

Risk management to avoid delays in road construction construction essay



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The challenges in the construction industry are of same nature irrespective of geographic locations. The areas of concern in construction project management are timely completion of projects within the allocated cost, also serious concerns about resources utilization and project planning/control measures.

Risk management is the art or practice of dealing with risk. It includes planning for risk, assessing (identifying & analyzing) risk issues, developing risk handling strategies, and monitoring risks to determine how they have changed. My core area of works is in the field of engineering consultancy for various road projects in Dubai, which includes project planning and monitoring the performance of these projects, most of the times we face delays as well as cost overrun at these projects. Intension of doing the project works in this area is to form a procedure/systematic approach for identification and management of various risks in the road project with the help of various lean tools and TOC concepts.

The risk management is not new to the organizations where as there is lack of awareness and systematic approach towards it. Risk management plan is successfully being implemented in Banks, Oil Companies, Health care etc also the IS 31000 suggests the frame work which can be implemented in any kind of industry irrespective of type & place. IS 31000 guidelines can be modified as per the specific industry requirements. (Ref ISO 31000 page v “ Introduction”)

Risk is an uncertain event or condition that, if it occurs, has an effect on at least one of the following project objective;

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Complete Project in allocated time

Complete the project in allocated budget

Maintain all quality standards as per Quality Management Plan

Cover entire scope of works

Project has known as well as unknown risks, in which known risks are considered for the risk management plan which can be identified, analysed and response plan can be prepared but to handle unknown risks we can have a contingency plan ready.

The project work will require access to highly sensitive data of RTA (Road Transport Authority Dubai) & Parsons Overseas Ltd's road projects and use of these data will be limited up to academic purpose only.

Working with the various road projects in Dubai, I first derived the basic data which shows how many projects are delayed in terms of time/days as well as how much more the client has to pay for these projects other than the budgeted cost. (Ref Chart 1 for Days & Chart 2 for Cost)

Chart 1

Chart 2

The data above is taken from ten road projects in Dubai which clearly suggests that the delay in days has caused the respective increase in the cost this cost also may include the variation in scope.

Causes behind the delay in these kinds of projects are external as well as internal, e. g. the global recession has caused client (RTA) to change the policy in terms of executing some projects, changing the priority, suspending some works etc is an external factor for the road projects where as the delay in material purchase is an internal factor. My work is more focused on the internal operational risks in these projects, where the data base in of ten RTA road projects will be used where as the sample risk management plan will be prepared based on ongoing project R800/6 for analysis purpose. Also the risk management plan for occupational Health & safety as well as environmental risks are not considered for this exercise.

Objectives behind Risk management plan -

Encourage Proactive rather than reactive management

Be aware of the need to identify and treat risk throughout the organization

Improve identification of opportunities and threats.

Comply with relevant legal and regulatory requirements and international norms

Improve reporting

Improve corporate governance

Improve stakeholder's confidence & trust

Establish reliable basis for decision making and planning

Improve Control

Effectively allocate and use resources for risk treatment

Improve operational effectiveness and efficiency

Improve incident management and prevention

Minimize loss

Improve organizational learning

RISK MANAGEMENT STRATEGY

PARSONS GOALS

Lead industry in Safety

Continuously enhance the value of Parsons Corporation

Maintain sustainable growth consistent with the demand in each market

Grow consolidated net operating income and sales at least 10% annually

Maintain a strong balance sheet.

PARSONS STRATEGY

Provide responsive, high quality service to our customers

Develop long term relationships with customers who share our values.

Promote best value solutions to our customers

This document describes how we will perform the job of managing risks for RTA road projects in Dubai. It defines roles and responsibilities for participants in the risk processes, the risk management activities that will be carried out, the schedule and budget for risk management activities, and any tools and techniques that will be used.

The objective behind this plan is to give systematic approach to identification, analysis, and monitor the various risks involved in the construction of Road/Bridge projects in Dubai and to avoid delay in the project.

The risk identification at design phase is not considered for the exercise; largely emphasis is on construction activities.

As a part of continuous improvement this plan has to be updated bimonthly or whenever necessary modifications are need to be done, with the consent of Risk Management team.

SCOPE OF SAMPLE PROJECT

This project is a component of the overall R800 Project “ Ras Al Khor Crossing Corridor”. This Contract matches R800/5 Contract on one side. It involves the construction of a major grade-separated interchange to replace the existing Interchange No. 1 at Shaikh Zayed Road. The new interchange involves the construction of several bridges and underpasses to allow free flow of traffic and caters for the high volumes of traffic that will access new developments such as the Burj Dubai Developments, Business Bay and Dubai International Financial Center (DIFC) from Shaikh Zayed Road. The bridges of this project are connected to the elevated viaducts above Doha
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Road that will be built as part of Contract R800/5's. The existing Interchange No. 1 structure will be demolished as part of this project

The project also include the construction of roadway signage and pavement marking, landscaping, street lighting, irrigation ducts, diversion and/or protection of services such as DEWA-ED, DEWA Water, Etisalat, Sewerage, Storm Drainage and Irrigation Systems.

Engineer

M/s Parsons Overseas Limited

Contractor

M/s Salini Costruttori S. p. A.

Contract Sum (Dhs.)

AED 617, 871, 651. 00

Project Commencment Date

11 October 2006

Contractual Completion Date

28 March 2009 (Work is in Progress)

Time of Completion

730 Days

ROLES AND RESPONSIBILITIES

The risk management team is not a separate task from the project management; it is an integral part of the project and requires team work. So as the construction team at project site is the part of risk management plan, where as to organize this work following members are assigned certain responsibilities.

TEAM MEMBER

RESPONCIBILITY

PROJECT MANAGER

RESIDENT ENGINEER

Form a risk management team

Review the risk management reports

Decide a mitigation / contingency plan.

Decision making.

Review the exposure assessments for any new risk items.

The Project Manager and other members of the Project Management team shall meetbiweekly suggestedto review the status of all risk mitigation efforts.

RISK OFFICER

PLANNING ENGINEER

The Risk Officer has the following responsibilities and authority

Coordinating risk identification and analysis activities.

Maintaining the project's risk list.

Notifying project management of new risk items

Reporting risk resolution status to management.

Project Member Assigned a Risk

Civil Engineer, Structural Engineer

Quantity surveyor

Material Engineer

The Risk Officer will assign each newly identified risk to a project member.

Assess the exposure and probability for the risk factor and report the results of that analysis back to the Risk Officer.

Assigned project members are also responsible for performing the steps of the mitigation plan and reporting progress to the Risk Officer biweekly.

PROJECT RISK MANAGEMENT PROCESSES

PLAN RISK MANAGEMENT

This is the controlled document to be prepared which suggests how to conduct risk management for projects. Risk planning is important to provide enough resources & time for risk management activities. To start the risk planning the following major inputs are necessary;

Scope of project

Schedule management plan

Cost management plan

Communication management plan

The output of this process is a “ Risk Management Plan” which can be modified as the project progresses also as the project scope changes.

Risk management plan includes;

Methodology - How to approach the risks, what are the tools to be used, data sources to be used in order to perform risk management.

Roles & Responsibilities - Risk management is not an individual task it is a team work. Organization chart to be prepared.

Budgeting - Assign resources, estimates funds needed for risk management in case of contingency plans if any. This part we are not considering at present for our risk management plan assuming the budgeting is readily available.

Timing - Establish the review for RMP during tenure of the project as well as establish a mile stone to prepare and approve RMP before the commencement of actual project works.

Risk Category - Prepare a Risk Break down structure that can provide a systematic approach to identify risks from different categories from the RBS.

Risk Probability, impact and matrix - The risks for qualitative as well as quantitative analysis can be measured as a defined scale and the specific combinations can be rated for planning response.

Reporting - Out come of the risk management processes to be documented and reported.

Tracking - How risk activities will be recorded for the benefit of the current project as well as for future needs and lessons learned, as well as the audit of the risk management processes.

IDENTIFY THE RISKS

The risk identification information is to be collected from all departments using tools such as document review, unstructured interviews, check list, assumptions, and experience from old projects.

The risk team can extend this task to all other projects team members in identifying the risks then it can be compiled together to prepare a risk register. The risk identification can be initiated by forming a risk breakdown structure.

RISK BREAK DOWN STRUCTURE

As per the project scope and nature of the project the risk breakdown structure can be prepared, for the sample project the risk are identified using the following risk breakdown structure.

RISK REGISTER

Once the risk break down structure is final then the risk identification can be done and can be listed in the following format called Risk Register.

Sr No

Risk

Risk WBS

Probability

Remark

1

132 kv electric line relocation

Obs – Utility

0.9

Obstructing NW bridge

2

1200mm dia water line

Obs – Utility

0.9

Bridge work

3

Sewerage line

Obs – Utility

0.9

Can delay the traffic diversion

4

Etisalat Line

Obs – Utility

0. 75

Obstructing NW bridge

5

Mobilization

Res- Manpower

0. 4

Overall project

6

Trial Trench works

Int- Authority Approvals

0. 8

Utility Relocation works

7

Traffic Diversion scheme implementation

Obs- Traffic Diversion

0. 9

Utility Relocation as well as bridge works

8

Toyota Building

Obs- Expropriation

0. 8

Traffic Diversion

9

Diversion of the Existing 600mm &300mm Water Diversion

Obs – Utility

0.8

affecting bridge UW3

10

Programme submission and approval

PM- Planninng

0.8

Overall project

11

132 Kv electric line, water pipe &valves , irrigation pipe &valves , long lead material

Int- Material

0.8

Relocation works

12

Soil investigation , Pilling, Rebar subcontractor finalization

Int-Subcontractor

0.8

Road &Structure works

13

Plant & machinery

Res- Machine

0.4

14

utility line crossing along Sheikh Zaid Road

Int-Method Statement

0.3

Special works required

15

Change in design

Int-Scope

0.5

QUANTITATIVE RISK ANALYSIS (Monte Carlo Simulation)

Monte Carlo simulation is a statistical method used to produce number of trials to determine the expected value of a random variable.

The Risk register mentioned above indicates a variable “Risk Probability” the major task in a risk management plan is to ascertain the probability right. The above variable can range from minimum to maximum probability limits which are taken from individual interviews as well as the expert’s opinion. Aim of the simulation exercise in to derieve Expected probability value. This exercise is done on MS Excel separatly results of which are attached in Appendix D

First step is to prepare a table as shown below which

Sr No

Risk

Probability Minimum

Probability Maximum

1

132 kv electic line relocation

7

10

2

1200mm dia water line

6

10

3

Sewerage line

5

10

4

Etisalat Line

4

8.5

5

Mobilization

4

4

6

Trial Trench works

6

9

7

Traffic Diversion scheme implementation

7

9

8

Toyota Building

6

9

9

Diversion of the Existing 600mm &300mm Water Diversion

6

9

10

Programme submission and approval

2

2

11

132 Kv electric line, water pipe &valves , irrigation pipe &valves , long lead material

4

6

12

Soil investigation , Pilling, Rebar subcontractor finalizatin

4

7

13

Plant &machinary

3

6

14

Utility line crossing along Sheikh Zaid Road

4

6

15

Change in design

4

6

Once the table is ready the data is transferred to the excel sheet to perform simulation. The results from the simulation are summarized below

Sr No

Risk

Probability Minimum

Probability Maximum

Probability From Simulation

1

132 kv electric line relocation

7

10

8.5

2

1200mm dia water line

6

10

8.0

3

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Sewerage line

5

10

7.5

4

Etisalat Line

4

8.5

6.2

5

Mobilization

4

4

4.0

6

Trial Trench works

6

9

7.5

7

Traffic Diversion scheme implementation

7

9

8.0

8

Toyota Building

6

9

7.5

9

Diversion of the Existing 600mm &300mm Water Diversion

6

9

7.5

10

Programme submission and approval

2

2

2.0

11

132 Kv electric line, water pipe & valves , irrigation pipe & valves , long lead material

4

6

5.0

12

Soil investigation , Pilling, Rebar subcontractor finalization

4

7

5.5

13

Plant & machinery

3

6

4.5

14

utility line crossing along Sheikh Zaid Road

4

6

5.0

15

Change in design

4

6

5.0

The above simulation is just a guide line to reach to a specific probability figures where as there are limitations to this method , one it is assumed that these variables for each risk are independent and analysed independently but practically there can be relationship between two or more risk issues.

PERFORM QUALITATIVE RISK ANALYSIS

Risk probability and Impact Matrix

With the help of risk register, risk management plan the risk will be identified for qualitative analysis. These risks are listed and assigned a risk rating using ' Risk probability and Impact Matrix'.

Aim of this method is to identify the critical risks based Risk rating which represents frequency of occurrence and the risk probability it self. The listed risks are then categorized as per the matrix established below.

The numbers in the matrix represents the risk numbers from the risk register, from the above matrix we can establish the below categories High Risk, Medium Risk & Low Risk.

Sr No

Risk

Risk Rating

Probability

Risk Type

1

132 kv electric line relocation

8

8. 5

High

2

1200mm dia water line

7

8.0

High

3

Sewerage line

6

7.5

High

4

Etisalat Line

4

6.2

High

6

Trial Trench works

5

7.5

High

7

Traffic Diversion scheme implementation

8

8.0

High

8

Toyota Building

3

7.5

High

9

Diversion of the Existing 600mm & 300mm Water Diversion

8

7.5

High

15

Change in design

6

5.0

High

10

Programme submission and approval

3

2.0

Low

5

Mobilization

5

4.0

Medium

11

132 Kv electric line, water pipe & valves , irrigation pipe & valves , long lead material

4

5.0

Medium

12

Soil investigation , Pilling, Rebar subcontractor finalization

2

5.5

Medium

13

Plant & machinery

4

4.5

Medium

14

utility line crossing along Sheikh Zaid Road

3

5. 0

Medium

ROOT CAUSE / CURRENT REALITY TREE ANALYSIS

The above identified and categorized risk need to be further analysed to identify the root cause in order to avoid a potential delay or prepare a mitigation plan or to prepare a recovery plan.

The above major risks are here classified by Current reality tree method Appendix E and the

Plan Risk Response

The process of developing options and actions to enhance opportunities and reduce threats to project objective.

Monitor & Control Risk

The process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk processes effectiveness throughout the project.

Identify Risks

The risks to be identified based on historical events of other projects as well as the expertise opinion on the current project.

1. Risk management methodology to be used

Risk Identification –

The objective behind this is to prepare comprehensive list of risks based on those events that might enhance, prevent, degrade or delay the achievement of objectives stated earlier. Also consideration has to be given to all risks whether they are with in the control or not in control.

Risk Assessment Questionnaire, historical delay events/reports of other projects will be used to identify the risk. The questionnaire will be asked to the Design Engineers, Resident Engineer, Civil Engineer, Structural Engineer, Quantity Surveyor, Quality/Material Egg, Planning Engineer etc. The data to be entered as per the formats attached in Appendix 1A.

B. Categorize Risks –

The data collected from risk identification templates will be categorized as per the risks High Risks, Medium Risks, Low Risks also the probability of risk occurrence to be mentioned. The data to be entered as per the formats attached in Appendix 1B.

Risk Impact Assessment –

For the each risk identified, the probability of risk occurrence for the particular risk will be established then asses impact of the same in terms of cost and time delay.

Monte carols simulation, Decision tree analysis, and Failure Mode & effect analysis to analyze risks one of these tools will be used to analyze the risk and forecast the impact.

D. Prioritize Risks –

Risks that meet the threshold criteria will be recorded in the Risk Response Plan.

E. Risk Response Planning:

- For each risk in the Risk Response Plan, determine the options and actions to reduce the likelihood or consequences of impact to the project's objectives.

- Determine the response based on a cost/benefit analysis (cost vs. expected effectiveness).

- Describe the actions to be taken to mitigate the risk

- Describe the actions to be taken when the risk event occurs (contingency plan)

- Assign responsibilities for each agreed upon response.

- Assigned a " due date" where risk responses are time sensitive

- Incorporated this information into the Risk Response Plan

F. Monitor Risk:

- Document the dates and the actions taken to mitigate the risk

- Document the actions taken when the risk event occurred (contingency plan)

- Document any subsequent actions taken

- Incorporate this information into the Risk Response Plan

Refer appendix 1F for the templates.

- Establish systematic reviews and schedule them in the project schedule.
- These reviews are to ensure:
 - All of the requirements of the Risk Management Plan are being implemented
 - Assess currently defined risks
 - Evaluate effectiveness of actions taken
 - Status of actions to be taken
 - Validate previous risk assessment (likelihood and impact)
 - Validate previous assumptions
 - State new assumptions
 - Identify new risks
 - Risk Response Tracking
 - Communications

H. Control Risk:

- Validate mitigation strategies and alternatives.
- Take corrective action when actual events occur

- Assess impact on the project of actions taken (\$\$, time, resources)
- Identify new risks resulting from risk mitigation actions
- Ensure the Project Plan (including the Risk Management Plan) is maintained
- Ensure change control addresses risks associated with the proposed change
- Revise the Risk Assessment Questionnaire and other risk management documents to capture results of mitigation actions.
- Revise Risk Response Plan
- Communications

4.

8. Assumptions

Only the project related risks are considered, the corporate issues, economy risks are not considered.

Separate risk management plan is to be prepared for Occupational Health, Safety & Environment as per IS14000 & 18000. The other significant assumptions to be mentioned if any.

The application of the risk management plan is only limited to the construction work

The objective behind risk management exercise is to implement a plan for a new project where as for dissertation purpose I have taken a old, ongoing

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project which gives realistic picture of delays happened so far and helps in analysis.