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Risk management approaches in CAR / EAR projects

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Executive summary

Developed for the conference of The International Association of Engineering Insurers (IMIA), this paper provides a best practice guide for implementing risk management in construction and erection projects to finish the projects on schedule, within budget and with minimised losses. (section 1)

Generally speaking, risk management is a process in which decisions are made to either accept a known risk and/or to eliminate or mitigate it. The benefits of successfully implemented risk management are mainly the prompt detection of potential risks and their mitigation. This paper focuses on risk surveys on-site, the recommendations made, their implementation on-site and risk mitigating characteristics in construction all risks (CAR) and erection all risks (EAR) projects. (section 2)

There should be a professional risk survey team to ensure open communication between insured and insurer which is key for successful risk management. Depending on the project size, this team comprises the risk surveyor, a progress monitoring specialist and a risk survey co-ordinator. (section 3)

This paper provides specific checklists for CAR / EAR and Third Party Liability (TPL) covers to warrant for the success and the quality of such surveys. Besides CAR and EAR, special attention is focused on Delay in Start Up (DSU) covers since their risk assessment demands special know-how. (section 4)

Such a professional risk management setup involves costs which must be covered. Since the primary beneficiary of risk management is the project itself, it is suggested that these costs must be covered by engineering fees integrated in the insurance premium. Three different vehicles of implementation were identified: The risk survey team can be outsourced to an independent risk management company, it can be owned by the leading insurance/reinsurance company, outsourced, or it can be a hybrid of the two vehicles. (section 5)

The project size, the type of works and the scope of cover will dictate the size and degree of specialisation required for the risk survey team. (section 6)

There are certain critical factors which threaten the successful implementation of the intended process: General reluctance on the part of the insured for the proposed process, the implementation of loss prevention recommendations and the attendant responsibility, the lack of statistical data on improvements after implementation of such a process, acceptance of the financing method and the expertise of the on-site risk survey team. (section 7)

This paper comprises a clause and an endorsement (just as an example) which could be used in policies. (section 8)

Risk management makes a major contribution to the successful completion of construction projects according to schedule, within budget and with minimised losses. Due to new challenges in the construction industry, increasing costs and greater time pressure, loss probability is increasing rapidly and leads to a rising demand for comprehensive risk management, to ultimately provide benefit for all stakeholders. (section 9)

A number of examples are given to underline the benefits of risk management. A detailed checklist for CAR / EAR projects is enclosed and an example of an adequate analysis is provided to consider the special features of DSU covers.(section 10)

1. Introduction

The International Association of Engineering Insurers (IMIA) is the forum for promoting understanding and best practise in the field of engineering insurance. This co-operation is required since engineering insurers are continually confronted with risks emerging from new technical developments in the construction industry. Following the annual IMIA conference in September 2002 in Switzerland, there was high demand for guiding information about risk management and risk surveys in construction and erection projects in relation with insurance specific characteristics. This paper was developed in response to this demand of this conference.

There is a strong demand for comprehensive project and risk management, given the greater complexity of construction and erection projects and increased cost and time pressure. Successful projects have certain characteristics in common, i.e. realistic financing and project management, technical expertise and managing risks from the inception of the project.
Risk management essentially involves the identification of potential hazards or risks and the decision to prevent, mitigate and transfer them. Therefore, it offers the possibility to quantify risks and required mitigation measures. An implemented risk management concept including risk surveys effectively reduces possible losses and leads to successful project completion.

Insurance is a key means for transferring risk from the construction industry, and it is in the interests of the insurance industry to develop and carry out successful risk surveys for reducing risks and losses.

After any insurance cover is agreed, it is in the mutual interest of the insurer and insured to mitigate and prevent loss. Since identifying and handling risks is a core competence of the insurance industry, this paper should offer guidance for reinforcing the existing approach, strengthening the relation between the construction and insurance industries and improving risk quality which, in turn ensures successful project completion. Further, this paper could give underwriters additional information and make it usable as a practical tool when underwriting construction all risks (CAR) and erection all risks (EAR) covers.

2. Risk management

Introduction

Risk management is a wide ranging discipline and the term is used in different ways. Therefore, risk management must be defined as it applies in this particular context.

Definition

Risk management can be described as a process in which decisions are made to accept a known risk and/or to eliminate or mitigate it or transfer it.
In further detail, risk management attempts to:

- identify hazards and attendant risks which impact project outcome in terms of costs and programme including those to third parties;
- quantify risks including their programme and cost implications;
- identify proactive actions for eliminating and/or mitigating risks;
- identify risk control techniques;
- allocate risks to various contractual parties and the contract insurers;

Essentially, there are two different risk management approaches. From the clients' standpoint, risk management processes must already begin during the tendering phase and prior to construction. The principal must first conduct this risk management procedure and involve the contractor at a later date. Both parties must identify and develop mitigation measures for certain hazards and risks at the earliest stage of a project.

The risk management approach involving the insurer, and described herein, starts after commencement of construction and erection works and should involve the insurer's expertise to reduce potential losses. These two risk management approaches – on the part of the client and the insurer – must work hand in hand to ensure the success of the project.

Risk management

The focus on risk management, as defined in this paper, is on on-site risk surveys, the recommendations made, their implementation on-site and risk mitigating characteristics. This paper confines discussion to the risk characteristics of construction and erection projects and CAR / EAR covers.

Benefits of risk management

As in the case of engineering construction insurance, most losses are caused either by human error or ignorance of potential hazards. Risk surveys can often:

- alert site management to major potential hazards;
- suggest practical loss prevention measures;
- keep reinsurers abreast of latest project developments;
- inform insureds about relevant losses and risks based on insurers' loss experience (while respecting the confidentiality of other insureds);
- create a fruitful dialogue between the insurer and insured to stimulate future business.

3. Procedure

Introduction

Certain procedural standards are required to successfully implement risk management. A best practice procedure was developed to provide the insured and the insurer with guidance for establishing a comprehensive risk management process.

The procedure described below focuses on the risk survey team whose size, availability and degree of specialisation depends mainly on the size and type of the project and the scope of cover.

Risk survey process / information flow

Access to project information is essential and full co-operation of the insured is required in this respect. Loss adjusters' reports are an essential component of the information reviewed by the risk survey team to derive mutual benefit from lessons learned with respect to losses. The information flow between the insured and the risk survey team can be illustrated as follows:

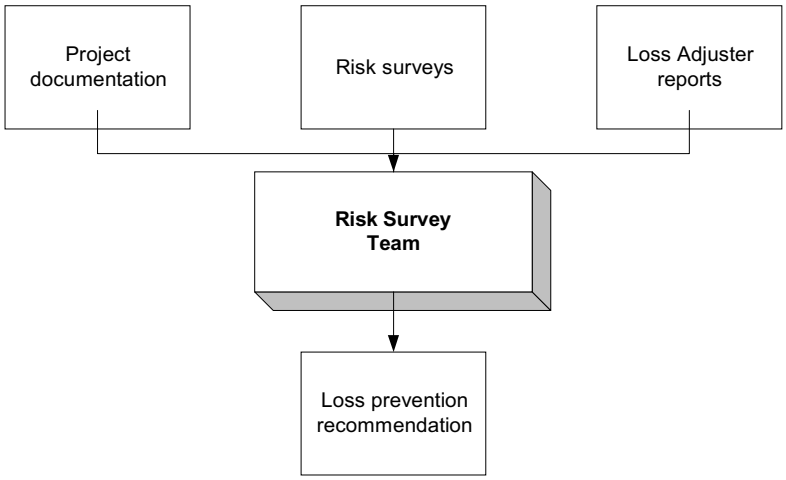

Figure 1, Information flow

Risk Survey Team

The risk survey teams consists of a risk surveyor, progress monitoring specialists (if required) and a risk survey co-ordinator.

Risk surveyors in CAR / EAR projects must:

- conduct on-site loss prevention surveys;
- prepare information and reports for underwriters and reinsurers;
- make recommendations / follow-up loss prevention activities during different project stages.

Beside these tasks, risk surveyors can provide the underwriter with specific technical advice for project evaluation.

Risk surveyors have the following competence profile:

- professional mechanical or civil engineer with practical on-site and consulting skills, i.e. so-called soft skills such as negotiation and communication competence. Additionally, they must be well versed in:
- contracts (division of risks of different parties, insurance requirements/clauses);

- evaluation of risk profiles at different stages in CAR / EAR projects;
- applicable technologies;
- geotechnology;
- natural phenomena risks;
- testing of installations;
- DSU analysis;
- TPL risks**;**

Risk surveys

Careful planning and preparation is required to ensure successful implementation and the outcome of surveys. A typical flowchart for a site survey is shown below:

Time to Survey	**Action**
-6 weeks	Formal notice of survey
	⇐
-2 weeks	Information provided to LPE
	⇐
0	Site survey followed by discussion with site management
	⇐
+4 weeks	Survey report issued
	⇐
+8 weeks	Feedback from insured

Figure 2, Risk survey timeframe

The principal survey steps are:

1. Notice of site survey issued by risk surveyor to the principal. It includes:
- scope of survey;
- list of principal's and contractor's representatives involved; and specifies:
- documents required 14 days prior to the survey;
- documents required during the survey;

2. Site survey

A survey will typically include three phases:
- discussion of the project/contract and a documentation review;
- actual survey;
- 'close-out' discussion of issues identified during the survey where preliminary recommendations are made; discussion of initial recommendations;

3. Survey report

The survey report should be issued within four weeks after the survey. It must include the following sections:
- Date of survey, participants;
- Contracts overview (the underwriter should have detailed information): contractors, designers, contract values, type of works;

- Description of works in progress;
- Risk analysis: monitoring of major exposures identified in previous surveys;
- Observations made during survey and recommendations;

Feedback from the insured on the survey report should be received within 8 weeks after the survey.

Comprehensive risk management reports

When justified by the project size and the scope of the insurers' risk management processes, a comprehensive report covering various programme aspects should be prepared in addition to the survey reports.

These reports can be issued on a quarterly basis or bi-annually and should include the following sections:

- Introduction: project description;
- Executive summary: Overall view of work progress; achieved milestones; areas of concern;
- Risk survey activities: contracts visited and surveys carried out; collection of recommendations made during the period;
- Progress monitoring: work progress for each contract;
- Claims history: claims summary;

4. Contents of survey

Introduction

Following the procedure cited in section 3, Best Practice checklists were developed to impart a specific framework for conducting risk surveys.

A general checklist for CAR / EAR projects is given. On the one hand, this checklist concerns an office-based meeting where all relevant documents and technical questions should be assessed and addressed, and, on the other, an on-site tour were the risk itself is analysed. Further, an extension checklist for TPL and DSU coverage is provided since they are common additional covers in CAR / EAR projects.

General checklist for CAR / EAR covers

1. General information
   Information about insured, type of risk, visit details, etc.
2. General risk information
   Information about risk, e.g., periods, shifts, resources, layout plans
3. General cover information
   Information on cover and its details
4. Office-based meeting – project progress
   Analysis of project plan, i.e. critical path; comparison between targeted and actual
5. Office-based meeting – project management
   Information on contractors, their experience, site organisation and communication
6. Office-based meeting – risks associated with location
   Analysis of external perils from the surroundings (e.g. Nat Cat) and their mitigation measures
7. Office-based meeting – construction-related risks
   Analysis of ground conditions, existing property, equipment, etc.
8. Office-based meeting – process-related risks
   Analysis of standards, quality and monitoring processes
9. Office-based meeting – fire-related risks
   Analysis of fire load and fire protection measures
10. Office-based meeting – risks relating to testing, commissioning and operation
    Analysis of testing procedures, hand-over process and level of staff expertise
11. Office-based meeting – structure-related risks
    Analysis of material quality, standards and existing quality systems
12. Site tour – civil engineering aspects
    Check of office based meeting information, detailed check of natural perils protection, potential hazards protection, access situation, equipment conditions and construction processes.
13. Mechanical and electrical engineering aspects
    Check of office based meeting information, detailed check of mechanical and electrical equipment and related hazards and its prevention. With special attention to transformers, transmission lines, boilers, turbines, etc. and control and monitoring systems.
14. Receiving of goods, storage
15. Warehouse and laydown areas
16. Site security

Refer to annex 10.2 for a detailed checklist for CAR / EAR projects.

Add-on checklist for TPL covers

1. Assessment of the surrounding property at risk (property damage and business interruption);
2. Critical works required, e.g. excavation works, lowering of water table;
3. Risk of accidental pollution, e.g. river near site; water table;
4. Cross liability: site organisation, etc

Add-on checklist for DSU covers

1. Objectives

- Assessment of material damage loss impacting construction schedule
- Identification of uninsured events and their impact on completion date
- Identification of possible mitigation measures in the event of a loss, e.g. by expediting repair works or re-scheduling some remaining works. There is usually a policy provision permitting payment of *increased cost of working* (ICOW) to mitigate a DSU loss, and insurers must be in a position to assess the need for such expediting measures.

2. Data requirements

The progress analysis relies entirely on the quality of the supplied information. The information which must be provided by the insured on a continual basis includes:

- Project master programme and revisions;
- Design and construction status reports;
- Monthly progress reports for each contract;
- Contract situation report including cumulative expenditure

3. Progress analysis

- Impact of each contract on overall project completion date;
- Progress in each works area;
- Critical activities, based on actual production rates vs. rates required to meet completion date.

Refer to annex 10.3 for an example of a detailed DSU analysis.

5. Financing

Introduction

Risk surveys and inspections cannot be successful unless conducted by experienced and professional risk surveyors specialised in specific areas. Surveys and inspections must be prepared properly; any recommendations and findings must be analysed and documented subsequently. These activities require time and resources which necessitates a budget. The investment for a successful survey with adequate recommendations which can effectively prevent losses is low compared to costs arising from a loss and follow-up costs for bringing the project back on schedule.

Financing method

Risk surveys lead to improved risk quality and significantly decrease losses on construction sites. Therefore, the key beneficiaries of implementing comprehensive risk management techniques are the client, i.e. principal and contractor, the insurers and, most importantly, the project itself. Since this benefit was realised, most major construction projects have an independent risk survey team employed by the leading insurers, in addition to their own risk management concept. Costs for this risk survey team in such projects are generally covered by engineering fees integrated in the insurance premium which range between 2.5% – 3.5% for major construction projects. This approach should extend to all engineering projects, regardless of their size.

After providing the funding, there are three different vehicles to implement and execute this approach depending mainly on the project size:

- risk survey team can be *outsourced*, i.e. an independent risk management company conducts the surveys, monitors the implementation process and impact on the risk;
- risk survey team can be employed by the insurer, i.e. a risk surveyor unit within the leading reinsurer conducts the surveys, monitors the implementation process and impact on the risk;
- A *hybrid approach*, i.e. the risk survey team is supervised by a risk surveyor from the reinsurer and other team members are outsourced from an independent risk management company;

6. Segmentation

Introduction

The nature, scope, workload and consequentially the costs of risk surveys and inspections vary depending on the:

- available budget, i.e. the project size;
- type of works involved;
- scope of cover provided;

Project size

The scope of services to be provided can be initially assessed from a financial viewpoint in terms of the time requirement (i.e. man-days) independently of the financing method. The calculation given below is based on the assumption of a 2.5 – 3.5% fee of the CAR/EAR premium, average costs of EUR 800 per man-day and on an average premium rate for a standard project of 4‰ on the total sum insured.

Project size (Total Sum Insured in m)	Risk management services (Number of man-days)	Financing method (RM = risk management)
> 500	> 60	Outsourced or hybrid RM
100 – 500	12 – 60	Outsourced or hybrid RM
10 – 100	1 – 12	Hybrid or employed RM
< 10	< 1	Employed RM

The figures shown are only approximations since actual costs depend on several factors including travel expenses to and from the site and frequency of surveys which depends mainly on the risk quality and size. For small to medium size projects, the number of site surveys is usually limited to one or two and a standardised format can be used for both surveys and reports. For larger projects, a project-specific risk management organisation can be established and involves several specialists, each focusing on a specific project aspect.

Project type

The content and timing of the surveys must be planned according to the project type.
CAR and EAR risks usually require different strategies from this perspective:

- CAR or civil work projects are usually exposed to natural perils throughout the construction period. As a result, site surveys should be conducted regularly during the entire construction period, preferably before rainy seasons, if applicable. Since completed works are normally more resistant to major natural events such as earthquakes or storms, exposure tends to reduce towards the end of the construction period. However, fire exposure increases dramatically near project completion since most values are installed but fire protection measures often have yet to be implemented;
- EAR or plants under construction experience highest exposure usually during testing at the end of the construction period. Site surveys should definitely focus on the perils arising during that period, especially fire and protection measures, focussing on the technique used;

Scope of cover

Different risk characteristics must be assessed depending on the scope of cover. Refer to checklists in section 4 and annex 10.2.

7. Critical success factors

Introduction

The final goal of this paper is the implementation of described risk management processes and promoting awareness within the construction and insurance industry for this topic. Therefore, the project faces certain critical success factors which must be identified to develop mitigation measures for achieving the ultimate project goal.

Critical success factors with details

1. General reluctance to suggested processes by insured (principal/contractor)

The principal/contractor is and remains the responsible party for successful risk management of the project. Insurers can provide their expertise based on past projects. Acceptance of this best practice principle by the insured is therefore the crucial part. Additionally, there is a danger that management will become complacent and “hazard blind”, particularly in cases where few losses have occurred in the past. Insurers and the described risk management process, i.e. surveys, can assist the client’s risk management in recognising potential hazards and reducing the probability of such hazards.

The probability of such hazards and appropriate risk management have a significant impact on the insurance premium and the acceptance of the risk. Therefore, sound co-operation should be achieved between all parties since they all share the identical objective of successful and scheduled project completion without losses and within budget.

2. Loss prevention recommendation

a): Implementation of such recommendations

The final statement of a survey must include certain recommendations leading to loss prevention or mitigation measures. Three areas of recommendations can be identified:

- Recommendations due to organisational problems where implementation might lead to a major change in the risk environment. These changes can be normally implemented without a recognisable increase of the project budget;
- Recommendations due to project-specific hazards or processes which might be in line with current standards but increases the risk in a specific situation.
- Recommendations due to obvious breaches of current technical standards which lead to a negative risk assessment and cannot be tolerated.

All recommendations should help the client to make the project as secure as possible and eliminate potential future losses. The acceptance of such recommendations and their implementation is another critical success factor.

Depending on the contractual agreement between the insured and insurer, recommendations from a risk survey must be implemented in an adequate time frame. If the client fails to follow recommendations and if a loss arises due to one of these identified hazards, this damage or loss will no longer be unforeseen. This situation is tantamount with a breach of the principles of insurance and can result in no coverage.

b): Responsibility of making such recommendations

The responsibility of such recommendations is another critical success factor. The client has the expertise on his project, he knows the strengths and weaknesses, the processes and its environment. For their part, insurers do not intend to infringe on the clients internal processes by issuing orders. Therefore, the following disclaimer could be incorporated before any recommendations are made:
Survey recommendations are made to maintain and improve the insurability of the site. They are not a safety review, are not exhaustive, and do not purport to identify all hazards, present or future, which may exist or occur on the site. Prior to initiation of implementation, the insured must analyse and develop in detail all required safety, engineering and working procedures necessary for implementation. The insured is solely responsible for any potential hazard at the site and for compliance with all applicable laws and regulations.

3. Statistical data on improvement

Since risk management concentrates on risk improvements to prevent potential future losses, it therefore lacks statistical data, making it difficult to quantify the impact of comprehensive risk management. Based on experts' judgement and new risk management concepts in the construction industry, risk management makes a substantial contribution to the successful hand-over of construction projects.

4. Financing

As mentioned in section 5, a budget is required for the experienced experts who actively support the client in identifying certain not yet recognised hazards and scenarios. The reluctance to cover these fee requirements will significantly impair the implementation of successful risk management and can therefore jeopardise the final insurability of the project. Costs for this service are covered through applicable engineering fees integrated in the premium. Therefore, even if the insurance premium is under pressure, it must be made clear that the premium must include these fees since the client and the insurers are the beneficiaries of such surveys. Therefore, both parties should focus on successful implementation.

5. Skill profile of risk surveyor / risk survey team

Another critical success factor involves the risk survey team. Besides technical skills, communication and negotiation skills are crucial since the on-site surveyor is the ultimate link to site representatives and is therefore in the best position to enforce the risk management process and its implementation.

8. Clauses

Introduction

The following clause and endorsements were developed (based on different examples used in the markets) to give a practical example which could be used in future wordings to reinforce the approach of integrating a risk management process in most construction projects. The mentioned risk survey clause can be incorporated in the slip and serves as basis for including the risk survey plan endorsement in the final wording.

Risk survey clause

As a condition precedent to cover under this policy, the risk survey plan shall be implemented. In the event that the risk survey plan is not implemented or maintained, a material change in the risk will have occurred.

The risk surveyor appointed by the insurers or reinsurers shall have the right at all reasonable times to conduct risk surveys at any construction site insured under the policy. This right includes the inspection of any documents relating to the insured construction site(s), which are on file at the office of the insured or any other location.

In the event surveyor recommendations are not implemented by the insured and a loss occurs due to a hazard which was identified by the surveyor recommendations, the loss shall be deemed to have been foreseeable.

Risk survey plan endorsement

As a condition precedent to cover under this policy, the risk survey plan shall be implemented. In the event that the risk survey plan is not implemented or maintained, a material change in the risk will have occurred.

A. Risk survey plan

1. The risk survey plan will be determined by the insurer and lead reinsurer (see declarations/schedule).

2. The risk survey plan has the following scope of associated work:
   a) Preparatory meeting with insured, risk surveyor (see paragraph B below) and underwriters.
   b) Regular site surveys by the risk surveyor.
   c) Monitoring of monthly progress reports and implementation of the risk surveyor's recommendations by the risk surveyor and review of reinsurance issues by underwriters.

3. The insured warrants that it will co-operate and assist in the implementation of the risk survey plan. `

B. Risk surveyor

1. The insurer and lead reinsurer (underwriters) will appoint an individually nominated expert (risk surveyor) selected from a specialised company to perform routine surveys and report on project progress and loss/near loss experience (See declarations/schedule).

2. The risk surveyor appointed by the insurer/reinsurer shall have the right at all reasonable times to enter and carry out risk surveys at any construction site insured under the policy. This right includes the inspection of any documents relating to the insured construction site(s), which are on file at the office of the insured or any other location.

3. The risk surveyor will be responsible for the daily management of the risk survey plan, including monitoring progress and implementation of recommendations. The risk surveyor will not have any decision-making authority regarding insurance or reinsurance issues or commercial obligations.

C. Risk surveys

1. The frequency of risk surveys will vary, depending on the results following the previous surveys and type of project. The frequency will increase if areas of concern arise from previous surveys or other actions of the insured, or if loss experience is poor. The risk surveyor may, from time to time, require site personnel to provide information when its area of expertise is under review. The risk surveyor will strive to minimise disruption of work at the site. An outline of the main topics of a risk survey is attached as annex 10.2

2. In the event of a loss, the risk surveyor may act on behalf of the underwriters to provide information to the loss adjuster regarding historical events and especially the status and/or progress of on-site construction on various dates and/or at different periods of project execution.

3.The cost of the risk survey plan and risk surveyor will be covered by the approximate 3% risk survey fee and identified on the slip (% depending on the size of the projects and scope of surveys).

D. Surveyor’s recommendations

1. The insured shall implement survey recommendations according to a schedule agreed with the risk surveyor.

2. In the event that the survey recommendations are not implemented by the insured and a loss occurs due to a hazard which was identified by the surveyor recommendations, the loss will be deemed to have been foreseeable.

E. Disclaimer

Survey recommendations are made to maintain and improve site insurability. They are not a safety review, are not exhaustive, and do not purport to identify all hazards, present or future, which may exist or occur on the site. Before the initiation of implementation, the insured will analyse and develop in detail all necessary safety, engineering and working procedures required for implementation. The insured will be responsible solely for any potential hazard at the site and for compliance with all applicable laws and regulations.

9. Conclusion

The risk environment for construction projects has been changing radically and also impacts CAR/EAR insurance and related risk management needs. New financing schemes can have adverse effect on risk management. In a global economy, optimised costs and schedules lead to cost pressures and elimination of time reserves. The increased usage of simulation and the presumed reliability of its results leads to reduced safety margins. Based on this development, the risk environment in construction projects is becoming increasingly more critical. Comprehensive risk management must be implemented to identify and mitigate all relevant risks so that future construction and erection projects can be completed according to schedule and budget and with minimum losses. Based on the experience of the insurance/reinsurance industry this approach provides a framework establishing a successful risk management process to make construction projects safer.

The following key elements are essential for the success of the relevant risk management approach:

- Professional set up of risk management process
- Experienced risk survey team (technical and soft skills)
- Open communication between insured and insurer and its representative, especially in the event of any recommendations
- Integration of risk management requirements in wording
- Acceptance of financing and funding methods

If these key elements are fulfilled by both the insured and the insurer, the relationship between the parties will be strengthened and the risk of losses will be reduced significantly. This is to the benefit of the project and all involved parties. Essentially, the costs and effort for successful risk management are minor compared with the potential losses which can be avoided.

10. Annex

10.1. Examples

10.1.1. Example 01

1. Risk name: unnamed

2. Description of risk

The construction project concerns a 350 km rail link between two major cities in the Far East. It involves major civil works including tunnels, viaducts, stations, track work and rolling stock testing. While the project is subject to standard CAR and DSU risks, it is highly exposed to natural perils (storm and earthquake).

3. Description of risk management

A comprehensive risk management plan was designed involving the following personnel:
- full-time risk surveyor(civil engineer);
- rolling stock specialist;
- progress monitoring specialist;

The civil works were divided into 12 sections and the frequency of site surveys is such that each section is visited twice a year. This represents one survey per week, plus spot surveys as required for the rolling stock.
Quarterly meetings are held with the insured for exchanging information, discussing key recommendations and planning future surveys.
The progress monitoring specialist issues a civil works progress analysis updated monthly based on the principal's progress reports. It details progress achieved in each area of work and what is required to achieve on-time completion.

4. Benefits for risk quality
- loss prevention issues raised and shared with insured at local level;
- work methods and loss experience shared between contracts;
- good knowledge of the work progress with regard to DSU coverage.

5. Experiences
- scope and purpose of the risk management plan must be thoroughly discussed and agreed before risk inception;
- good communication and information flow between insured and insurers are essential for the success of the risk management plan;
- recommendations must be discussed on-site and further procedures after the survey agreed upon;

10.1.2. Example 02

1. Risk name: unnamed

2. Description of risk
Double arch concrete dam. Height: 185 m; volume: 2 500 000 m^3 of concrete; tunnel length: 97 km; contract duration: 1991 – 1998

3. Description of risk management and implementation
All technical aspects of construction methods reviewed by insurers and agreed on. Regular (at least every 3 months) site visits by insurers. During the 3 – 4-day site visits, detailed works inspections were conducted with insurers, engineers and contractors. Potential loss scenarios were identified, minimised or prevented. All changes in construction methods, programme, materials, etc were communicated to insurers and agreed upon prior to implementation. Insurers were constantly and closely involved in project management. Insurers were given copies of minutes of monthly site meetings held between contractors and consulting engineers.

4. Risk quality benefits
Continual risk monitoring of conditions and the involvement of risk monitoring specialists during the project enabled insurers to better manage risk and exposure. The insurers were able to offer advise (such as drilling pilot tunnels) to minimise possibility of losses.

5. Experiences
Insurers were flexible and accepted changes in work procedures/scope of contract which facilitated project completion according to schedule.

10.1.3. Example 03

1. Risk name: unnamed

2. Description of risk
Construction of new subway system by Tunnel Boring Machine (TBM) partially below groundwater table. The works were carried out in alluvial soil and involved various tunnels, shafts and substations.

3. Description of risk management and implementation
When the project commenced, the principal had a permanent risk manager, who left the project at an early stage. Subsequently, three major losses occurred due to very complicated soil conditions. In addition, TPL claims (especially “cracking” claims) occurred as superficial cracks appeared on walls of surrounding buildings which were not necessarily caused by the construction works.
To minimise losses, a civil engineer employed by the lead reinsurer was responsible for the following:

- identification of the phases and works procedures critical to the project
- analysis of the method, planning and process of critical works immediately before executing such works
- report to principal, contractor and insurers, if works procedures are comprehensive
- if works procedures were not comprehensive, problems and risks were identified and documented. Therefore, the risk was no longer unforeseeable which meant there was no coverage if the insured proceeded with the works.

Risk management costs were covered by the insurance companies and were divided according to their respective shares.

4. Benefits for risk quality
No major losses were reported after on-site placement of the risk management engineer. Transparency and public image of the project improved which helped create a win-win situation.

5.Experiences
Had a risk management concept been in place immediately after project commencement, perhaps all of the major losses could be prevented. The risk management programme tended to resemble a partnership especially between the insurer and some contractors.

10.1.4. Example 04

1. **Risk name:** unnamed

2. Description of risk

Construction of a new major paper mill including standard CAR/EAR and DSU risks. The new mill was built on an existing industrial site surrounded by pulp and paper mills, power generating plants and chemical factories which increased exposures.

3. Description of risk management

A conventional risk management plan was established for the project as a standard procedure. Tasks fulfilled by insurance company:

- a part-time loss prevention engineer was employed for the project;
- a systematic loss control tool developed by the insurance company was put into use;
- in this loss control tool, the project was divided into different areas based on the areas of responsibility of the different subcontractors. The tool is designed to steer risk management and safety-related matters in different areas of responsibility;
- special attention was given to structural fire protection and sprinklers. Insurance company specialists advised the client in these areas;
- continual follow-ups were carried out;
- the contractor issued weekly reports.

4. Benefits for risk quality

The project was completed on schedule and without losses.

5. Experiences

Loss prevention plans were carried out well in advance, and a systematic approach to loss control was adopted during the construction period.

10.2. CAR / EAR checklist

General checklist for CAR / EAR covers

1. General information
   - Policy no.
   - Class of business
   - Name and address of insured
   - Name and address of risk
   - Type of risk
   - Date/duration of visit
   - Persons visiting
   - Persons met
   - Documents received
   - Purpose of visit

2. General risk information
   - Construction period or year of completion
   - Number of work force
   - Normal working hours/number of shifts
   - Plant layout description (or, even better, layout plans)
   - Description of plant operation/process
   - Description of surrounding property/neighbourhood

3. General cover information
   - Cover details (CAR, EAR, DSU, TPL)
   - Sum insured, deductibles

4. Office-based meeting – project progress:
   - Project plan overall and main activities
   - Project actual overall and reasons for variance
   - Total float in main project activities
   - Project plan – critical path
   - Deviations from original project plan

5. Office-based meeting – project management:
   - What are the main contracts and who are the main contractors?
   - What is the experience level of management and construction personnel?
   - What communications exist – meetings and reports, on-site and with off-site management as well as subcontractors?
   - How are changes or variation to the contract managed?
   - What is the safety philosophy for the project and what procedures and permit systems are used?
   - What risk management activities are planned and occur?
   - What are the current incident, damage, accident reporting procedures?
   - How are “near misses” recorded and investigated?
   - What incidents or near misses have occurred to date and what has been learned form these events?
   - Have any incidents occurred which have given rise to an insurance claim?

6. Office-based meeting – location-related risks:
   What measures are taken (during the construction and testing periods) to prepare for and mitigate the effects of:
   - Windstorm
   - Earthquake
   - Flood
   - Tsunami
   - Inundation
   - Impact from road, rail, marine or air

7. Office-based meeting – construction-related risks:
   - What were the original ground conditions?
   - How was the site used previously and for what purpose?
   - What actions are taken to stabilise the foundation and to what standards?

- Existing property

- What is the progress of the wet works?
- Are the wet works subject to external influences including ship damage?
- What actions are taken to ensure surface water runoff during construction?
- What procedures are taken to receive equipment at the site?
- What procedures are taken to store equipment on the project site?
- Is equipment stored temporarily offsite?

8. Office-based meeting – process-related risks:
   - What changes from the original plan have been made to the layout or the equipment?
   - Is the supplied equipment of proven design for these precise operating parameters?
   - What design standards have been used?
   - What computer control systems are in place?
   - What equipment monitoring is in place?
   - When do control and monitoring systems become operational?
   - At what stage does fuel become available on-site?
   - When is electric power supply planned?

9. Office-based meeting – fire-related risks:
   - How are fuel supplies managed to prevent fire and what fire detection systems are used?
   - How are fuel supplies managed in the event of a fire?
   - What other flammable materials are stored on-site, where and how?
   - What permits and procedures exist for preventing fire?
   - What procedures exist for ensuring good housekeeping?
   - What permanent fire protection and firefighting systems are planned and when will they become fully operational?
   - What portable/mobile construction firefighting equipment is planned and when will it become fully operational?
   - What “fire alert/alarms” are planned and when will they become fully operational?
   - What site fire fighting resource is planned and when will it become fully operational?
   - What municipal firefighting resource is currently available and have regular visits and fire drills been conducted?

10. Office-based meeting – risks relating to testing, commissioning and operation:
    - What investigations have been carried out to check the site for unrecorded services?
    - What testing and commissioning procedures and reports are planned?
    - What connections are to be made to either existing site services or new offsite facilities? Will they be managed under own testing and commissioning procedures?
    - What loss prevention procedures and control will be implemented between various project phases?
    - When will operational personnel arrive on-site? What is their level of experience? What training will be given?
    - How/when will hand-over occur? How will phased hand-over be managed?
    - How will major problems be identified, discussed and rectified?

11. Office-based meeting – risks related to structures:
    - What building codes were observed for design?
    - What design safety margins were adopted particularly in relation to foundation work?
    - What is the design life of the main foundational structures?
    - What is the role, structure, process and procedures of the resident engineer and other independent inspectors of the design and construction?
    - Can civil works still pending be documented?
    - Are there actual concrete samples comparing result results with design specifications for key areas of the plant such as pier, machine foundations, water intake/outlets?
    - What are the test pile procedures and test results?

- Have any delays occurred due to site civil construction incidents?
- Are any novel or previously untested technologies employed for the civil works or in the contractor's plant and equipment?
- Are there any specific design features related to environmental protection?
- Is site landscaping (including tree and grass planting) included in the scope and if so what does it include and when is it scheduled?
- What sea defences exist for flood and tsunami? Have there been any modifications of existing defence structures related to this project?
- Do the civil works exhibit any latent earthquake damage?
- Are any details available regarding the exterior wall finish of the power house including the plate sprayed tiles, cement formed plate and metallic panel
- How does planned progress compare with actual progress and what is the current buffer period available

12. Site tour – civil engineering
    - Connection to industrial water facility
    - Cooling water inlet, and discharge port
    - Protection from natural perils
    - Wastewater treatment plant
    - Offsite assembly plant and off-loading facility for silo units
    - Special contractors plant and equipment
    - Road access, marine access
    - Grades and elevation

13. Mechanical and electrical engineering
    - Fuel receiving (storing), cleaning and tank pressure monitoring
    - Boilers and flue gas treatment system
    - Steam turbine(s) and generator(s)
    - Condensers, feed pumps and feed system
    - Water treatment plant
    - Main transformers
    - Switchyard and transmission
    - Connections for services
    - Main control area with control and monitoring systems

14. Receiving of goods, storage
15. Warehouse and laydown areas
16. Site security

10.3. DSU analysis – detailed example[1]

An example of how the analysis can be performed is given below. The method used was designed specifically for a large civil engineering project, but it can be applied to other types of projects, subject to appropriate adaptations.

A summary sheet (see below) is prepared for each of the civil contracts and provides three different measures of progress:

- cumulative financial expenditure against forecast;
- work progress during the period;
- construction achieved to date, whereby an indication of the critical areas of activity is obtained by comparing the rates achieved so far with those required to meet the targeted completion date;

To be meaningful, this analysis must be performed on a regular (preferably monthly) basis to determine how the contractor's resources are allocated or re-allocated to each area of activity based on progress achieved in each area.

This method addresses the issue of progress monitoring and is not meant to be a loss adjusting tool. If a delay occurs following a material damage loss, additional investigations will be necessary to gauge the impact of this loss on the schedule. These investigations are not described here since they are beyond the scope of this paper.

Civil engineering contracts

Contract progress analysis

Contract	**C1**		**Description**	Viaducts, bridges and tunnels
Reporting date	**Oct 2002**		**Chainage TK**	
Day number	**1004**		**Contractor**	

Contract length	0,000	kms
Commence	1 Apr 2000	
Complete	28 Jun 2004	
Scheduled term	1550	Days
Remaining	546	Days
Contract period completed %	64.77	

CRITICAL CONSTRUCTION BASELINE QUANTITIES Viaduct, bridges & tunnels	
	lin. m.
Mined tunnel	5866
Cut and cover tunnel	3436
Pre cast deck	17684
CIP / other deck	11834

Progress analysis based on financial reporting data		
Planned progress %	76.48	based on payment forecast
Actual progress %	70.65	based on cumulative payments
Deviation - actual to planned %	5.83	
Recovery target (days)	90	converting payment deviation into contract duration

Days remaining to

[1] Thanks to Ewan Cresswell (Integra Technical Services) for his contribution to this analysis.

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Progress analysis based on reported construction achievement (expressed monthly)

All quantities in linear metres unless stated	TOTAL	Percentage Complete %	Quantity Outstanding	Progress This Period	Rate Required	Trended Production Average	Best
Piles no.	776	70	233	15	15	28	46
Piers no.	915	78	202	35	13	48	136
Pre-cast deck in place	17684	19	14268	746	937	569	1325
CIP/other deck in place	11834	48	6159	639	404	489	1315
Mined tunnel, benching	6104	58	2585	142	170	244	423
Invert construction	6104	38	3754	192	246	204	402
Lining	6104	25	4600	216	302	137	324
Cut and cover tunnel Lining	3436	55	1555	378	102	155	378

NOTES

Pre-cast deck placement commenced July 2002 and trended over 6 months only, rate required has not yet been sustained consistently on this contract, but has once been exceeded.

Tunnel collapse will reduce mined tunnel productivity in future periods although progress is good from Adit B , and well ahead of programme. No delay anticipated from the August 2002 event,

October 2002 event; redesign underway,

Critical aspects in the future will depend largely on the proposed remedial scheme and sustainability of deck placemer