tunnel shall be controlled to ensure that all personnel are accounted for
	12	Guard rails should be installed to separate vehicles and pedestrians

#### 7.1.4.2 Contractor's Management of Safety in Tunnelling

The Contractor has established its own procedure for tunnelling, the Drill and Blast Tunnel Construction Health and Safety and Emergency Rescue Plan, hereafter referred to as the Tunnel HSE Plan. To assure that work is carried out in a safe manner, the Contractor has developed method statements for underground excavation work by drill and blast.

#### 7.1.4.3 Implementation at Site and Immediate Effect

##### 7.1.4.3.1 Compliance with the Tunnel HSE Plan and Method Statement for Tunnelling

To assess the level of implementation of Contractor's safety management in tunnelling, a mini-audit was carried out of the Tunnel HSE Plan and the method statement for tunnelling. The requirements were divided into the categories tunnel personnel and safety management in tunnelling in line with the Client's requirements. The results of the mini-audit have been shown in Table 18 and Table 19. Requirements that are not posed by the Client, but are defined in the Contractor's internal requirements are not given a number.

Table 18 Compliance with the Tunnel HSE Plan and method statement- Tunnel personnel

Client's requirement no.	Contractor's requirement	Evaluation of implementation /Immediate effect	Comment
-	All persons working underground shall be at least 18 years old and all plant operators and bandsman shall be at least 21 years old.	Good	Before employment, the ID of the worker has to be provided to the personnel department who makes a control of the age of the employee. The personnel department keeps ID records of all employees.
5	Pre-employment health screening shall be carried out on prospective employees relevant to their job function.	Good	Pre-employment health screenings are being carried out for all workers. A site doctor makes a full medical and physical examination of all of the Contractors workers before employment.
1	Special PPE such as hearing protection, steel toe capper rubber boots	Good	The personal protective equipment used in the tunnels is hard hats, safety shoes, protective clothing and ear protections.

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation of implementation /Immediate effect</b>	<b>Comment</b>
	should be worn when inside the tunnels		
4	Specific tunnel induction training shall be given before any person is permitted to work underground	Good	Since the beginning of the project, 563 employees have been given tunnel works and entry training.
2	Regular toolbox talks will be transmitted as a method of on the job training	Good	Records gathered from the Contractor shows that informing workers by toolbox talks have been implemented by the Contractor to a good extent. Since the beginning of the project, 358 workers have been given toolbox talks on different subjects of tunnelling.
3	Personal lights shall be provided as an provision for adequate escape in case of fire or other accident	Poor	Worker does not carry headlights. According to one of the tunnel engineers, workers do not carry headlights because they are easily broken.

*Table 19 Compliance with the Tunnel HSE Plan and method statement- Safety management*

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation implementation /Immediate effect</b>	<b>Comment</b>
9	There is a documented risk assessment for tunnelling	Good	The Contractor has carried out a generic risk assessment for underground excavation work by drill and blast as required. In addition, risk assessments specific for a particular tunnel is also provided along with the method statements.
12	Pedestrians and vehicles will be segregated with barrier wherever possible	Poor	Only two tunnels are wide enough to have pedestrian and vehicles segregated with barriers according to the method statement: The A1 TBM and the LDO outlet tunnel. In the A1 TBM and the LDO outlet, approximately 30 % and 20 % of the tunnels has barriers to segregate vehicles and pedestrians, respectively.
11	A tally system is in place at each portal to account for every personnel in the tunnel	Good	The tally system is in place at the entrance of all tunnels. To be given access to the tunnel, one has to deliver a metal disc when signing in to the tunnel.
8	Turning areas in tunnels are marked and is adequately illuminated	Poor	None of the turning areas in the tunnels is marked. Of the turning areas spotted in the tunnels, 2 of 5 are illuminated.



<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation implementation /Immediate effect</b>	<b>Comment</b>
10	Records of all routine monitoring of physical risk factors shall be maintained	Good	The HSE supervisors perform daily inspections of lightning, noise, humidity, temperature and dust. The records of these daily inspections are kept at the entrance of each tunnel.
10	The tunnels are being inspected regularly by competent personnel (geologist or tunnel engineers)	Good	After each blasting, geologists from the Consultant make a geological examination of the tunnel. From the geological mapping, the geologist decides the thickness of the shotcrete and the length and spacing for the rock bolts.  In addition, The Contractor has own mining engineers who supervise the drill and blast sequence. The mining engineers are also responsible for safety.
10	Accurate and adequate records of the physical aspects of the tunnel construction work and materials used shall be kept	Good	After each blasting operation, the Consultant fills out a Tunnel Face Mapping Record containing geological descriptions of the rock mass as well as detailed descriptions of the materials being used, such as thickness of concrete and length of rock bolts. The Consultant keeps the records.

Overall, the mini- audit shows that the Client's requirements have been implemented to a large extent. The deviations discovered during data collection were related to the segregation of pedestrians and vehicles, the illumination of turning areas and use of headlights or personal lamps.

#### **7.1.4.4 Intermediate Effect**

To evaluate the intermediate effect of Contractor's management of safety in tunnelling, behavioural sampling was performed. In the behavioural sampling, attention was paid to the hazards of moving machinery and rock fall, which are the most common causes of severe accidents in the Client's company. Requirements marked with (\*) are based on less than five observations. The result has been displayed in Figure 16 and Figure 17.

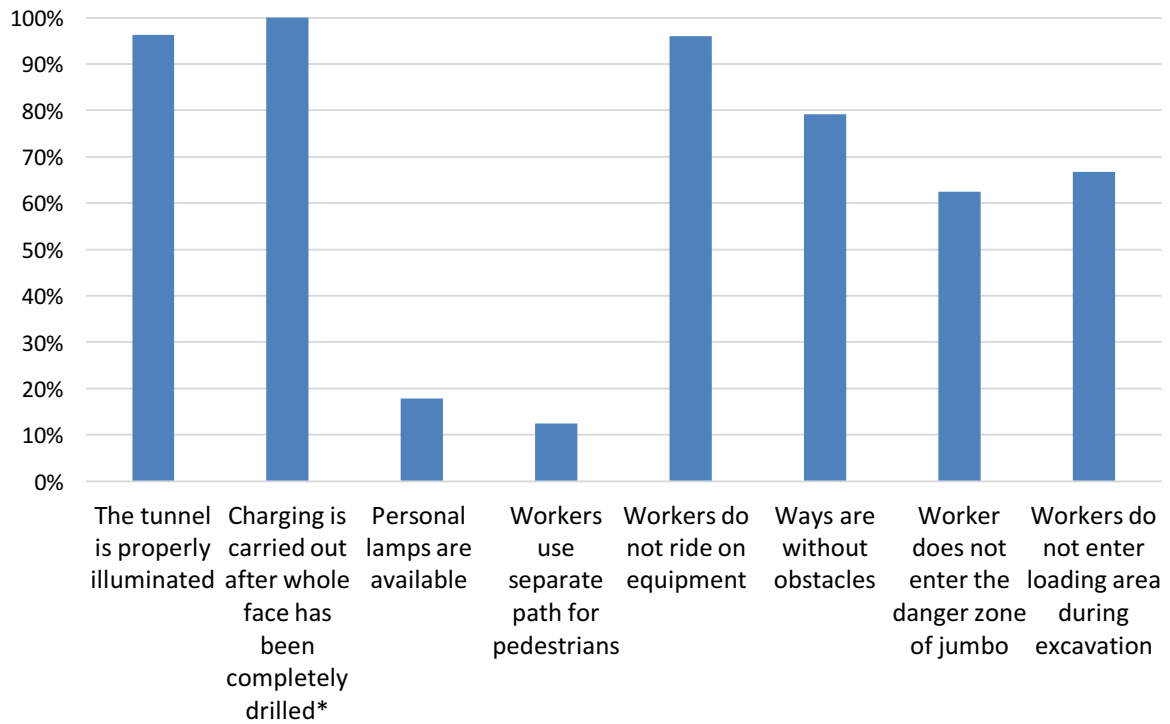


Figure 16 Percentage of safe behaviour from behavioural sampling in tunnelling and the hazard of moving machinery

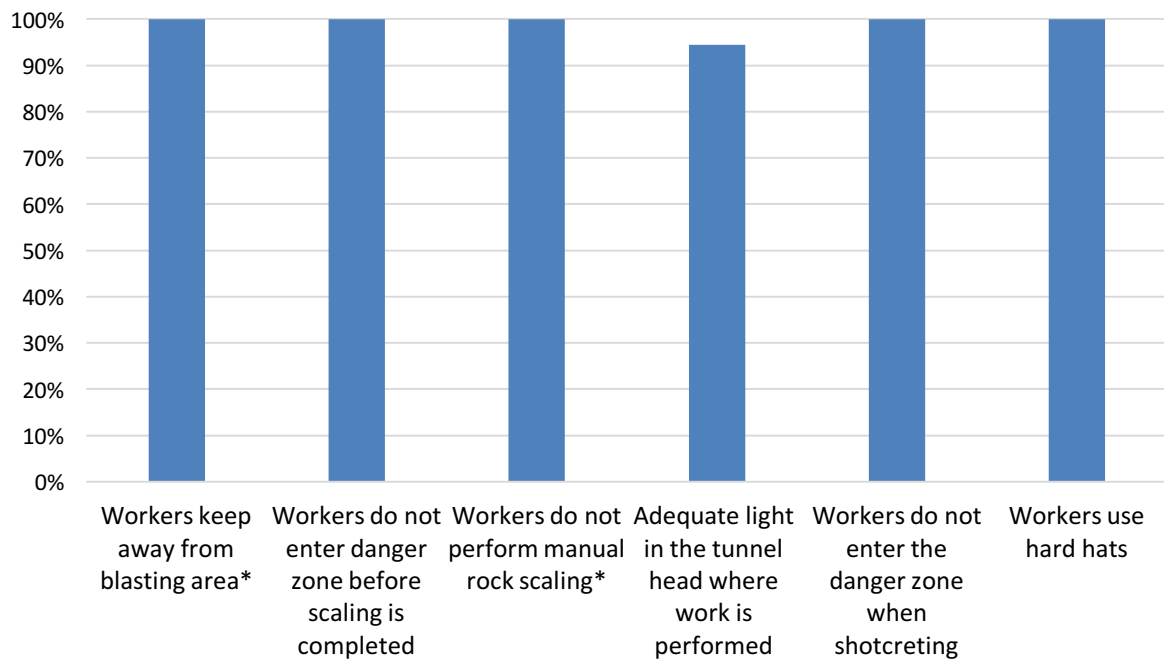


Figure 17 Percentage of safe behaviour from behavioural sampling in tunnelling and the hazard of falling rock

From the behavioural sampling in tunnelling, the unsafe behaviour demonstrated was related to human- moving machinery interaction. In only 14 % of the witnessed cases, the pedestrian walkways were used. From the author’s point of view, this is considered the main issue in tunnelling in the project, due to the especially large amount of heavy vehicles and

workers in the tunnels at all times. Only 27 % of the personnel consulted had headlights or personal lamps available. In none of the circumstances were drilling and charging performed at the same time. On the hazard of rock fall, no unsafe behaviour was spotted during the behavioural sampling.

#### 7.1.4.5 Summary of Contractor’s Management of Safety in Tunnelling

In Table 20, the results from the field study of Contractor’s management of safety in tunnelling have been summarised.

*Table 20 Summary of Contractor’s management of safety in tunnelling*

<b>Requirements</b>	<b>Client’s Requirements no.</b>	<b>Implementation and immediate effect</b>	<b>Intermediate effect</b>
Pedestrians and vehicle segregation	12	Fair	Poor
Illumination	8	Good	Good
Provision to work at the face	6	-	Poor
Compliance with method statement	6	Good	Good
Use of PPE	1	Good	Good
Personal lamps	3	Good	Poor
Supervision of tunnelling	10	Good	Fair

### 7.1.5 Case 3: Lifting Operations

#### 7.1.5.1 Client’s Requirements

The requirements posed towards the Contractor’s management of safety in lifting operations are described in Chapter 7.13.3 in the contractual documents. In the contractual documents, requirements are posed towards lifting personnel, lifting equipment and the management of lifting operations. Examples of the Client’s requirements have been shown in Table 21 and have been further assessed in the following chapter.

*Table 21 Client’s requirement towards Contractor’s management of safety in lifting operations*

<b>Category</b>	<b>Number</b>	<b>Requirement</b>
Lifting personnel	1	Workers involved with lifting equipment should be trained
	2	Tool box talks on the subject of lifting operations should be carried out regularly with lifting personnel
Lifting equipment	3	All lifting equipment must be certified
Management of safety in lifting operations	4	Areas where lifting is performed must be clearly marked with warning signs

Category	Number	Requirement
	5	Unauthorised access below the work range of the crane should be prevented
	6	The Contractor shall inspect and monitor to ensure compliance with HSE requirements in lifting operations
	7	The Contractor shall have a documented risk assessment for lifting operations

In Chapter 5.5.3 in the contractual documents, it is stated that all equipment should be properly maintained and suited to their purpose. No further details are provided about tagging, inspections and storage of lifting equipment.

### 7.1.5.2 Contractor's Management of Safety in Lifting Operations

The Contractor has established procedures for the executions of lifting operations; the Lift Plan Procedure and Lifting Equipment and Plant Procedure. In comparison to the Client's requirements, the internal requirements in these documents go beyond what is required by the Client. There is no generic method statement for crane lifts. However, the method statement for lifting operations is described in the method statement for the TBM assembling work.

### 7.1.5.3 Implementation at Site and Immediate Effect

#### 7.1.5.3.1 Compliance with Lifting Procedures and Method Statement

A mini- audit was performed to evaluate the level of implementation of Contractor's management of safety in lifting operations. Requirements from the Lift Plan Procedure, Lifting Equipment and Plant Procedure and method statement were divided into the categories lifting personnel, lifting equipment and management. The result of the mini- audit has been displayed in Table 22, Table 23 and Table 24.

*Table 22 Compliance with lifting procedures and method statement - Lifting personnel*

Client's requirement no.	Contractor's requirement	Evaluation implementation /Immediate effect	Comment
-	Operator shall check lifting machinery / plant daily basis prior to use according attachment form	Good	The crane operator fills out the daily inspection checklist of the technical standard of the crane. The records are kept by Forman at the site.
-	The Crane operators shall be over 18 years of age and competent and licensed to operate the crane	Good	The two crane operators at site got their crane operating licence and are over 18 years old of age.

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation implementation /Immediate effect</b>	<b>Comment</b>
1	The Crane operators shall be adequately trained on the crane he is assigned to operate	Fair	The crane operations did not receive any training when being employed by Contractor. However, the two crane operators at site have 14 and 7 years' experience as crane operators.
2	Toolbox talks shall be transmitted on a regular basis	Fair	As of march 2016, eleven toolbox talks with talks have been transmitted on the topics of general lifting operations and signalling in the project.
1	Only specially trained personnel is authorized to connect parts to the crane (Slinger or Banksman)	Good	19 workers have received training in "safe operation and use of mobile cranes". A professional company, TUV Australia, carried out the training.

*Table 23 Compliance with lifting procedures and method statement - Lifting equipment*

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation of implementation /Immediate effect</b>	<b>Comment</b>
-	The colour code system is applied all lifting equipment in the project.	Poor	The colour code system has not yet been implemented in the project.
-	Lifting equipment must be inspected prior to use on each shift.	Poor	According to the Contractor's HSE team, the HSE supervisors also perform daily technical inspections of the crane, but there are no records of these.
-	All equipment is CE marked	Good	All equipment checked on site were CE marked.
-	All lifting equipment shall be registered on a monthly basis. Form shall be kept in the HSE department.	Poor	Lifting equipment is not registered using the lifting equipment register form as required.
-	All lifting equipment shall be inspected quarterly within a year. Form shall be kept in the HSE department.	Poor	Lifting equipment is not inspected quarterly. No records from the inspections are kept.
3	All lifting equipment manufacture declaration certificate shall be kept in the HSE department and Machinery Department.	Good	Certification of lifting equipment is kept in the Machinery Department by the TBM mechanical engineer.
-	When lifting equipment is not being used, it shall be stored in secure dry conditions, preferably by	Poor	According to the Construction manager for the TBM assembling, all lifting equipment is stored in a container during the night. However,

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation of implementation /Immediate effect</b>	<b>Comment</b>
	hanging on a rack where they cannot get tangled or contaminated.		observations during night-time shows that the lifting equipment attached to the crane is not removed after the lifting operations are finished. Because of limited space for storage of equipment for the TBM assembling, lifting equipment such as wires are stored outside under a plastic cover.
-	Before operation begins all lifting equipment has to be checked for eventual damage and a protocol has to be written	Poor	Lifting equipment is only checked for damage in the beginning of the day. Protocols are kept.

*Table 24 Compliance with lifting procedures and method statement- Management*

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation of implementation /Immediate effect</b>	<b>Comment</b>
-	There is an approved lifting plan for the activities	Good	It is mandatory to fill out a lifting plan if the weight of the load is more than 5 tons. The records for the lifting plans are kept at the area of the TBM- assembling. For the lifting operations at the cement factory, lifting plans are not used.
-	Before lifting, the correct size of the lifting load has to be checked	Fair	According to the crane operator, the weight of the load is only checked in cases with doubt. For the assembling of the TBM, documentation with the correct weight of each device is provided by the manufacturer.
4	The remedial area around the load has been barricaded and warning signs are provided	Poor	During the time of the audit, the remedial area was barricaded of by the Client's Site team previous in the day. However, observations on site shows that the remedial area around the crane is not barricaded at all times. No warnings signs are provided at the area of the lifting operations.
-	Areas where lifting is repeatedly going on, is clearly marked with warning signs	Poor	There are no warning signs in the area of the lifting operation
7	The Contractor shall have a documented risk	Good	A documented risk assessment of lifting operations is provided

<b>Client's requirement no.</b>	<b>Contractor's requirement</b>	<b>Evaluation of implementation /Immediate effect</b>	<b>Comment</b>
	assessment for lifting operations		along with the Lift Plan Procedure
6	The Contractor shall inspect and monitor to ensure compliance with HSE requirements in lifting operations	Poor	At the area of the TBM assembling, an HSE supervisor is present to ensure that work is carried out safely. The supervisor makes sure that there is a lifting plan signed and approved before any lifting operation with a load that weighs more than five tons. From observations made on site, the HSE supervisor responsible for the area at the time did not pay much attention to the lifting operations. Conversations with the HSE supervisor discovered that he had no experience from working with HSE and had not received any training.

The requirements towards the crane operator are considered to be implemented in accordance to the Client's requirements. However, on the subject of lifting equipment, registration and colour marking of lifting equipment has not been implemented. In addition, issues related to the daily technical inspections of lifting equipment and issues related to proper storage of lifting equipment were identified.

#### **7.1.5.4 Intermediate Effect**

Behavioural sampling was performed in order to evaluate the intermediate effect of Contractor's safety management in lifting operations. The result has been displayed in Figure 18.

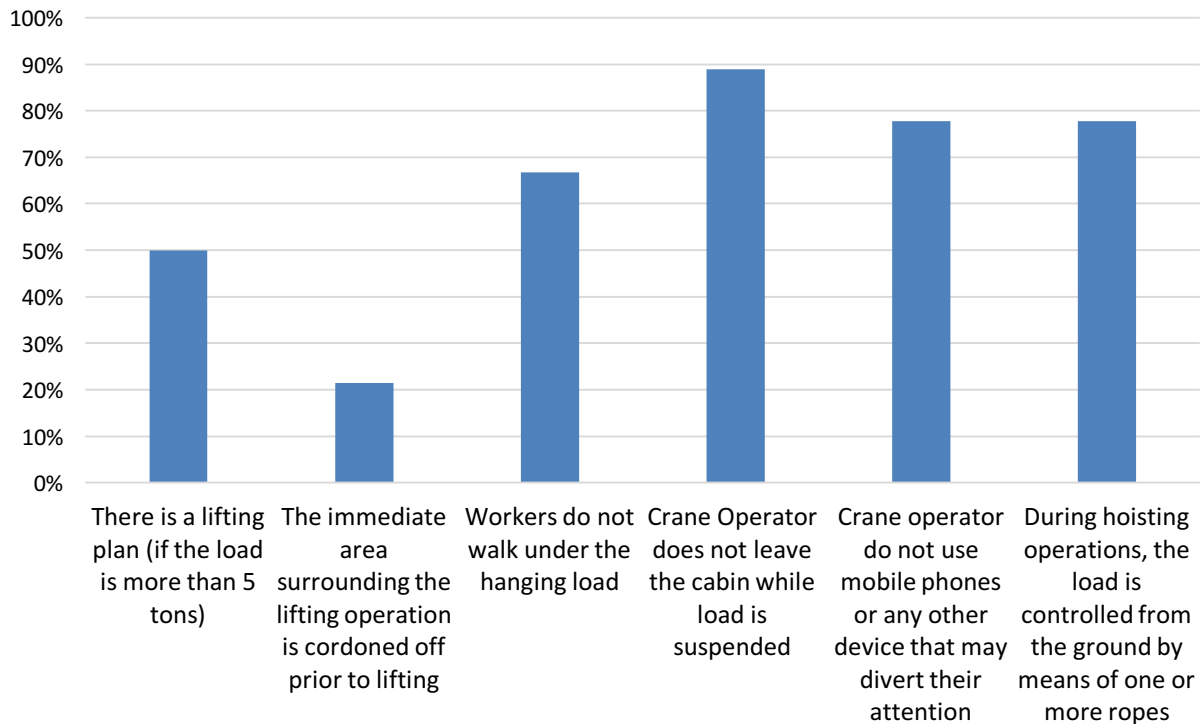


Figure 18 Percentage of safe behaviour from behavioural sampling on lifting operations

In only 22 % of the cases, the immediate area around the load was cordoned off during lifting operations. For loads more than 5 tons, a lifting plan was available in only 50 % of the cases. All of the lifting operations without a lifting plan took place at the cement factory. For 67 % of the lifting operations, the workers did not go under the hanging load. For the majority of the lifting operations at the TMB assembling, the load was controlled from the ground by means of one or two ropes. However, in some cases the ropes were very short, and were not used during the entire lifting operation.

#### 7.1.5.5 Summary of Contractor’s Management of Safety in Lifting Operations

In Table 25, the results from the field study of Contractor’s management of safety in lifting operations have been summarised.

Table 25 Summary of Contractor’s management of safety in lifting operations

Requirements	Client’s Requirements no.	Implementation and immediate effect	Intermediate effect
Inspections of lifting equipment	-	Poor	-
Area of lifting operations are cordoned off	5	-	Poor
Provision to walk under the handing load	5	Poor	Poor
Lifting plan	-	Good	Fair
HSE training	1	Good	Poor
Supervision of lifting operations	6	Poor	Poor



Requirements	Client's Requirements no.	Implementation and immediate effect	Intermediate effect
Storage of lifting equipment	-	Poor	-

### **7.1.6 Summary of Contractor's Management of Safety in Work with Severe Accident Potential**

The findings from the assessment of Contractor's management of safety in work with severe accident potential have been summarized in bullet points:

- The Client's requirements are implemented into the Contractor's safety management system to a satisfactory extent.
- Deviations related to the implementation of daily technical inspections of vehicles were discovered.
- Issues related to proper storage, registration and inspections of lifting equipment were identified.
- Issues related to the implementation of segregation of vehicles and pedestrians in tunnelling were discovered.
- The Contractor has a good training program for tunnelling and lifting operations.
- Supervision of road transportation and lifting operations is considered poor.
- Safety rules in lifting operations and traffic rules such as obeying the speed limit were frequently broken.

## ***7.2 Client's site team's Management of Contractor's HSE Compliance through Inspections***

The Client's site team does not have a risk- based approach to their daily safety inspections and consequently, does not practise directed inspections in any of the hazardous work cases, i.e. road transportation, tunnelling and lifting operations. Therefore, an overall assessment of the Client's site team's daily safety inspections has been performed in this chapter.

### **7.2.1 Client's Requirements and Expectations towards the Site Team**

The Client's requirements towards the site team's follow up on the Contractor during construction are defined in the group requirement Management of HSE in Field Investigations and in Manufacture and Construction of Plant. The Client requires the project to establish an HSE management program to describe the requirements, responsibilities for follow up on

Contractor on HSE during construction. The requirements in terms of following up on Contractor through observations have been summarised in Table 26.

*Table 26 Client's requirements to follow up on Contractor's SHE compliance through observations*

Category	Client's requirement no.	Requirement
Inspections	1	The site team shall have a risk based plan for follow up on HSE in construction
	2	The site team shall establish a plan for regular inspections of the site
	3	The inspections shall cover all areas and shifts at regular intervals
	4	A specialist is required for performing inspections on temporary electrical systems, construction roads, tunnels and vehicles and heavy equipment
	5	The site team shall participate in inspections by the Contractor
	6	Management both in the Client and the Contractor's organisation shall participate in inspections
	7	There shall be a system for documentation and follow up of findings to ensure timely closure of deviations identified
Road transportation safety	8	The site team shall carry out inspection of new project roads
	9	The site team shall carry out inspection of new vehicles and heavy mobile equipment brought to site
	10	The site team shall perform acceptance test of new drivers brought to site
	11	The site team shall carry out regular inspections of the safety standard of project roads, vehicles, rivers kills and auditing of transportation service providers

From a document review of the Client's requirements towards their own site team, it is evident that the Client does not pose any requirements on how the inspections should be executed. From interviews with the Client's HSE management, it was discovered that the Client expects the team to make their own necessary calls by hiring a competent Site team.

### **7.2.2 Site Team's Follow up on Contractor through Observations**

The Client's site team has not established an HSE management program for their follow up on HSE in construction. The Client's site team does not have a written procedure for inspections or an inspection plan. In the project, no routines have been established for the follow up on Contractor on transportation safety, as required by the Client.

### 7.2.3 Implementation at Site

The resources used to conduct HSE inspections have been summarised by using the Man, Technology and Organisation (MTO) model and has been presented in Table 27.

*Table 27 Review of the Client's site team's HSE inspections by using the MTO model*

<b>MTO category</b>	<b>Daily inspections</b>	<b>Weekly inspections</b>
Personnel	<p>The Client's site team consists of the HSE coordinator and two HSE inspectors on the dayshift and one in the night shift. The HSE inspectors rotate between Banja HPP and Moglice HPP, spending an average of four weeks on each project.</p> <p>The majority of the Client's Site team has no formal qualifications in HSE, only experience from working with HSE. According to the Client's Site team, there is a big lack of qualified HSE personnel in Albania due to the lack of big construction projects in the country. However, the Client offers their HSE inspectors to obtain qualifications and certificates such as NEBOSH.</p>	<p>Weekly inspections are performed by the Client's HSE Coordinator, the Client's Project manager, the Contractor's HSE manager and the Contractor's project manager. The weekly inspections are performed on a selected geographical area of the site.</p>
Instruments and tools	<p>No checklists are used for the daily inspections. During the inspection, the HSE inspector takes a photograph of the deviation spotted. At the end of the day, the HSE inspectors record their findings in inspection protocol. The inspection protocol includes:</p> <ul style="list-style-type: none"> <li>• Date</li> <li>• A photo of the non-compliance</li> <li>• Location and description of hazard</li> </ul>	<p>No checklists are used for the weekly HSE inspections carried out by the management team. The Contractor records the findings from the inspection in an inspection protocol.</p>
Organisation and procedures	<p>The information gathered in the inspection protocols are sent to the Contractor's HSE department and the Client's HSE Coordinator in the end of the day. The Client's HSE Coordinator collects all the recorded deviations into an excel document called the Observation Tracker. This excel document is also shared with the Contractor's HSE department every week. The Observation Tracker document shows the status of the observation and the close out date. From the recorded deviations, the spreadsheet presents the statistics from the following month, as well as statistics cumulated for the entire year. The statistics allows the site team to follow the development in deviations by category, and to follow up on Contractor's work with closing the matter.</p>	<p>The area to be inspected is decided on the weekly progress meetings. The area of inspection is decided by using a risk-based approach where the main HSE concern for the week will be addressed.</p>

In Table 28, an assessment of the level of implementation and immediate effect of the site team's safety inspections have been summarized based on the resources utilized.

Table 28 Assessment of level of implementation and immediate effect from the site teams inspections

No.	Client's Requirements	Evaluation of level of implementation /Immediate effect	Comment
3	The inspections shall cover all areas and shifts at regular intervals	Good	The site team cover all site areas every day
4	A specialist is required for performing inspections on temporary electrical systems, construction roads, tunnels and vehicles and heavy equipment	Poor	No specialists are used on the inspections of special fields
5	The site team shall participate in inspections by the Contractor	Good	Observations made on site reveals that the site team frequently participate in the Contractor's daily inspections
6	Management both in the Client and the Contractor's organisation shall participate in inspections	Good	The Client and Contractor's upper management perform weekly inspections
7	There shall be a system for documentation and follow up of findings to ensure timely closure	Good	The inspection findings is registered by the end of the day by all site team members
	There are own dedicated personnel and routines for follow up on transportation safety	Poor	There are no routines for follow up on transportation safety
1	The inspection team has a risk approach to inspections	Poor	The inspection team does not have a risk-based approach to their daily inspections. The inspectors focus on covering all site areas where work is carried out on the particular day.

In Chapter 7.2.1 about the Client's requirements towards the site team, it was stated that the Client expects the inspection team to be competent and make their own necessary calls. The majority of the Client's site team has no formal qualifications in HSE, only experience from working with HSE. However, the Client offers their HSE inspectors to obtain qualifications and certificates such as NEBOSH.

#### 7.2.4 Immediate Effect

To evaluate the immediate effect of safety inspections, it was decided to perform an analysis of the status of the observations made from the Client's inspections in 2015. Figure 19 shows that only 20 % of the observed deviations have been closed by the either the Client or the Contractor. It appears that an entire 71 % of the work activities were finished before a corrective measure was implemented.

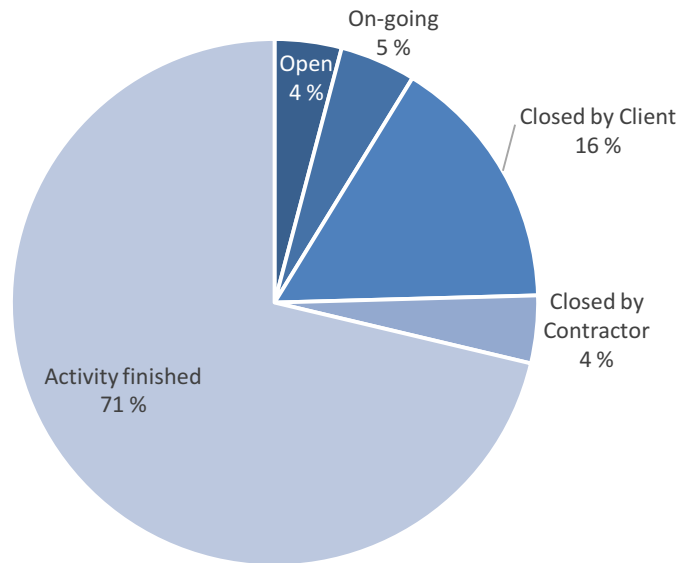


Figure 19 Observation status for all deviations recorded in 2015 by the Client's Site team (N=2703)

In February 2016, the Client's site team recorded 504 deviations. To evaluate the immediate effect of the remedial actions suggested, the remedial actions were evaluated by using Van Court Hare's hierarchy of level of feedback. The remedial actions assessed are suggested by both the Client and the Contractor. For the observations with zero level of feedback, no remedial measures were recorded. As seen from Figure 20, the majority of the proposed measures are of first order of feedback, which means that deviations are identified and corrected. Based on relevant theory, it is expected that the deviation may reoccur and that the immediate effect of the inspections is low.

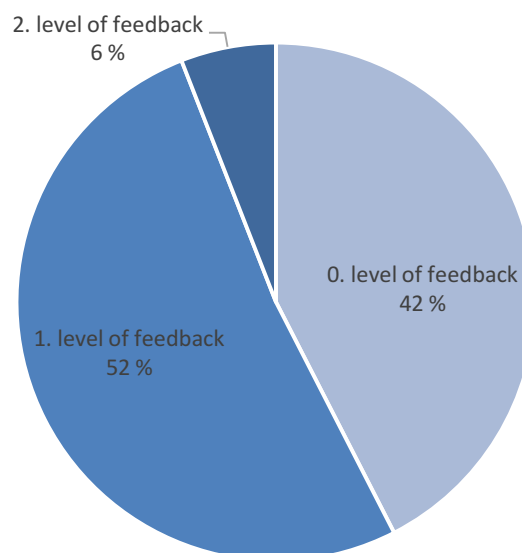


Figure 20 Classifications of remedial actions suggested from Client according to Van Court Hare's theory (N=504)

Based on the success criteria defined in the literature review in Chapter 5.2, the daily inspections carried out by the site team have been evaluated and the result has been presented

in Table 27. When comparing the requirements defined by the Client and the criteria established in the literature review, it is apparent that the criteria from the literature review are more directed towards the quality and the execution of the inspections. As previously stated, the Client does not pose any requirements towards their own site team on how the inspections shall be executed.

*Table 29 Evaluation of the site teams daily safety inspections based on criteria established from the literature*

<b>Success criteria</b>	<b>Evaluation</b>	<b>Comment</b>
Themes for inspections are defined	Poor	Themes for inspections is not defined
Theme specific checklists are established	Poor	The site team does not use checklists
There is a limited number of themes to be checked during one inspection	Poor	The HSE inspectors identify all deviations on the site
Actions are proposed based on findings from inspection	Poor	For each of the inspections findings, comments are recorded. Remedial actions are proposed approximately 20 % of the time. According to the Client's Site team, remedial actions should not be suggested due to legal prosecutions.
Actions proposed are adequate, feasible and comprehensive	Poor	For February 2016, only 58 % of the recorded deviation had proposed actions, as shown in Figure 20. Of the actions proposed, 52 % were of first order of feedback and 6 % of second order of feedback.
Remedial actions are implemented	Poor	As seen from Figure 19, only 20 % of the observed deviations have been closed out.
The inspections cover all aspects of MTO model	Fair	Inspections findings are mostly related to technical findings and human behaviour, as seen from Figure 21.
Inspections are based on a positive approach	Poor	During inspections, the HSE inspectors take a picture of the worst deviation they witness on site. In the inspection protocol, a photo of the non-compliance is to be included.

Figure 21 shows all the inspection findings from 2015 sorted by hazard category. From the figure, it can be seen that the majority of deviations recorded are related to the environment, working at height and use of personal protective equipment (PPE). In light of the MTO-model, organisational factors are underrepresented in the observations, which mainly focus on the man and technology dimension, which can be more easily spotted. The figure also shows that the hazardous work activities focus of Chapter 7.1 accounts for many of the recorded findings.

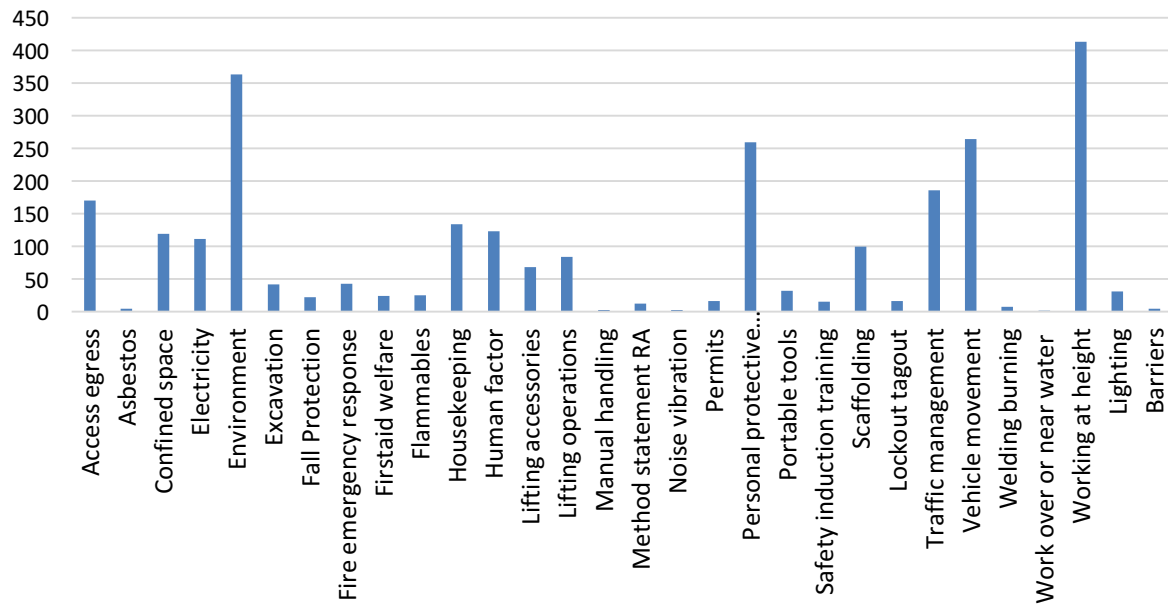


Figure 21 Observation findings sorted by hazard category (N=2703)

### 7.2.5 Intermediate Effect

To investigate the intermediate effect of the site team’s safety inspections, the number of deviations between September and February 2016 were sorted by the hazardous work activities. It is important to point out that Figure 22 only provides an indication of the effectiveness of the safety inspections, as several factors such as the amount of work and number of safety inspections performed may influence the result. Nevertheless, Figure 22 does not provide any unambiguous conclusion that the safety inspections have had a positive effect on the safety performance. Especially for tunnelling, the number of observations varies to a large extent, and has an increasing trend line. It is reason to believe that the increasing trend has a correlation with an increase in the amount of tunnel work. For road transportation and lifting operations, the number of observation has a stable trend. This is in line with Van Court Hare’s theory of hierarchy of feedback, which states that feedback from safety inspections are so-called first order of feedback and that deviations may reoccur.

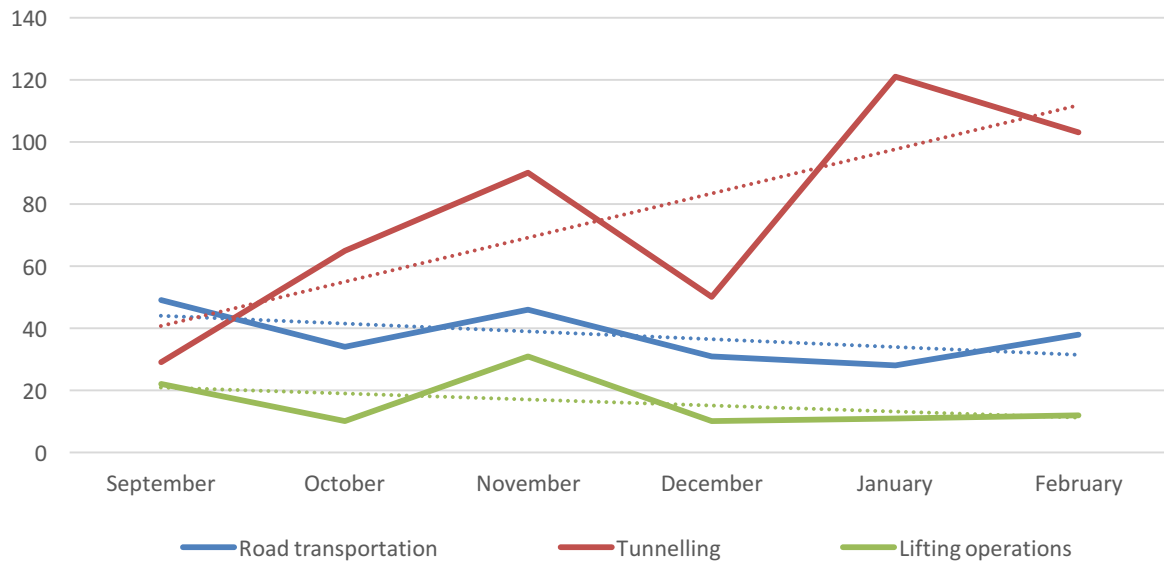


Figure 22 Number of safety observations for September 2015 to February 2016 (N=780)

## 7.2.6 Summary of Client's site team's Management of Contractor's HSE Compliance through Observations

In Table 30, selected requirements from the evaluation of the Client's safety inspections have been summarized.

Table 30 Summary of site team's management of Contractor's HSE compliance through observations

No.	Requirements	Site team's safety management system	Implementation and immediate effect	Intermediate effect
2	The site team shall establish a plan for regular inspections of the site	Not covered	Poor	Poor
3	The inspections shall cover all areas and shifts at regular intervals	Not covered	Good	
4	A specialist is required for special fields	Not covered	Poor	
5	The site team shall participate in inspections by the Contractor	Not covered	Good	
7	There shall be a system for documentation and follow up of findings to ensure timely closure	Covered	Good	
7	Remedial actions are implemented	Covered	Poor	
8-11	Special inspections for road transportation safety	Not covered	Poor	



### 7.3 Initiatives to Ensure Employee HSE Engagement

In this chapter about Contractor’s initiatives to ensure employee engagement, JSAs, toolbox talks and RUOs have been assessed. In the evaluation, it has been attempted to connect the evaluation of employee HSE engagement with the hazardous work cases road transportation, tunnelling and lifting operations as far as possible.

#### 7.3.1 Client’s Requirements

The Client’s requirements towards Contractors to ensure employee HSE engagement are defined in the contractual document. The requirements have been divided into the categories RUO, toolbox talks and JSA and have been summarised in Table 31.

*Table 31 Client’s requirements towards Contractor’s initiatives to ensure worker HSE engagement*

Category	Number	Requirement
RUO	1	The RUO-rate shall be included in the monthly reporting to the employer
	2	The Contractor should establish a goal for RUO rate
	3	Reports by personnel with the duty to follow up on HSE and reports from regular inspections should not be defined as RUOs
Toolbox talks	5	The Contractor shall perform regular toolbox talks with all personnel
	6	Toolbox talks should be recorded
JSA	7	All personnel involved in the difference work processes shall participate in reviewing the JSA

The Client has set the goal for the RUO- rate to an average of one RUO per employee and year in all their international projects. The Client’s site team expects the Contractor to establish its own system for RUOs. For the implementation of the RUO system, it is expected that an incentive system for the reporting is established along with the implementation of the RUO system.

From discussions, it has become known that there are different opinions in the Client’s project organisation on whether the RUOs should be implemented on site. Some of the managers in the Client’s organisation do not believe that a system such as the RUO-system should or can be implemented on site due to the poor safety culture in the project. His or her concern is that nobody would bother reporting unless there were money or a price involved. On the other hand, with such an incentive system, it is in their opinion that the quality of the RUOs would be poor.

### 7.3.2 Contractor's Documented Safety Management System for Employee HSE Engagement

The Contractor's approach for ensuring employee HSE engagement is described in the Contractor's HSE program. In the HSE program, the requirements towards JSAs, RUOs and toolbox talks have been covered in accordance to the Client's requirements.

### 7.3.3 Implementation at Site

In Table 32, the level of implementation and immediate effect of Contractor's initiatives to ensure employee HSE engagement have been evaluated by carrying a mini audit.

*Table 32 Assessment of level of implementation from Contractor's initiatives to ensure employee HSE engagement*

Client's requirement	Contractor's requirement	Evaluation of level of implementation	Comment
-	All notable events or hazardous conditions should be reported to the employer. Routines for ensuring compliance must be documented.	Poor	No routines for reporting of unwanted incidences are documented
1	The RUO-rate shall be included in the monthly reporting to the employer	Poor	The number of unwanted occurrences and the RUO-rate is included in the monthly report, but are not reliable
2	The Contractor should establish a goal for RUO rate	Poor	The Contractor has not established a goal for the RUO rate
3	The RUOs shall be reported by personnel without duty to follow up on HSE	Poor	Only personnel with duty to follow up on HSE report RUOs.
4	The Contractor shall perform regular toolbox talks with all personnel	Fair	As of February 2016, 126 toolbox talks have been carried out since the beginning of the project. According to the questionnaire issued to Contractor's workers, 65 % claimed that there were regular toolbox talks at the work site
5	Attendances from toolbox talks should be recorded	Good	In the toolbox talks register, themes and attendances from toolbox talks are recorded
6	All personnel involved in the difference work processes shall participate in reviewing the JSA	Poor	No JSAs have been carried out since the beginning of the project

The Contractor's HSE team are not familiar with the term RUO and a form for RUOs does not exist in the project. According to the Contractor's HSE team, non HSE-personnel

rarely report hazardous situations and near miss accidents in the project. The RUOs in the project are made by gathering the reported near misses from the incident report filled out by the Contractor's HSE supervisors. In light of this, it is clear that a system for RUOs has not been implemented in the project as required by the Client. However, conversations with the Contractor's HSE team reveals that a written system for RUO is something they are willing and interested in implementing.

Message boards with the contact information for the HSE department are located on site. According to the Contractor's HSE team, any unwanted occurrences and hazardous situations occurring in the project are reported by employees phoning the HSE office. From conversation with the Client's Site team, the Client's Site team are also contacted for help, instead of construction workers notifying their manager. The site team will then make a "routine" inspection of the site where the hazardous situation takes place.

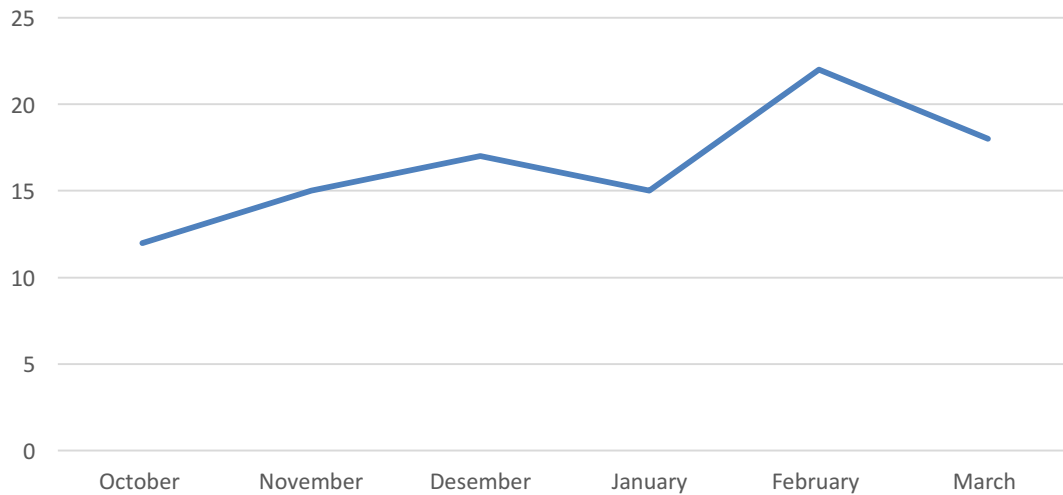
#### **7.3.4 Immediate Effect**

So far, it has been discovered that systems for RUOs or JSAs are not implemented in the project.

Consequently, an evaluation of the immediate effect of the RUOs and JSAs are not worth pursuing. Therefore, the evaluation of the immediate effect of Contractor's initiatives to ensure employee is limited to the engagement of workers through toolbox talks.

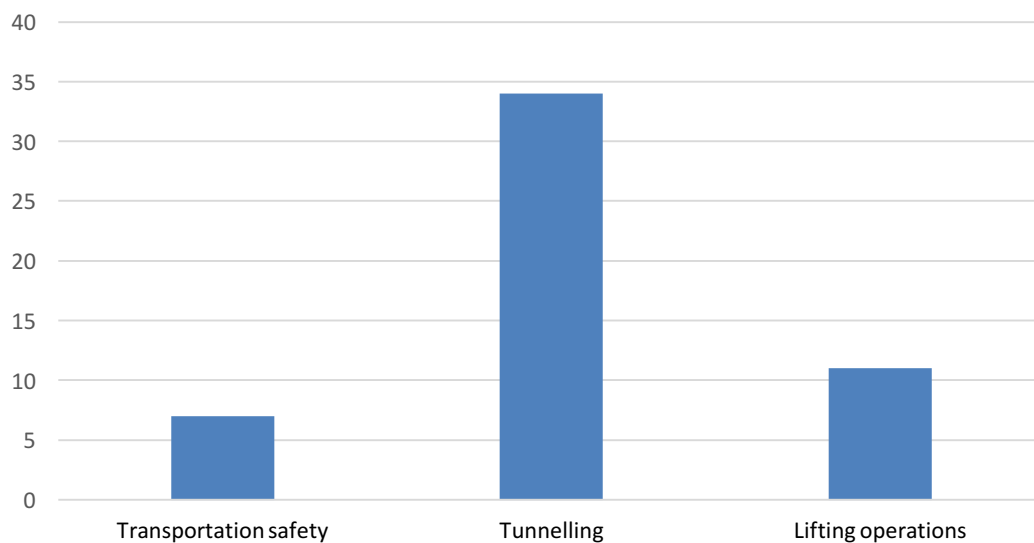
##### **7.3.4.1 Toolbox Talks**

As of February 2016, a total of 126 toolbox talks have been carried out since the beginning of the project. In Figure 23, the number of toolbox talks between October 2015 and March 2016 is presented. For the months reviewed, there was an average of 16.5 toolbox talks transmitted every month. The topics and attendees for the toolbox talks, are recorded in an excel spreadsheet. The spreadsheet does not record feedback from the toolbox talks.



*Figure 23 Number of toolbox talks for the months between October 2015 and March 2016*

As Figure 24 shows, engagement of workers' through toolbox talks is implemented to a various extent for the hazardous work cases. While several toolbox talks have been carried out on the issue of tunnelling, few have been transmitted on the issue of road transportation and lifting operations.



*Figure 24 Number of toolbox talks carried out on the subjects of transportation, safety, lifting operations and tunnelling between November 2014 and March 2016*

According to the Contractor's HSE team, the main purpose of toolbox talks is to raise awareness about hazards associated with the work activity and not to consult with workers. The toolbox talks transmitted in the project are therefore considered as a one-way communication and do not engage workers in HSE issues to a large extent. Although toolbox talks have been implemented to a fair extent, the immediate effect in terms of engaging workers is considered low.

### 7.3.5 Summary of Initiatives to Ensure Employee HSE Engagement

In Table 33, the assessment of the Contractor’s initiatives to ensure employee HSE engagement has been summarized.

*Table 33 Summary of initiatives to ensure employee HSE engagement*

<b>Client requirement no.</b>	<b>Contractor’s requirements</b>	<b>Contractor’s safety management system</b>	<b>Implementation</b>	<b>Immediate effect</b>
1	The RUO-rate shall be included in the monthly reporting to the employer	Covered	Poor	-
2	The Contractor should establish a goal for RUO rate	Not covered	Poor	-
-	All notable events or hazardous conditions should be reported to the employer	Covered	Poor	-
4	The Contractor shall perform regular toolbox talks with all personnel	Covered	Fair	Poor
6	All personnel involved in the difference work processes shall participate in reviewing the JSA	Covered	Poor	-

### 7.4 Long Term Effect of Safety Management Practices

In this Chapter, the long-term effects of the HSE methods have been assessed by evaluating the overall safety performance of the project. In addition, a questionnaire was issued to evaluate the long-term effect of employee HSE engagement and Contractor’s management commitment towards safety.

#### 7.4.1 Overall Safety Performance on Site

The Client has established a goal for the TRI rate to less than five in all their international operations. In Figure 25, TRI- rates from the first 36 months of construction have been displayed for three of the Client’s construction projects: The Cheves HPP, the Cetin HPP and the Devoll HPP (Moglice HPP and Banja HPP). In the figure, the accumulated average TRI-rates for the three projects as well as the target TRI- rate, has been outlined. As can be seen from Figure 26, the Devoll HPP has so far delivered good TRI- rate results, as the accumulated average TRI- rate for Devoll HPP is less than the target TRI- rate. When assessing the Moglice HPP and the Banja HPP separately, the Moglice HPP has an average

TRI- rate of 3.83 since the beginning of construction. Compared to the other construction projects 15 months into the build, the Moglice HPP has a low TRI- rate.

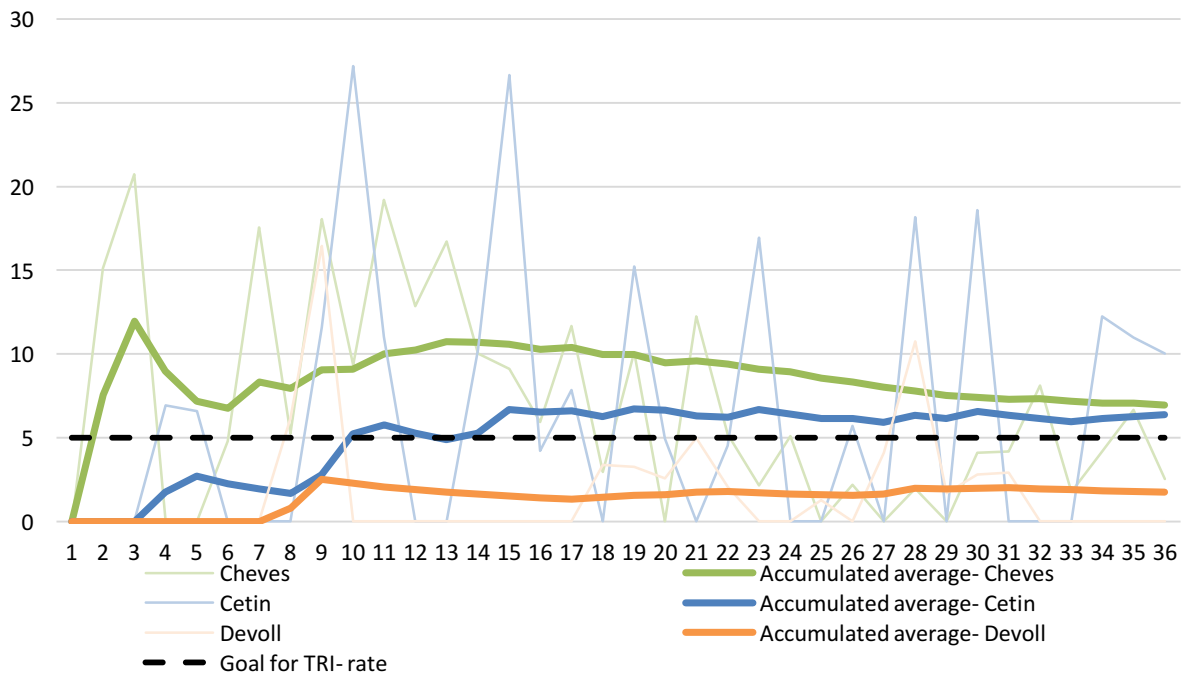


Figure 25 TRI-rates for three of the Client’s construction projects until 36 months after start of construction

Figure 26 shows all incidents recorded in the project between January 2015 and March 2016 sorted by incident type. As can be seen in Figure 26, motor vehicle accidents make up a big proportion of the registered incidents (N=6). In the literature review, it was stated that traffic due to loss of control without any collision, are more frequent in rough terrain, such as dam construction zones. Of the registered motor vehicle incidents, four does not involve collisions.

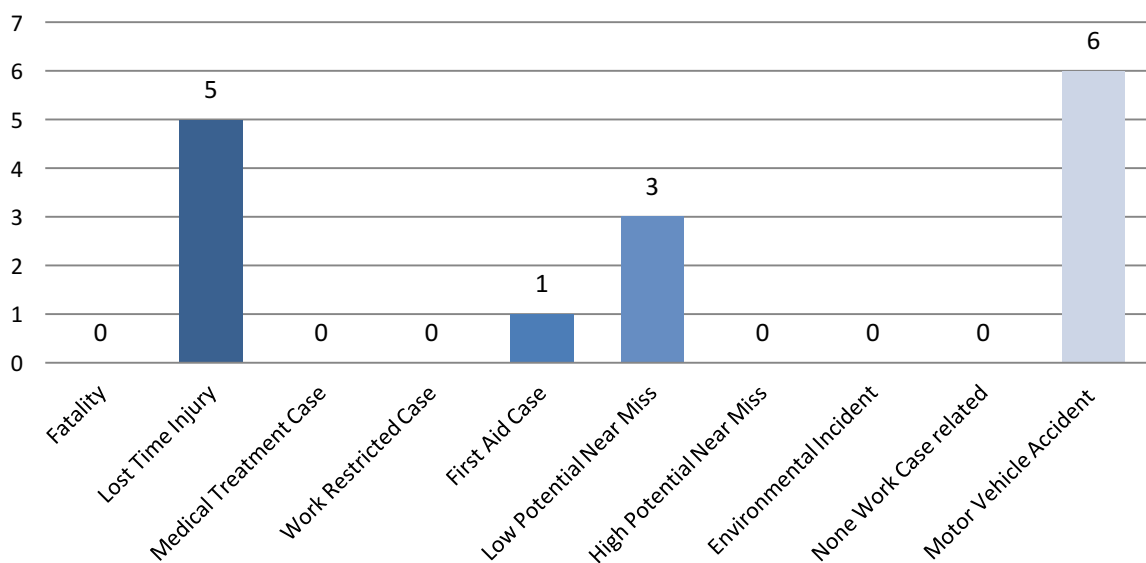


Figure 26 Overall safety performance in the project

From the Project’s accident database, six LTI’s have been recorded between May 2015 and February 2016. The LTIs sorted by work activity have been shown in Figure 27. No LTIs have been registered from lifting operations.

Although six motor vehicle accidents have taken place in the project, only one has resulted in a LTI. The LTI registered from road transportation were caused by a rock smashing into the window of the car, hitting one of the passengers in the head. From the Project’s incident database, the rest of the motor vehicle incidents have been caused by speeding, the driver falling asleep or local drinking and driving.

Three LTIs have been registered in tunnelling. Of the LTIs, all three resulted from rock fall. From the behavioural sampling in tunnelling on the hazard of rock fall, no unsafe behaviour was spotted.

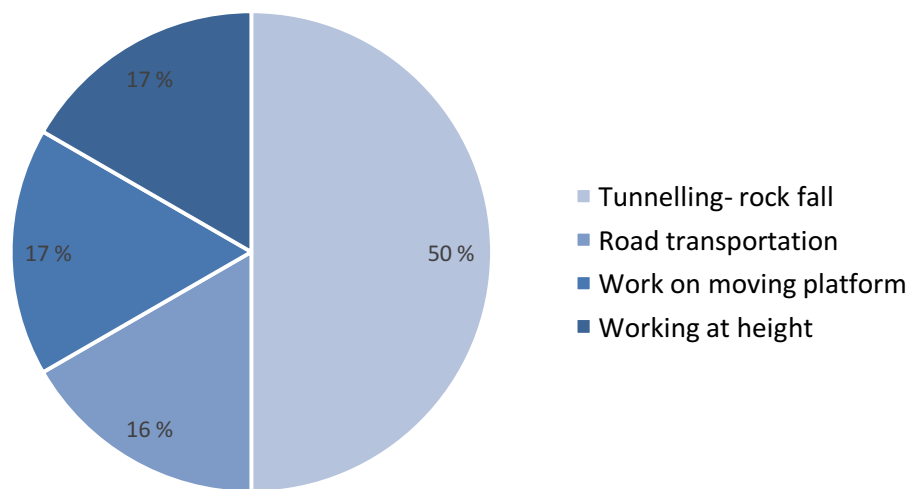


Figure 27 Total number of LTIs recorded between January 2015 and March 2016 (N=6)

#### 7.4.1.1 Reliability of HSE Statistics

According to Senneck (1975), a high average recorded severity of accidents is correspondent to a low reporting reliability. At the Moglice HPP, all of the recorded TRIs are LTIs. Of the LTI’s recorded, five of the six recorded LTIs are accidents with hazards with a high energy content.

Two of the Client’s construction projects with a perceived high reliability of reporting are the Cheves HPP in Peru and the Cetin HPP in Turkey. To review the reliability of the reporting, it was desired to compare the percentage of LTIs from TRIs for the Moglice HPP with the percentage of LTIs from TRI from the Client’s other projects. As can be seen from Table 34, the Moglice HPP has a high percentage of LTIs from TRIs compared to the other projects. The high percentage of LTIs from TRIs and the high average recorded severity of the LTIs might suggest some degree of underreporting.

*Table 34 HSE statistics for three of the Client's construction projects*

<b>Project</b>	<b>Percentage of LTIs from TRIs</b>
Moglice	100 %
Cheves	72 %
Cetin	45 %
All projects in the Client's database (N=25)	64 %

Due to a low level of LTIs (N=6), no firm conclusions can be drawn, but there are indications that the low TRI- rate for Devoll does not reflect the actual risk level due to under-reporting.

#### **7.4.2 Safety Climate Questionnaire**

A questionnaire was issued to Contractor's employees to assess the long-term effect of managements' commitment towards safety and worker consultation. The result of the questionnaire is attached in Appendix 1.

The results from the questionnaire shows that workers have an overall positive perception of management's commitment towards safety. Of the respondents, 55 % think that that the workers' safety practises are very important to the management of their company. However, on the issue of management concern for workers' safety, the minority feel that management do as much as possible to make the job safe. Of the workers, 41 % claim that top management is concerned for their safety, but that they could do more to make the job safe. 34 % claimed that they are only interested in getting the job done as fast as possible.

The majority of the respondents believe that the proper equipment is available at the job site. 32 % states that the foreman regularly and frequently makes workers aware of dangerous work practices and praises workers for safe conduct. However, 28 % and 23 % says that the foremen seldom mention danger and safety practices and that they never mention danger or safety practices.

On the dimension of worker involvement, the result indicates that there are room for improvement. 65 % states that regular toolbox talks are held at the work site, while 35 % of the respondents claim that toolbox talks are not being held regularly.

On the likelihood of injuries, the majority of workers feel that is very likely or somewhat likely that they will be injured on the job in the next 12 months' period. Of the respondents, 59 % feel that risk is somewhat or very much a part of the job. At the same time, an entire 66 % claim that they always alert their supervisor if they see a hazardous situation at the job site.



The Contractor's HSE policy states that they shall "Consult and engage with all employees and sub-contractors regarding site health and safety conditions on a daily basis". While 30 % of the respondents say that they are consulted on health and safety matters on a daily basis, 24 % of the respondents say that they are never consulted on health and safety issues.

## ***7.5 Summary of Results from Field Study***

The main findings from the field study that will be discussed in Chapter 8 have been summarized with bullet points in the following subsection.

For Contractor's management of safety in hazardous work, it has been discovered that:

- 1) The Client's requirements are implemented into the Contractor's safety management system to a satisfactory extent.
- 2) Requirements towards the construction roads are implemented to a good extent.
- 3) Deviations related to the implementation of technical control measures and inspections of vehicles and lifting operations were discovered.
- 4) Issues related to the implementation of segregation of vehicles and pedestrians in tunnelling were discovered.
- 5) The Contractor has a good training program for tunnelling and lifting operations.
- 6) Supervision of road transportation and lifting operations is considered poor.
- 7) Safety rules in lifting operations and traffic rules such as obeying the speed limit were frequently broken.

For the Client's site team's follow up on Contractor, it was discovered that:

- 1) The site team do not have a risk based approach to their daily safety inspections.
- 2) The Client's requirements are not implemented into the site team's documented safety management system.
- 3) Requirements such as using a specialist for special fields and special inspections for road transportation are not implemented at site.
- 4) The site team does not have a systematic approach to their safety inspections and do not use checklist
- 5) The deviations recorded by the site team mainly focus on human behaviour and technical deviations which are easily spotted.
- 6) The site team has a have a distinctly negative approach to their safety inspections
- 7) The short term effects of safety inspections are low as remedial actions are not implemented.

- 8) The Client does not pose any requirements on how the inspections should be executed, but rely on the site team to make the own necessary calls by hiring competent people  
In the assessment of Contractor's approach to ensure workers employee engagement,

the following conclusions can be made:

- 1) Executions of JSAs or workers' participation in JSA is not implemented in the project.
- 2) There are different opinions in the Client's organisation about whether an RUO-system should be implemented at the project.
- 3) There is no system for RUOs implemented in the project.
- 4) Toolbox talks are implemented in the project but are a means of one-way communication and do not engage workers in HSE issues.
- 5) A large percentage of workers claim that they are never consulted on health and safety issues.

## **8 Evaluation of Safety Management Practices and Significance of Influencing Factors**

This chapter will address the following research questions: “Are there any gaps between the Client’s requirements and expectations to the implementation of the HSE methods and how this actually has been executed?” and “How may identified gaps be explained in light of prevailing frame conditions (ref. research question 1)?”

In Chapter 7.5, the main findings from Chapter 7 were summarized. In the following Chapter, these findings will be subject for discussion.

### ***8.1 Contractor’s Approach for Managing Safety in Work with Severe Accident Potential***

The result presented in Chapter 7.1 shows that The Client’s requirements are implemented into the Contractor’s written safety and construction management system to a satisfactory extent. However, the mini-audits discovered that Contractor in some instances fails in implementing the procedures in its work.

From the assessment of Contractor’s management of safety in road transportation, it became apparent that the Client’s requirements regarding the standard of the construction roads have been implemented in accordance with the Client’s requirements. However, from the mini- audit it became apparent the Contractor has a lack of control on the technical standard of the vehicles and safety equipment in vehicles. This was also supported by observations made on site, where damaged vehicles were frequently spotted. As stated in the literature review, regular maintenance and inspections of vehicles was one of the important aspects when managing road transportation safety. Based on this, it is clear that the Contractor has a potential for improving their management of road transportation safety by carrying regular inspections of their vehicles.

Behavioural sampling showed that traffic rules such as obeying the speed limit were frequently broken and that the Contractor’s supervision of road transportation safety was considered poor. It is reason to believe that there is a link between the low compliance of traffic rules and the poor supervision of road transportation safety in the project.

A mini-audit of the HSE procedure and method statement for tunnelling showed that the Contractor overall has succeeded in implementing the requirements posed by the Client. From the assessment of the long-term effect of Contractor’s management of safety in

tunnelling, it was discovered that 50 % of the LTIs registered in the project have come from rock fall in tunnelling. According to the Client's site team, major improvements with respect to the hazard of rock fall in tunnelling have been made after the project experienced a tunnel collapse in November 2015. It is reason to believe that this might be one of the reasons for the good results from the mini- audit and the behavioural sampling.

No LTIs have been registered from the hazard of moving machinery in tunnelling. However, one of the issues identified was that pedestrians and vehicles are not separated with barriers, and that workers do not used the paths designated. As stated in Chapter 2.2, 33 % of the fatalities from tunnelling in the Client's company resulted from workers being squeezed or driven over by moving machinery. In the chapter about nature of project and site layout, it was stated that the Consultants raised concern about the large number of people in the tunnels due to the rotation of work in the drill and blast sequence. Observations made during data collection shows that there is a large amount of workers and vehicles in the tunnels at all times. It is in the author's opinion that barriers should be installed and that the number of workers in the tunnels should be reduced in order to prevent accidents involving moving machinery and other tunnel related accidents.

From the mini-audit performed, it was discovered that the Contractor has no or little control on their lifting equipment as there are no registration, colour marking or technical inspections of lifting equipment. In addition, the Contractor has no proper system for storage of their lifting equipment. From the literature review, poor state of lifting equipment was listed as one of the typical failures in lifting operations. From the mini- audit it also became apparent that the Client does not pose many detailed requirements on lifting equipment compared to other hazardous jobs. Based on the findings in the project, it may seem like the Contractor's own internal requirements in practice does not have the same status as explicit contractual requirements. This was further supported by the Client's site team, who were under the impression that *"if it was not stated in the contract, it would never happen"*. Based on this, it seems that the Contractor has a limited capacity of living by their own rules. Therefore, it is in the student's opinion that more detailed requirements towards lifting operations should have been defined in the contractual requirements. Based on information received from the Client's HSE team, more detailed requirements have been posed in more recent projects. In addition to posing requirements, it is important for the Client's site team to ensure that the Contractor implements its own safety requirements by carrying out audits.

During the time of data collection, it became known that the Contractor's HSE team was not aware of the HSE procedures concerning lifting operations. The reason mentioned

was that they were written by the previous HSE manager. It is reason to believe that this may have been one of the reasons for the low level of implementation of safety procedures in lifting operations.

In the evaluation of the intermediate effect of Contractor's safety management in lifting operations, it was discovered that safety rules such as "not walking under a hanging load" were often broken. In the investigation, it was also discovered that the supervision of lifting equipment was poor and that the HSE supervisor responsible at the time had no experience in working with HSE and had not received any training. Yet again, there is a clear connection between low enforcement and low compliance of safety rules. However, in spite of the low level of implementation of safety procedures and low intermediate effect of safety management in lifting operations, no accidents or incidents have been recorded in the project. Based on the findings in the project, it is in the author's opinion that such an accident will eventually will occur in the future.

## ***8.2 Client's follow up through own Safety Inspections of Contractor's Management of Safety at Site***

As stated in Chapter 7.2, the Client's site team does not have a risk-based approach to their daily inspections. This means that for the hazardous work cases, the Client does not have a particular approach for follow up on road transportation, tunnelling and lifting operations with directed inspections.

In Chapter 7.2, it was discovered that one of the main issues in the project were that the Client's requirements to the Site team's follow up of Contractors were not implemented into the site team's documented safety management system as required. From discussions with the Client's site team, it became apparent that it was in their perception that documented procedures were not necessary. In addition to not being implemented in the site team's documented procedures, it was also discovered that some of the requirements, such as using a specialist for special fields and special inspections for road transportation were not implemented at site. From conversation with the Client's site team, it became clear that the majority of the members of Client's Site team at site are not aware of the Client's group requirements explaining their role in the following up on Contractor in the construction phase. It is reason to believe that this may be one reasons to why the routines are not implemented.

In Chapter 7.2.3, it was stated the immediate effects of safety inspections was low due to the fact that remedial actions are not implemented. It was also discovered that the site team did not have a systematic approach to their safety inspections using checklists. According to

the Client's site team, they are expected to think for themselves and not work from a sheet. Information gathered from the Contractor's HSE team reveals the daily emails received from the Client's site team are deleted due to an extremely large amount of observations (> 500 every month) and the poor quality of the findings. Only email with deviations received by the Client's HSE coordinator is opened and taken into consideration. For this reason, the Client's HSE coordinator gathers the daily inspection protocols and filters them before they are resent to the Contractor's HSE team. It is reason to believe that the unstructured approach to inspections generating a large amount of observations are one of the reasons to why the remedial actions are not implemented by the Contractor. In the literature, it is a common agreement that inspection plan and checklists should be developed to secure a reliable and comprehensive mapping of the workplace. In light of this and the large amount of observations and low quality of the findings, it is in the author's opinion that the site team could benefit from using checklists.

In the evaluation of the Client's site team's daily safety inspections, it was also discovered that the deviations recorded by the site team mainly focus on types of human error and technical deviations, which are easily spotted. As stated in the introduction, Statkraft has experienced in previous projects that the Client's site team's methods of work often do not differ from the Contractor's. This was also the case in the project, where the Client's site team's and the Contractor's safety inspections did not differ to a large extent. Therefore, it is in the author's opinion that the Client's site team's should develop an approach to safety inspections that reflects their role as a Client. To do this, they could utilise the methodology from level 3 investigations where the identified deviations are being analysed to identify the contributing factors and root causes. This may be carried out in 2 steps: 1) directed theme inspection by safety inspectors and 2) "mini-audits" by more qualified personnel in the Client's team.

Based on observations of the Client's site team, it is in the author's impression that they have a distinctly fault- finding approach to their safety inspections. In the Project, the HSE inspectors are told to take a picture of the worst deviation they witness on site. According to Holt (2008), inspections must seek to establish what is well done as well as what is not. In the the inspection protocol which is filled out at the end of each day, it is written "photo of non- compliance", giving the HSE inspectors no opportunity to praise the Contractor for good behaviour. From interviews with the Contractor's HSE team, it became apparent that the routine of taking a photo of the non- compliance, which often involves

taking photos of the workers, creates a tense relationship between the Client and the Contractor.

When comparing the requirements defined by the Client and the criteria established in the literature review, it became apparent that the criteria from the literature review were more directed towards the quality and the execution of the safety inspections while the Client did not pose any requirements on how the inspections should be executed. Instead, they relied on the site team to make the own necessary calls by hiring a competent site team. As will be discussed in the next chapter, it is striking how much the implementation of HSE methods are depending on people and placing the right person at the job.

### ***8.3 Contractor's Approach to Ensure Employee HSE Engagement***

In Chapter 7.3, it was discovered that both JSAs and RUOs had not been implemented in the project. At first glance, an RUO- rate was provided every month as required. However, a further examination showed that the RUOs were not reported by workers and there was no system established for the reporting of near misses from them. However, the fact that an entire 66 % of the respondents in the questionnaire study claimed that they always alert their supervisor if they see a hazardous situation on the job site and that the Contractor was positive regarding the implementation of a written RUO- system, a RUO- system has great potential in the project from the author's point of view.

From the literature review, an incentive program should be established to encourage and rewards workers for reporting injuries, near misses and hazards. Further, criteria on what should be reported should be established to help in making priorities and establish focus on the vital near misses. From discussions with the Client's site team, it was a concern that nobody would bother reporting unless there was money or a price involved and that the quality of the RUOs would be poor with such an incentive system. However, it is the author's opinion that the main intention of the of the RUOs is to engage workers in HSE issues, and not the quality of the RUOs. However, once the RUO- system has been established and is functioning, criteria should be defined to increase the quality of the RUOs.

An issue raised by the Contractor's HSE team, was that the construction workers have poor literacy skills and do not like to write. From their point of view, reluctance against writing might complicate the implementation of a written RUO- system. The Contractor's perception was further supported by findings from the literature review, where it was stated that construction workers prefer oral rather than written communication and that attempts to engage construction workers in written communication had less effect. It is in the Author's

believe that the reluctance against written communication may entail some extra challenges regarding the implementation of the RUO system required by the Contractor. However, due to the high literacy in Albania (97,6 %), it is in the author's opinion that literacy is not a big issue in terms of implementing a RUO-system.

In the assessment of engagement of workers through toolbox talks, it was discovered that toolbox talks are implemented in the project to a fair extent. From the questionnaire issued to Contractor's workers, only 65 % claimed that toolbox talks were held regularly. From the literature review, it was stated that safety meetings are often driven by management and do not produce much engagement among workers. Further investigations showed that this was also the case in the project and that the toolbox talks carried out were a means of one-way communication. In light of this, it is apparent that the toolbox talks carried out in the project do not engage workers in HSE issues to a large extent.

From the questionnaire issued, 24 % of the respondents claimed that they were never consulted on HSE issues. In light of this and the evaluation of Contractor's initiatives to ensure employee HSE engagement, it is in the author's point of view that engagement of workers in HSE issues is almost none existing in the project. While toolbox talks are carried out to some extent, their sole purpose is to inform workers on risk issues, not engage them in the risk management process. Therefore, it is the author's opinion that the project has a large potential for improvement in terms of employee HSE engagement.

#### ***8.4 The Significance of Influencing Factors on the Identified Gaps***

While a more extensive discussion of the significance of influencing factors on the HSE methods will be performed in Chapter 9.1, the author will in the following chapter attempt to explain the gaps identified in Chapter 7 in light of the internal and external factors mapped in Chapter 6.

In Table 35, some of the main findings from Chapter 7 have been summarized along with an overview of whether the gaps (or absence of gaps) identified from Chapter 7 are caused by internal or external influencing factors. The causes of the gaps have been classified by using the classification of external and internal factors from Figure 11 in Chapter 6.



*Table 35 Results in light of influencing factors based on findings in the project*

<b>Results from Chapter 7</b>	<b>Significance of external factors</b>	<b>Significance of internal factors</b>
The Contractor has a sufficient documented safety management system		X (Safety Prevention and Control System)
Lack of implementation of safety procedures and method statements in hazardous jobs		X (Management commitment and Safety Prevention and Control System)
Poor supervision of lifting operations and road transportation	X (National Economic Wealth)	X (Safety Arrangements)
Lack of compliance of safety rules		X (Safety Prevention and Control System)
Sufficient job specific training in tunnelling and lifting operation		X (Human Resources and Safety Prevention and Control System)
Client's requirements are not implemented into the Project's documented management system		X (Management Commitment)
Low immediate effect from the Client's safety inspections	X (National Economic Wealth)	X (Management Commitment)
JSA's and RUO's are not implemented in the project		X (Management Commitment)
One sided communication in toolbox talks meetings	X (National Culture)	

In Chapter 7.1 it was stated and that the majority of the requirements posed by the Client were covered in the Contractor's documented safety management system. In addition, the risk assessments and methods statements are considered adequate. In the literature on internal factors about safety prevention and control systems, it was stated that placing the right person on the right job is critical for a successful safety management system. It is the author's impression that the good quality of these documents is due to the qualified HSE manager of the Contractor who was responsible for producing the necessary documentation for the safety management system.

The mini- audit carried out to assess the Contractor's management of safety in the hazardous work cases discovered that some of the requirements were not implemented in the project. As stated in the literature on influencing factors, it is the management of a company who are responsible for translating ideas into actions. It is reason to believe that the lacks in

implementing the HSE methods are caused by a lack of management commitment towards safety in the project. In addition, a safety management system must be regularly evaluated to determine its success in terms of achieving the defined objectives (Aksorn & Hadikusumo, 2008). In Chapter 6.2.3 it was stated that the Contractor has carried out regular reviews and audits of the safety management system to identify areas of improvement. As discussed in Chapter 8.1, the Contractor's HSE team were not aware of their HSE procedures regarding lifting operations although they are referred to in their HSE program. Based on this, it is the author's opinion that evaluation of the safety management program is a shortcoming in Contractor's safety prevention and control system and that they should perform an audit of their safety management system.

From the evaluation of Contractor's management of safety in hazardous work, Contractor's supervision of road transportation safety and of lifting operations was considered poor. In addition, issues related to the Client's safety inspections were also discovered as it was in the Contractor's view that the quality of the Client's observed deviations were poor and therefore deliberately ignored by the Contractor. Consequently, remedial actions were not always implemented. In the analysis of influencing factors, it was stated that there is a big lack of qualified HSE personnel in Albania, the reason being a lack of big construction projects in the country due to Albania's economic situation. In the analysis of national culture differences, the importance of strict supervision was emphasized; companies in an extremely hierarchal society should have a centralized structure with rigid rules and strict supervision. In light of this, it is reason to believe that that the lack of experienced and qualified HSE personnel in Albania affects the quality of both the Contractor and Client's supervision of work.

From the behaviour sampling on the hazardous work activities, it was discovered that safety rules were often broken. It may be speculated that the lack of compliance of safety rules in road transportation and lifting operations may be due to a lack of strict supervision. In Chapter 6.2.3, the "yellow card" system used for the violation of traffic rules was described. It is speculated that a lack of compliance with safety rules in the project are caused by violations not being encountered with enforcement to a large extent. It is in the author's opinion that the Contractor lacks an effective enforcement scheme and that the "yellow card" system should be used on other types of violations to a greater extent.

In chapter 6.2.2, it was stated that the project has a large potential for improvement when it came to motivating their workers to act safely. As stated in the literature, a high score of masculinity indicates that the society is driven by competition, achievement and success.

As discovered in the analysis of national culture, Albania is an extremely masculine society. It is believed that a lack personal motivation also may be one reason for the low compliance of safety rules in lifting operations and tunnelling.

From the assessment of Contractor's management of safety in hazardous work, it was discovered that the Contractor had a sufficient training program for tunnelling and lifting operations. As stated in the literature, training and strict supervision is especially important when workers are unfamiliar with the works. At the project, approximately 60 % of the construction workers did not have any experience from construction from before. It is in the author's impression that the Contractors has realized and embraced the need for training of their workers by establishing a sufficient training program using professional companies.

In the evaluation of Contractor's initiatives to ensure employee HSE engagement it was discovered that JSAs and RUOs were not implemented in the project. For the JSAs, the reasons for why it is not implemented by the Contractor are not known to the author. As for the RUOs, internal disagreements in the Client's project organisation on whether the RUO-system should be implemented or not may be one of the reasons why it has not been implemented. Regardless of reasons, it is apparent that the lack of implementation of initiatives to ensure employee engagement are exclusively caused by internal matters in both the Client's and the Contractor's company.

From Chapter 7, it also came apparent that toolbox talks where a means of top down communication line in the project and that the engagement of workers was considered low. From the cultural analysis, it was also discovered that employees coming from cultures with high power distance prefer placing themselves as subordinates and only do "their own job". It is believed that this may be one of the explanations to the top down communication between management and workers and the poor engagement of workers in HSE matters at the project.

As can be seen from Table 35, internal factors has larger influence on the identified gaps than external factors. The findings in the project are therefore in accordance with the findings from the literature, where it is a common agreement than management commitment towards safety has a stronger influence than culture related matters (Mearns & Yule, 2009; S Mohamed, Ali, & Tam, 2009). However, as will be discussed in the next chapter, external factors such as national regulations and authority handling, national culture and national economic wealth, often seem to make internal factors more determining.

In the evaluation of the Client's site team's safety inspections, it was stated that the Client expects the site team to make their own necessary calls by hiring a competent Site team and therefore do not wish to pose any requirements on how the inspections shall be executed.

It was also stated that the Client's site team did not have plan or procedures for inspections because they were under the impression that it was not necessary. In the evaluation of Contractor's initiatives to ensure employee HSE engagement, it was discovered that managers in the Client's project organization were against the implementation of a RUO- system although it was a contractual requirement defined by the Client. In light of this, it is inconspicuous how the implementation of HSE methods to such a large extent are depending on individuals. It is reason to believe that for organisations in developing countries with a higher power distance, with less transparency and a tall organisational structure, it is easier for one individual to use one's authority to reject or cancel a requirement.

## **9 Discussion**

### ***9.1 Lessons Learned: Implementation of HSE Management Practices at Construction Sites in Developing Countries***

While the previous chapter attempted to explain the gaps identified in light of prevailing frame conditions, the author will in this Chapter draw some general conclusion on which considerations that should be taken into account when implementing the HSE methods at a construction site in a developing country (ref. research question 6). To do this, findings from the literature review, the evaluation of the HSE methods and the analysis of internal and external influencing factors will be used.

From Chapter 8.4, we saw that the gaps identified in Chapter 7 largely could be explained by internal influencing factors. This was further supported by findings in the literature, which claimed that management commitment towards safety has a stronger influence than external factors such as national culture. From the author's point of view, this is considered a positive thing, because it means that it is something that investors in emerging markets may influence, unlike external factors which are out of their reach.

In Chapter 8.4 it was also discussed how the implementation of the HSE methods to a large extent were depending on individuals in the project. For investors in emerging markets, such as Statkraft, it is therefore important to select the right people for the job. According to Statkraft, it is a problem that they often hire external consultant as managers to do the job on their behalf instead of using their own personnel, as the consultants may not share the same values and beliefs.

From the analysis performed of external influencing factors, it was stated that the Albanian national legislation did not provide detailed requirements on HSE issues and that the involvement of the government was highly reactive. From the literature, it has discovered that governments in developing countries are often unconcerned about occupational health and safety. Although comprehensive national health and safety regulations may exist, they are not adequately enforced (Nuwayhid, 2004). In addition, Corruption is more prevalent in developing countries than in rich ones (Olken & Pande, 2011). Due to a lack of enforcement by the government, it is considered even more important that investors in emerging markets to ensure that safety management systems are implemented by carrying out audits.

From the evaluation of Contractor's management of safety in lifting operations, it was discovered that few requirements were posed by the Client and that Contractor's routines for

inspections and storage of lifting equipment had not implemented. From discussions with the Client's site team, it was discovered that it was in their perception that nothing was done unless it was clearly stated in the contract between the Client and the Contractor. In light of the findings at the project, it is in the author's opinion that it is important for the Client to provide detailed requirements on hazardous work issues such as lifting operations in the contractual documents, as some Contractor's may have a limited ability to live by their own book. In addition, it is at least as important to ensure that the Contractor implements its own internal safety requirements by carrying out audits.

From interviews at the project it became evident that many people were afraid of losing their jobs if they did not do as they were told by their managers. In conjunction with the cases of overloaded vehicles, this was especially an issue. Albania and other developing countries face high unemployment rates. In light of this, it makes it even more important for investors to pay attention to the managers' commitment towards safety in low-income countries. With respect to near miss reporting, it is from the author's point of view even more important to strive for ensuring a no blame culture.

In the project, approximately 60 % of the construction workers did not have any experience from construction from before. A case study of construction workers in developing countries showed that 51 % of the workforce in Sri Lanka consisted of unskilled construction workers (Jayawardane & Gunawardena, 1998). From the literature, it is apparent that the workforce in some developing countries seems to consist of unskilled workers to a larger extent than in developed countries. In the literature, it was also stated that training and strict supervision is especially important when workers are unfamiliar with the work. Therefore, the establishment of training programs and strict supervision is even more important in developing countries than in developed ones.

From the evaluation of Contractor's approach to ensure employee HSE engagement, it was discovered that the Contractor's was concerned about the workers' literacy skills. According to a literature review performed by Alkilani et al. (2013), poor literacy skills of labours are one of the factors that might influence safety management at construction sites in developing countries. According to Cameron et al. (2006), attempts to engage construction workers in written communication had little effect. In terms of engaging workers' in HSE issues through RUOs, poor literacy skills and reluctance against written communication are some of the issues that managers should consider when implementing systems for near miss reporting.

Many of the workers in the project were strongly religious, which again influenced their perception of risk. As described in Chapter 6.2.1, a potential accident is considered as the will of God. Research shows that there is a relationship between the average income level and the religiosity of a population (GALLUP, 2010). It is the author's opinion that emphasizes on the need for the establishment of strict safety rules and supervision to ensure compliance with safety rules.

Although each country has its own cultural profile, it is possible to some extent to distinguish between developed and developing countries by comparing them in light of Hofstede's cultural dimensions. From comparison between countries on Hofstede's cultural dimensions, it is apparent that developing countries generally have a higher power distance than developed countries. People coming from cultures of high power distance and uncertainty avoidance are more likely to follow rules. It is in the author's opinion that this is something that should be exploited by establishing lifesaving rules which again should be communicated to the workforce. However, a negative implication of high power distance and uncertainty avoidance is that employees are inclined to follow orders even if it includes putting themselves at risk.

From the evaluation of Contractor's initiatives to ensure employee HSE engagement, it was discovered that workers' participation in HSE issues in the project was almost non-existing. In the literature on national cultural differences, it was stated that safety management in high power distance cultures belongs to the management of the company, and that the workers' only responsibility is obeying the rules. It is believed that the fact that people in such cultures often prefer to only do their own job, makes it more challenging to involve people in health and safety.

From the assessment of Contractor's management of safety in hazardous work, it was discovered that the Contractor had a sufficient training program for tunnelling and lifting operations. In terms of individualism, there is a contrast between western countries and eastern countries, where western countries are considered more individualistic. In such collectivistic society, training is most effective when focused at group level. This is something companies should have in mind when implementing training programs.

In chapter 6.2.2, it was stated that the project has a large potential for improvement when it came to motivating their workers to act safely. As stated in Chapter 6.1.3, a high score of masculinity indicates that the society is driven by competition, achievement and success. If the country has a high score on the dimension of masculinity, it should be exploited by managers by implementing award systems and incentives for safe behaviour.

In light of the discussion in this chapter and in Chapter 8.4, it has become apparent that the external factors often seem to make the internal factors more prominent. Especially external factors such as national regulations and authority handling, national culture and national economic wealth, often seem to make internal factors such as management commitment and safety prevention and control systems more determining. In some instances, the implementation of HSE methods becomes more challenging, but in some instances, also more feasible. Nevertheless, it does not follow that HSE methods such as those discussed in this master's thesis should not be implemented. Below, some examples of both negative and positive influences have been summarized based on the findings from this master's thesis:

- For organisations in developing countries with a higher power distance, less transparency and a tall organisational structure, it is easier for one individual to use one's authority to reject or cancel a requirement.
- A lack of governmental enforcement of safety regulations makes the Contractor's management commitment towards safety and the Client's follow up the Contractor's management system even more important.
- A high level of employment makes it more important for investors to pay attention to management's commitments towards safety so people are not exploited and forced to commit unsafe acts.
- A lack of experienced workers makes it more important to establish effective training programs and supervision.
- A high power distance and uncertainty avoidance makes people more inclined to follow safety rules, which should be exploited by managers by defining clear rules.
- Poor literacy skills may make it more challenging to implement a written RUO system.
- A large share of religious workers makes it more important to establish safety rules and strict supervision.
- A high power distance may make it more challenging to engage people in HSE issues.
- In masculine societies where people are driven by competition and success, incentive systems will have a larger effect.



## ***9.2 Discussion of Method***

Although the objective of evaluation research is to provide some feedback to improve the program being evaluated, it is ideal that the lesson learned shall be communicated to an academic audience as well. The generalizability of a research project refers to in which extent the findings may be applied to a wider setting than the setting of the research (Bickman, Rog, & Hedrick, 1998). One of the disadvantages with a case study research design is that it may be difficult to derive some general conclusions based on a study of one subject (Bryman, 2015). A question that arises is whether it is possible to draw some general conclusions on which considerations that should be taken into account when implementing HSE methods in a constructions site in a developing country based on a study of one construction project in one developing country. As described in Chapter 9.1, some common denominators may be established between developing countries, which allow some generalization of the findings. Therefore, it is the author's opinion that the research presented in this master's thesis to some extent is valid beyond the particular project and may be interesting to a wider academic audience.

In Chapter 7, the long-term effect of the HSE methods was assessed. It was discovered that the overall safety performance at the project was satisfactory as the project has delivered good TRI- rate results. To reveal the causal relationship between the HSE methods and the long-term effect, the immediate and intermediate effects of the HSE methods were evaluated. However, uncertainty exists to whether something entirely else may have caused the good safety results. The HSE statistics analysed were based on information received from the Contractor. In Chapter 7.4.1.1, the reliability of the reporting was analysed by checking the high percentage of TRI's that were LTS. A high percentage indicates that under-reporting likely takes place. According to the Client's Site team, the project has experienced some issues with underreporting at a previous stage. Therefore, the reliability of the assessment of the long-term effect of the HSE methods may be questioned.

The behavioural sampling was performed based on the method presented by Kjellén (2000). For the behavioural sampling in tunnelling, the representativeness of the observations may be discussed. Although many visits (N= 27) were paid to the tunnels, the checklist items related to work performed at the face were not so easily observable as expected. When entering the tunnel, it was impossible to know what type of work or if any work was going at the face. Considering that one drill and blast sequence (drilling, charging, scaling, mocking, shotcreting, bolting) lasted an entire day, it was time consuming to get an adequate number of

observations of each work activity. Therefore, only eight drilling, six mocking, three bastings, seven scaling, three rock bolting and five shotcreting operations was witnessed.

The interviews were all carried out in a foreign language to both the interviewer and the interviewees. Due to the fact that some of the interviewees did not speak English fluently, language barriers may have affected the accuracy of the information obtained. Since none of the construction workers spoke English, a larger proportion of managers were interviewed during data collection. For the workers, it was considered more efficient to use a quantitative approach with a questionnaire translated to Albanian and Turkish. In addition, language issues made it impossible for the author to participate in toolbox talks.

### **9.2.1 Action Research**

In Chapter 3.2, the Hawthorne effect, or observer effect, was described as a phenomenon in which individuals modify or improve their behaviour in response to their awareness of being watched. During the fieldwork, some modification of behaviour was witnessed during the time of data collection.

As discovered in Chapter 7.3, the RUO- system has not been implemented in the project in accordance to the Client's requirements. However, after having questioned several people in the Client's organization on the reason why, one of the Project Managers took the initiative to call for a meeting with the Client's Site team to discuss the RUOs. It is clearly that simply investigating and asking questions about the RUO- system has initiated a process at the project.

That individuals improve their behaviour while being watched became apparent in the executing of the behavioural sampling. During the observation of one of the lifting operations, the workers cordoned off the area after realizing that it was one of the items on the checklist. However, at the end of the observation and the rest of the time the student stayed at the project, the barrier was gone.

In the Tunnel HSE Plan, one requirement was that pedestrians and vehicles should be segregated with barriers wherever possible. While visiting the tunnels, the lack of hard barriers was pointed out at several occasions by the student and the HSE inspector who accompanied the student. To the author's great pleasure, vehicle- pedestrian segregation was finally installed at the end of the stay at the places that lacked segregation.

## 10 Conclusion

The evaluation of Contractor's management of safety in work with severe accident potential showed that the Client's requirements have been implemented into the Contractor's written safety management system to a satisfactory extent. However, audits of the safety procedures and method statements showed that the Contractor in some instances fails in implementing the safety management system at site. Especially deviations related to the technical control measures and inspections of vehicles and lifting operations, segregation of vehicles and pedestrians in tunnelling were discovered.

Behavioural sampling on the hazardous work cases showed that safety rules in road transportation and lifting operations were often broken. It is reason to believe that there is a link between the low compliance of safety rules and the poor supervision of road transportation and lifting operations.

The Client's site team does not have a risk-based approach to their daily inspections. The evaluation of the Client's site team's approach for following up on Contractor showed that the site team has failed in terms of implementing the Client's requirements in their written safety management system and implementing requirements such as carrying out special inspections for road transportation safety at site. Due to a low level of implementation of medial actions, it is concluded that the immediate effect of safety inspections is low. It is in the author's opinion that the site team lacks a structured approach in carrying out their inspections and could benefit from using pre-defined checklists.

From the evaluation of Contractor's initiatives to ensure employee HSE engagement, it became apparent that engagement of workers in HSE issues at the project is non-existing. Investigation showed that the RUO- system and JSAs required by the Client had not been implemented in the project. Although toolbox talks had been implemented to a fair extent, the engagement of workers through toolbox talks was considered low because it was a means of one- way communication from the management.

When analysing the gaps identified in light of prevailing frame conditions, it became apparent that internal factors had a larger influence on the findings than external factors. Of the internal influencing factors, management support, personal motivation, appropriate supervision, enforcement scheme, personal competence and program evaluation stood out as key factors. Of the external factors, national culture seemed to have an influence on the workers' participation in HSE matters. Albania's economic situation also seemed to influence the quality of both the Client's and Contractor's safety inspections, as there is a lack of

experienced and qualified HSE personnel in the country. When analysing how prevailing frame conditions influenced the gaps identified, it became clear that the level of implementation and the quality of the execution to a large extent were depending on individuals. For investors in emerging markets, it is therefore important to select the right people for the job.

A further analysis of how external and internal factors influenced the HSE methods, showed that external factors in developing countries such as national regulations and authority handling, national culture and national economic wealth, often seem to make internal factors such as management commitment and safety prevention and control systems more prominent. When implementing safety management practices at construction sites in developing countries, it is important for investors to carry out audits to make sure that the safety management system has been implemented as the governmental enforcement of safety regulations may be low. As the workforce in developing countries often consists of a large amount of unskilled workers, the establishment of training programs and strict supervision is even more important than in developed countries. People coming from societies characterized by high power distance and uncertainty avoidance are more likely to follow rules, which should be exploited by establishing lifesaving rules. As societies in developing countries are often categorized as masculine, managers should exploit this by implementing award systems and incentives for safe behaviour and RUOs.

## **11 Recommendations for Improvement**

In this chapter, the final research question has been answered: *“Based on an overall analysis, how can the selected HSE methods be improved to increase the overall safety on the studied site?”*

### ***11.1 Recommendations to the Contractor***

A potential for improvement has been identified and the following recommendations have been proposed:

- The Contractor should perform an internal audit of their safety management program.
- The Contractor should gain better control of the technical condition of their lifting equipment by carrying out inspections of lifting equipment and storing lifting equipment in a rigging loft.
- Segregation should be installed between vehicles and pedestrians in tunnels and the number of workers inside the tunnels should be reduced.
- The Contractor should gain better control of the technical standard of vehicles by carrying out daily inspections of the vehicles.
- The Contractor should perform daily traffic controls to enforce speed limits and use of seat belts.
- HSE supervisors should pay more attention to lifting operations and enforce safety rules.
- The Contractor should establish safety rules in work with severe accident potential which should be clearly communicated to the workforce.
- A system for RUOs and JSAs should be established to engage workers in HSE issues.
- An incentive system for safe behaviour and for RUOs should be implemented.

### ***11.2 Recommendations to the Client***

The evaluation of the Client’s following up on the Contractor through safety inspections showed an unsatisfactory result. Based on the findings in the master’s thesis, the author has made the following recommendations to the Client and the site team:

- The Client should perform an audit of the Contractor’s safety management system to make sure that the requirements in the contractual documents are implemented.

- The Client should develop a more structured risk based approach and thematic inspections based on checklists in their daily inspections.
- The Client's site team's inspections should follow up on their daily safety inspections by inspections into contributing factors and root causes of critical findings.
- The Client's site team should have a less fault-finding approach to their daily inspections and also praise the Contractor for good behaviour.
- Due to a large proportion of road transportation incidents, the Client should require the Contractor to implement ISO 39001 for Road traffic safety (RTS) management systems in all their international operations.
- The Client should make a further investigation of the reliability of the reporting at the project.
- When hiring external consultants, the Client should make sure that they possess the same values and beliefs as the parent company.

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## APPENDIX

### APPENDIX A: Questionnaire

Please check one answer on each question / Ju lutem, plotësoni vetëm një përgjigje për çdo pyetje / Lütfen her soru için bir cevap işaretleyiniz

**How important to you think the workers' safety practices are to the management of your company? / Si mendoni, sa e rëndësishme është për menaxherët e kompanisë siguria teknike e punëtorëve? / İşçi güvenlik uygulamaların, firmanızın yönetimi için ne kadar önemli olduğunu düşünüyorsunuz?**

- Very important / Shumë e rëndësishme / Çok önemlidir
- Important / E rëndësishme / Önemlidir
- Very little important / Pak e rëndësishme / Çok az önemlidir
- Not important at all / Aspak e rëndësishme / Hiç önemli değildir

**How much do supervisors and other top management seem to care about your safety? / Sa kujdesen supervizorët dhe shefat e tjerë për sigurinë tënde teknike? / Süpervizörleriniz ve diğer üst düzey yönetim, güvenliğinize ne kadar önem veriyorlar?**

- They do as much as possible to make the job safe / Ata përpiqen aq sa munden ta bëjnë punën sa më të sigurtë / Onlar, işi güvenli etmek için mümkün olduğu kadar yapıyorlar
- They are concerned about safety but they could do more than they are doing to make the job safe / Kujdesen për sigurinë teknike, por mund të bëjnë edhe më shumë për ta bërë punën më të sigurtë / Onlar, iş güvenliği için ilgilenirler ama daha fazla da yapabilirler
- They are only interested in getting the job done as fast as possible / Ata duan vetëm të mbarojnë punën sa më shpejt të jetë e mundur / Onlar, sadece işi mümkün olduğunca hızlı bitirmekle ilgilenirler

**How much emphasis does the foreman place on safety practices on the job? / Sa rëndësi ju kushton formeni/përgjegjësi praktikave të sigurtë të punës? / Formeniniz, iş güvenliği uygulamalarını ne kadar vurgular?**

- He regularly and frequently makes us aware of dangerous work practices and conditions, and praises us for safe conduct / Ai na shpjegon rregullisht praktikat apo kushtet e rrezikshme në punë dhe na lavdëron dhe mbështet për sjelljet dhe punën e sigurtë / O, bizi düzenli ve sıkça tehlikeli iş uygulamalarıyla ilgili haberdar eder ve güvenli çalışmamızı över
- He occasionally points out the most dangerous work practices and conditions / Ai na shpjegon herë pas here praktikat apo kushtet e rrezikshme në punë / O bazen, en tehlikeli iş uygulamalarını ve koşulları belirtir

- He seldom mentions danger or safety practices / Nodnjëherë, ai na shpjegon praktikat apo kushtet e rrezikshme në punë / O nadiren tehlke veya güvenlik uygulamalardan söz eder
- He never mentions danger or safety practices / Ai nuk ka shpjeguar asnjëherë rreziqet apo praktikat e sigurta në punë / O tehlike veya güvenlik uygulamalardan asla söz etmez

**When you were hired by your present employer, were you given instructions on the safety policy and the safety requirements of the company? / Kur fillove punë në këtë kompani, a more informacion rreth rregullores së sigurisë teknike të kompanisë? / Şimdiki işveren tarafından ise alınırken, şirketin iş güvenliği politikası ve güvenlik gereksinimleri için eğitim verildi mi?**

- Yes / Po / Evet
- No / Jo / Hayır

**Are there regular tool box talks at your work site? / Bëni diskutime të rregullta mbi sigurinë teknike në vendin tuaj të punës? / Sahada, düzenli toolbox konuşmaları yapılıyor mu?**

- Yes / Po / Evet
- No / Jo / Hayır

**Is the proper equipment for your task available at your job site? / Keni pajisjet dhe veglat e duhura të punës, në vendin tuaj të punës? / İşinizi yapmak için sahada uygun araç/cihaz bulunur mu?**

- Always / Gjithmonë / Her zaman
- Most of the time / Pjesën më të madhe të kohës / Çoğu zaman
- Occasionally / Ndonjëherë / Bazen
- Rarely / Rrallë / Nadiren
- Never / Asnjëherë / Hiçbir zaman

**How much control do you feel you have yourself over what happens to your safety on the job? / Si mendoni, sa kontroll keni mbi sigurinë teknike në punën tuaj? / İş yerinde, kendi iş güvenliği ile ilgili, kendiniz ne kadar kontrolü olduğunu hissediyorsunuz?**

- Almost no control / Pothuajse nuk kam fare kontroll / Hemen hemen hiçbir kontrol
- Almost total control / Pothuajse kontroll të plotë / Nerdeyse tam kontrol/ Nerdeyse tam kontrol
- Primary control, but luck is a factor / Kam kontroll, por edhe fat / Birincil kontrol, ama şans bir faktör
- Little control, mostly a matter of luck / Pak kontroll, por më shumë fat / Az kontrol, çoğunlukla şans meselesi

**Is taking risk part of the job? / A je i detyruar të vesh veten në rrezik për shkak të punës? / Risk almak, isinizin bir parçası midir?**

- Very much / Jam shumë I detyruar të vë veten në rrezik / Çok fazla
- Somewhat / Në një farë mënyre jam I detyruar / Oldukça
- Not at all / Jo, nuk jam aspak I detyruar / Değildir

**How likely do you think it is that you will be injured on the job in the next 12 months' period? Would you say it is: / Si mendon, sa mundësi ka që ti të lëndohesh/dëmtohesh në punë, përgjatë 12 muajve në vazhdim? Do të thoje që: / Önümüzdeki 12 ayda, isinde yaralanabilme ihtimali ne kadar büyük olduğunu düşünüyorsunuz? Bu kadar olduğunu söyleyebilmişsiniz:**

- Very likely / Ka shumë mundësi që unë të lëndohem / Büyük ihtimalle
- Somewhat likely / Ka mundësi që unë të lëndohem / Muhtemel
- Not very likely / Nuk ka dhe aq mundësi që unë të lëndohem / Çok olası değil
- Not at all likely / Nuk ka fare mundësi që unë të lëndohem / Hiç olası değil

**How often do you alert your supervisor if you see a hazardous situation at your job site? / Sa shpesh e lajmëron përgjegjësin/shefin nëse shikon një situatë të rrezikshme në vendin tënd të punës? / Is yerinde tehlike durumu gözetlediğinizde, süpervizörünüzü ne kadar sıklıkla uyarıyorsunuz?**

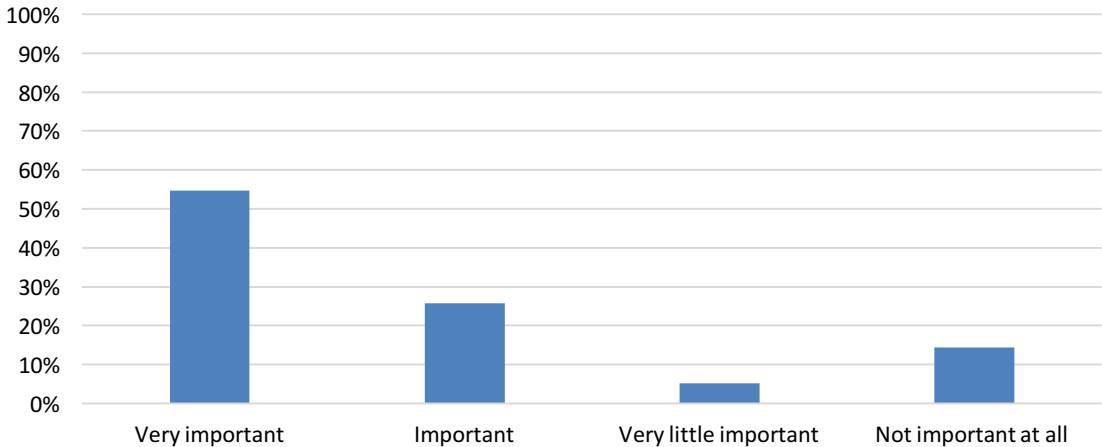
- Always / Gjithmonë / Her zaman
- Most of time / Pjesën më të madhe të kohës / Çoğu zaman
- Occasionally / Ndonjëherë / Bazen
- Rarely / Rrallë / Nadiren
- Never / Asnjëherë / Hiçbir zaman

**I am consulted on health and safety matters on a: / Cështjet në lidhje me shëndetin dhe sigurinë teknike më shpëtohen: / Ben sağlık ve güvenlik konularında ... istişare ediniyorum:**

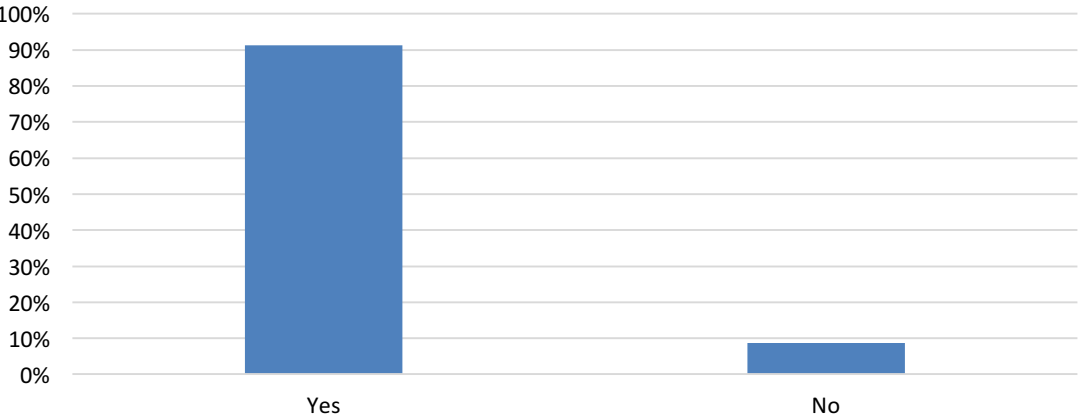
- Daily basis / Cdo ditë / Günlük
- Weekly basis / Një herë në javë / Haftalık
- Monthly basis / Një herë në muaj / Aylık
- Never / Asnjëherë / Hiçbir zaman

**APPENDIX B: Results from Questionnaire**

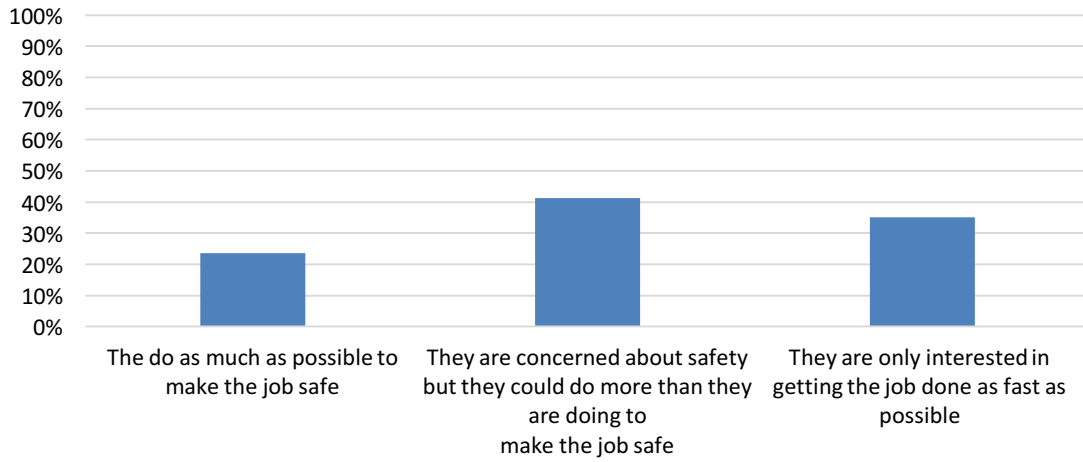
How important to you think the workers' safety practices are to the management of your company?



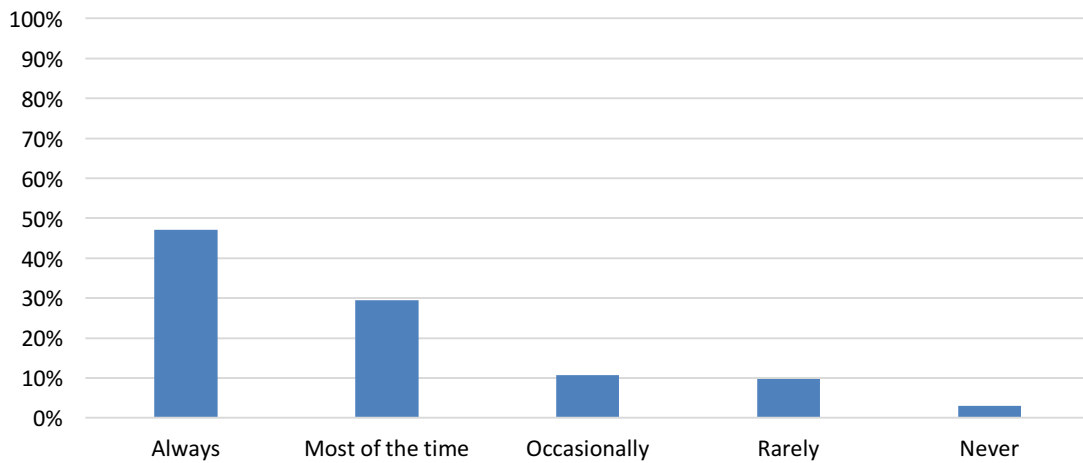
When you were hired by your present employer, were you given instructions on the safety policy and the safety requirements of the company?



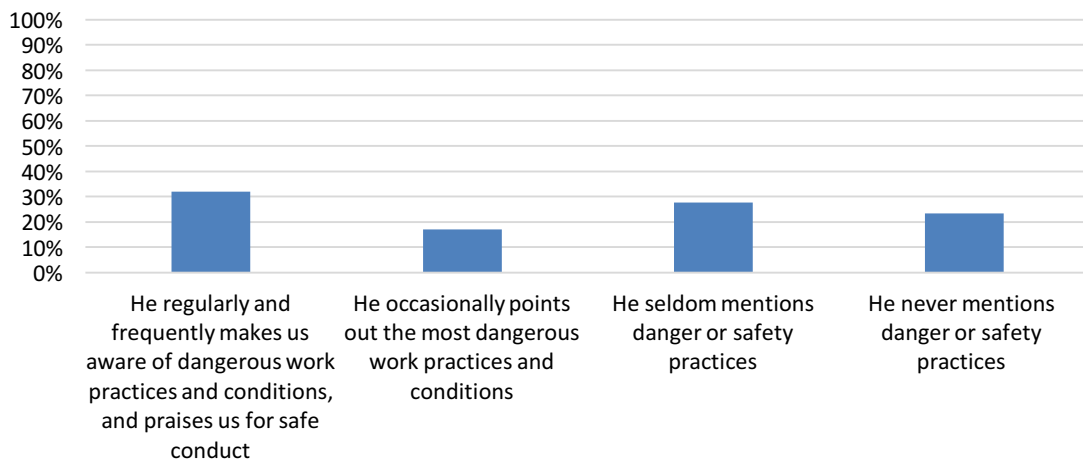
How much do supervisors and other top management seem to care about your safety?



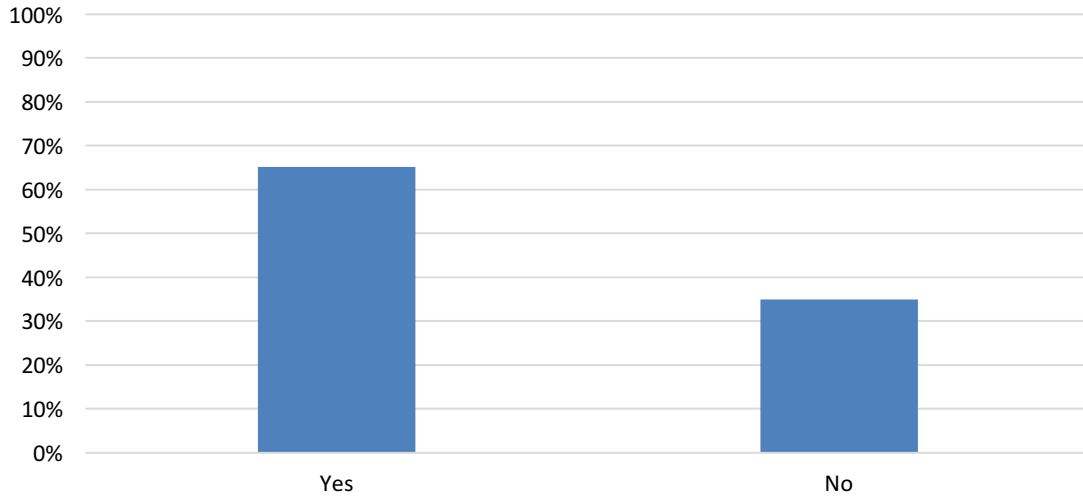
Is the proper safety equipment for your task available at your job site?



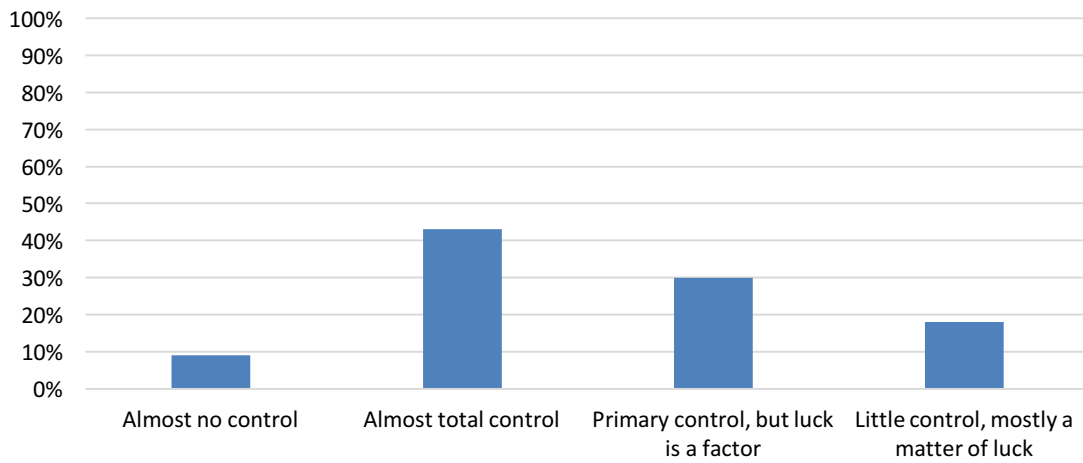
How much emphasis does the foreman place on safety practices on the job?



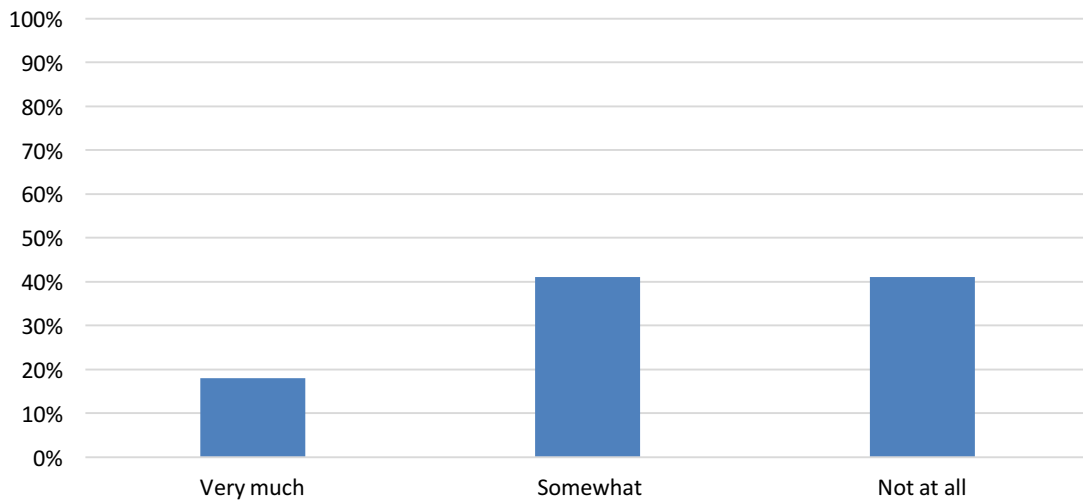
### Are there regular tool box talks at your work site?



### How much control do you feel you have yourself over what happens to your safety on the job?

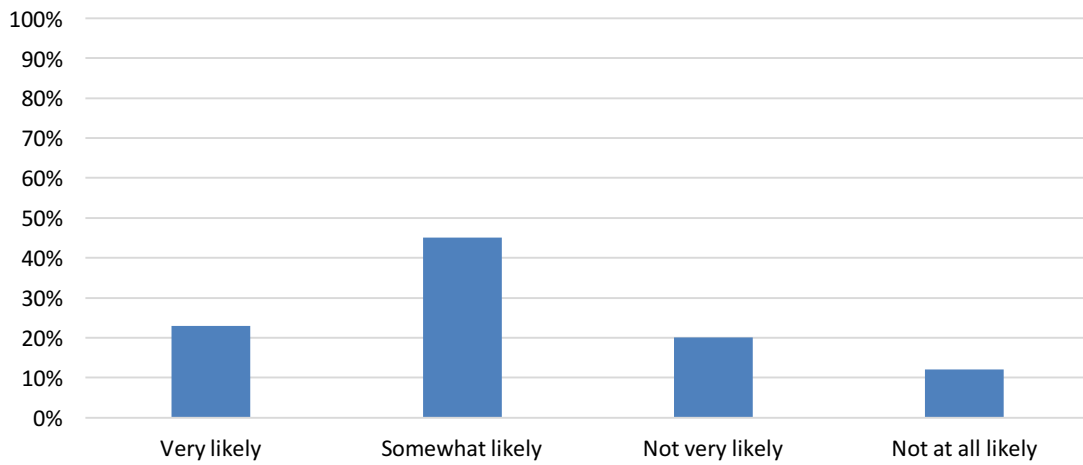


### Is taking risk part of the job?

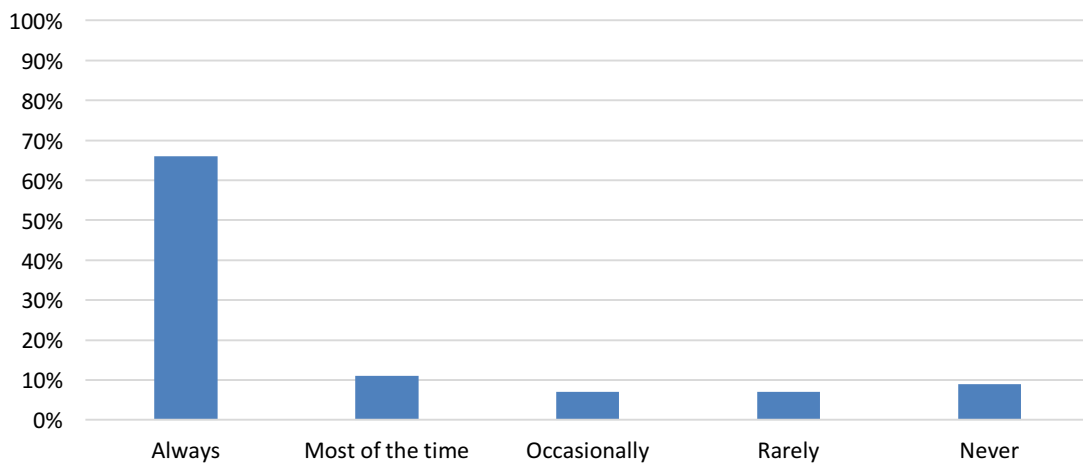




How likely do you think it is that you will be injured on the job in the next 12 months' period? Would you say it is:



How often do you alert your supervisor if you see a hazardous situation at your job site?



How often are you consulted on health and safety matters?

