Managing Risk is Vital for Organisation's Survival

Leslie Gunaratne, BSc, MSc, FIQA, CQP, MBEng, CEng.

Society of Sri Lankan Engineers & Scientists in the UK

Abstract

Hazard means 'what can go wrong' and risk is the combination of 'how often' and 'how bad it will be'. Risk Assessment is the process of evaluating risks, arising from hazards, taking into account the adequacy of any existing controls, and deciding whether or not risks are acceptable, where as whole process is the risk management.

Risk Management is paramount in running a business or a project. Although Structural Engineer or Construction Manager of a project is aware of hazards and related risks, unless they are assessed, identified, analysed, evaluated, treated, communicated, monitored and reviewed, there might be consequences, including leading to business risks with financial implications.

Business risks could emanate at Design, Construction and Management Processes.

See Figure 1

Risk Management starts at the conceptual design stage to final design, and then through to Construction and Management Processes.

Structural Engineers' main responsibility is to ensure that the structure he designs is 'Fit for Use'. At the outset of a project, Structural Engineer should plan to determine hazards and related risks that could arise at Construction, Maintenance and demolition stages and needs to take actions for eliminating and or designing out risks. Information, regarding residual risks- cannot be eliminated by design actions must be informed to all parties concerned in a project.

In oil and gas industry, design integrity checks and HAZOPS are carried out to eliminate risks.

There should be an effective risk management process to determine and manage risks arising from Health and Safety, environment aspects, quality, waste, wastage and most importantly in

maintaining the Technical Integrity- ensure that construction is performed in accordance with design specification and drawings.

Waste Plan and Lean Constructions could be useful tools for managing risks during the construction phase.

Lack of a system for controlling management of change would bring disastrous results.

This paper illustrates the importance of establishing a robust risk management system, embracing- P-D-C-A Methodology with particular reference to good practices implemented in London 2012 Olympic Park and Hull UK Gas distribution projects. See figure 2

‘**Keywords’**

Construction and Management Regulation 2007-CDM; Design Integrity; Plan- Do-Check- Act; Technical Integrity; Lean Construction

Figure 1 demonstrates roots for emanating risks during Design (Structural Engineer), Construction and Management Processes, and Figure 2 shows the application of Pan- Do- Check – Act Methodology for Risk Management Process.

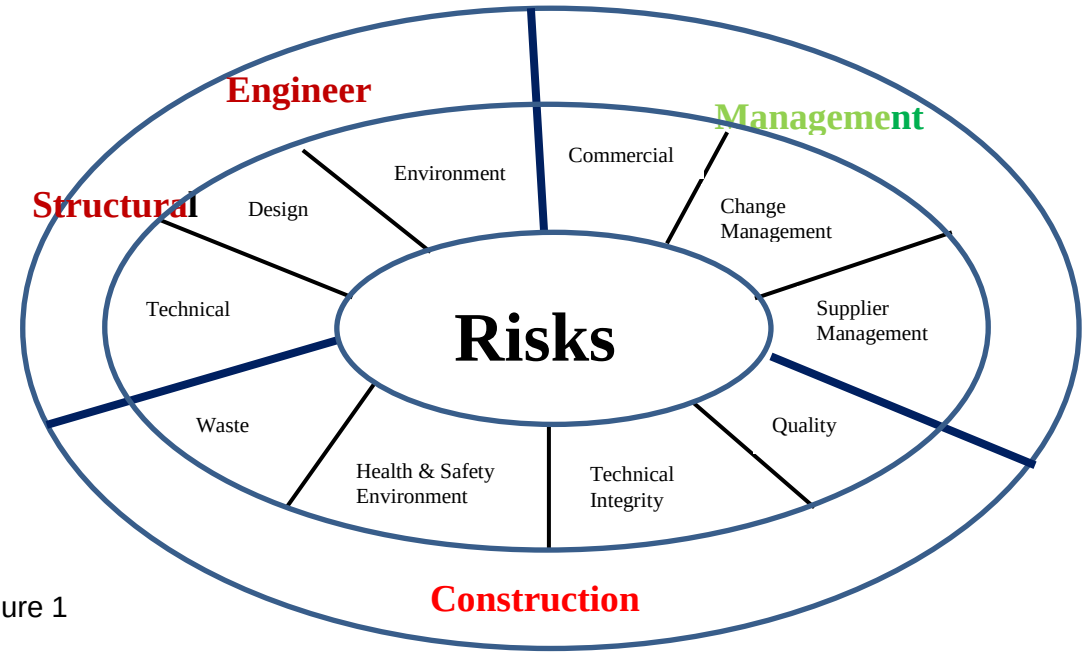

Figure 1

	Design	**Constructions**	**Management**
Plan	Basis of Design Quality Plan	Construction Inspections/ verification Arrangements for maintaining Technical Integrity Waste Plan Health and Safety Quality Residual Risks Site Rules	Management Plan Supplier/ Sub Contractor selection, evaluation and performance Measure Arrangements Colander for Progress/ design review and budget controls Change Control Lean Construction
Do	Hazard Identification Risk Assessment HAZOPS Hazard Register	Risk Assessments Method Statements Risk Register PPE	Review Contract Progress/ Design Co-ordination Meetings Cost Analysis- Cost Forecasts
Check	Design Reviews Design Verification Design Integrity	Inspections Tests Audits Measuring and Testing Equipment Calibrations	Sub-contractor/supplier performance Cost/ Programme/ quality/safety and environment requirements
Act	**Final Review**	**Progress Review**	Management Of Change

Figure 2- Plan- Do-Check- Act Methodology

1.Risks originate during Design and Development Stage- Sources, Identification and Controls

In the UK, Construction, Design and Management Regulation (CDM) applies to all projects and there are additional requirements for notifiable projects.

Structural Engineer is a Designer. A simple definition of a Designer is that of a person with authority to specify or amend the specifications or elements. In accordance with CDM Regulation, Designers should ensure that they are competent and when carrying out designs, they should avoid foreseeable risks to those involved in construction works and future use of the structure. The designer is also, responsible for identifying hazards and eliminating them, as far as reasonably practicable.

At the outset of a design, Structural Engineer should plan to determine hazards that could arise at construction, maintenance and demolition stages. Generally, 'Basis of design', is established at this stage, comprising technical data, applicable standards, codes, fire safety requirements, and other inputs, such as, soil reports, environment regulatory requirements, material considerations and or restrictions and where applicable, information derived from similar designs. Subsequently, it is important to prepare hazard evaluations system for systematic identification, elimination controls and communication arrangements.

The Design/ Structural Engineer's next responsibility is eliminating hazards and reduce risks by design actions, and it is vital to inform about any residual risks to all parties concerned in a project. Maintaining, Risk/ Hazard Register is highly desirable in order to manage risks effectively.

Design and development reviews, verifications and validations have distinct purposes.

Systematic reviews of designs need to be performed at planned intervals in order to ensure that the structure is fit for use, meeting legal, environmental and clients specified requirements, identifying any problems and propose necessary actions. At least two design reviews, one at Tender stage and the other at Construction Stage are deemed to be necessary.

It is essential to carry out Design and development verifications in order to ensure that the design output meets design inputs. Disasters including structural failures could happen, if there are any errors in the design. Hence, calculations need to be checked and or verified by a different competent Structural Engineer or by utilising different soft ware. In addition, drawings need to checked, prior to issue to ensure that the Designer's/ Structural Engineers' requirements have been correctly transferred.

1.1-HAZOPS

The purpose of a Hazops is to identify hazards and operationability and is mandatory for all designs in oil and gas industry. Hazops are carried out by a team, where the Team Leader is an experienced person in identifying problems. Formalities of HAZOPS are detailed recordings of problems and proposed solutions and follow up reviews to eliminate risks. Design Validation

1.2- Design Validations

Design Validation need to be performed to ensure that the resulting product- calculations, drawings, specifications are capable of meeting specified applications or intended use in order to avoid latent defects.

1.3-Control of design and development

Design and development changes should be identified, reviewed, verified and validated, and approved before implementation.

1.4-Technical Risks

Technical Reviews are essential to ensure that material specified are ‘fit for purpose’.

Experience show that incorrect materials, ‘black top, formally known as’ wearing course and well known in Sri Lanka as ‘carpet’ had been specified for all internal access roads for a high pressure gas reduction and distribution plant in the UK, and if this material had been used inadvertently, it would have give rise to serious fire risks due to combustibility of the material. In addition it does not fit for the purpose. Fortunately, this error was detected at a Technical Review and concrete was substituted.

1.5- Environment Risks

Environment Sustainability is one of the key policies, which is being implemented in London 2012 Olympic Park Project. Designers are instructed to specify ‘environmentally friendly materials. Construction Product Leader and a team have been appointed to wet and approve all materials which are specified to be used in permanent structures.

1.6-Design Integrity

Design Integrity should be maintained in all designs this includes calculation checks, software validations, hazard evaluations, risk identifications/ risk mitigations and communications, management of change and continual improvement. Where considered necessary and appropriate for a Project, a Design Integrity Review should be carried out, involving Project Team and Corporate Management.

2.0- Risks at Construction Phase- Sources, Identification, Controls and Communication.

Due to the nature of Construction processes, there are many unknown foreseeable events. Hence, planning for risk identification, mitigations and risk controls are vital.

2.1- Planning

The effort made in planning and managing health and safety should be in proportion to the risks and complexity associated with the project. Time and thoughts to establish a Health and Safety Plan at the start of a project will undoubtedly pay dividends not only in improved health and safety but also in reduction of delays, more reliable costings and completion dates, together improved communication and co-operation between key parties.

All Construction works should be executed safely with due considerations to health and welfare of people involved in construction works. In the UK, risk assessments under CDM for all notifiable projects (generally works last more than 30days, involving 50 people working over 10 days), is compulsory. If Method Statements are pre-requisites in risk assessments, these should be prepared, reviewed and approved and communicated prior to commencing the activity.

2.2- Controls

Site Rule need to be established determining Personnel Protective Equipment- PPE requirements.

It is often seen in some projects that hard hats are worn to protect the head when actually there is no danger from overhead whilst Safety Boots which are essential to protect feet (in Projects which involve danger), are completely ignored.

The policy' NO PPE- NO WORK' ought to be implemented in all sites.

2.2.2-Technical Integrity

Technical Integrity, conformance to the Engineer's specifications and or drawings must be maintained at all times in order to avoid failures at defect liability period and or during latent defect period. Cutting Corners, lack of proper supervision, working under pressure due to any reason seem to be the root caused of defects.

Inspection Plan, determining inspection requirements at material arrival and in- process stages, determining inspection requirements with 'Hold Points' and final inspection criteria, depending on complexity, size and nature of the project would enhance, controlling construction operations.

2.3-Waste

Statistics show that the Construction Industry waste around 15-20% of materials on average per year.

Waste means throwing the money away and it is a business risk

London 2012, Olympic Construction Park Project has established 'Zero Waste Policy'. The site is located on 2.5 sq.km, contaminated waste land. Contaminated soils was extracted, treated and re-deposited after testing the treated soil. For this purpose, soil treatment plant and a testing laboratory were set up on site, backed with stringent testing criteria.

A Leader for Construction Products has been appointed in order to ensure that all materials/products which are utilised on the project are obtained from environmentally friendly sources.

In addition, 'Zero Waste Policy has been established. Under this policy, any unused material/ products has to be used within the project in some other activity or to be carted away to be used on another project

In the UK, establishing a 'Waste Plan' identifying types of waste and disposal arrangements is a legal requirement for all construction projects. Depositing hazardous waste on unlicensed land or 'fly tipping' create major risks, sometimes leading to prosecutions.

2.4-Quality

Quality for the Constructions means conformance with specified and or Clients' requirements.

Any non conformance or variations or re-works cause delays and incur additional costs, also might lead to Clients' dissatisfactions with loss of future business opportunities.

2.5-Environment Risks

Construction Sites often produces excessive noise, emanate dust and fumes and pollute drainage and water, damaging not only the humans but also environment and wild life. Risks emanating from these aspects and non compliances with environment regulations should be identified, controlled and managed.

The best practice in the Construction Industry is maintaining a Risk Register; identifying risks arising from Health and Safety, Environment aspects and Design Residual Risks.

2.6-Measuring and Testing Equipments

Construction Errors due to usage of uncalebrated measuring and testing equipments are common in the Construction Industry. Therefore, it is important to ensure that all measuring and testing equipments, used on site are appropriately calibrated and or tested before its use.

3.0 Management

Construction and Management are interactive and mutually inclusive.

The success of a Construction Manager is measured by results. This means completing a Project assigned to him on time, safely, within the planned budget and meeting the Customer's/ Clients expectations.

3.1-Planning

A Management Plan, integrating Health and Safety and Environment requirements together with arrangements for Progress Reviews, Design Co-ordination Reviews, Valuations together with Construction Programme, Organisation Structure and responsibilities and authorities, auditing arrangements, need to be prepared in order achieve construction objectives.

3.2-Lean Construction

Lean Construction is a philosophy based on the concept of Lean Manufacturing. It is about managing and improving the construction process to profitability and delivering what the Customer/Client needs.

Lean Main Principles are:

- Eliminate Waste
- Precisely specify value from the perception of the ultimate customer
- Pursue perfection by continual improvement.

Lean about designing and operating the right process and having right systems, resources and measures to deliver things right first time. Essential to this is the elimination of waste –activities

and processes that absorb resources but create no value. Waste can include mistakes, working out of sequence, redundant activity and movement; delayed or premature inputs, and products or services that do not meet Customer/ Client needs.

The idea of 'right first time is essential to the lean philosophy. 'Right in this context means making it so that it cannot go wrong.

3.3-Supplier/ Sub Contractor Management

It is fundamentally important to establish criteria for selection, evaluation and re-evaluation-performance measures for Suppliers and Sub-Contractors. Also, it is essential to establish controls needed for out-sourced processes.

Time lost in waiting or delayed supplies, sub contractor disputes, incompetent sub-contractors are business risks.

3.4-Management of Change

The vital key for risk management is to establish a system, providing controls for changes to engineering designs, documents and drawings and distribution to relevant parties.

4.0-Conclusion

Risk Management is all about fear of unknown- what are the unknowns of foreseeable events, and how much preparation can be made for the unsafe unforeseeable. Fear Translate into adverse implications for the business. Threats to an organisation are fluid, dynamic and high pressure phenomenon which often spring on a business with little notice.

5.0-Recommendations

Apply Lean Thinking in Construction; Avoid waste in both processes and activities; Consider concept of partnering; Benchmark to establish' best in class' construction methods and out puts; Establish a stable project programme, with clear identification of critical path; Consider implementing CDM 2007 Regulation; Manage risks throughout the project; Establish a supply Chain management process; Provide transparency of costs.

References

ISO 9001, 2008

ISO 14001 2004

OHSAS 18001, 2007

CDM Regulation 2007

ISO Model ISO 3100

Constructing Excellence publication No3- lean construction