



استراتژی مدیریت ریسک در طول چرخه حیات پروژه (بر اساس سند مهمی از CMAA)

بخش چهارم: پاسخ ریسک (Risk Response) در پروژه‌های صنعت ساخت

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

CMAA Authorized Trainer

دانشگاه Illinois Tech آمریکا



What we will learn?

- ☐ Introduction
- ☐ Risk Treatment (AACE TCM)
- ☐ Risk Owner and Deadlines
- ☐ Risk Response Plans
- ☐ Risk Register Updates

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Introduction



Introduction

- ❑ After identifying and analyzing a risk, **teams may respond** to each opportunity or threat through design, engineering, and management decisions.
- ❑ **These responses** may include actions that change
 1. Scope,
 2. Schedules,
 3. Budgets, and
 4. Quality.

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Introduction

❑ By this point in the risk management process, **teams** should at least generally **understand** how a **risk** may **affect** the project or program.

❖ Recall from Sections 2 and 3 that the **team must recognize** that

1. Some risks will be **unique** to the project/program, and
2. That risks can be **internal** or **external** to the team.

❑ This understanding also includes

1. likelihood,
2. severity, and
3. priority

for each threat and opportunity on the **risk register**

Introduction

- ❑ The **risk manager (the CM or risk specialist)** will
assign a risk to the team member or entity that is **best able to manage** it, also known as a “**risk owner.**”
- ❖ The **assignee/risk owner** will then **develop a risk response plan** with
 1. A set of action items and
 2. Related deadlines
 - ❖ to manage the opportunity or threat.
- ✓ The **team** will then **implement** the **risk response plan**.
- ✓ **After implementation**, the **risk manager updates** the risk register.
The RMP should explain these steps.

Introduction

❑ A **risk's impact(s)** on the project/program **may change after** the team **responds** to the risk.

❖ For example, a **response might avoid** a threat or enhance an opportunity.

❖ **Risk management** is a **continuous process**,

so the team should

1. **re-analyze** the risk and

2. note any changes

to the risk's qualitative status or quantitative impact scores in the **risk register**.

If necessary, this may involve **additional risk responses**.

Risk Treatment

(AACE TCM)

Process map for risk management

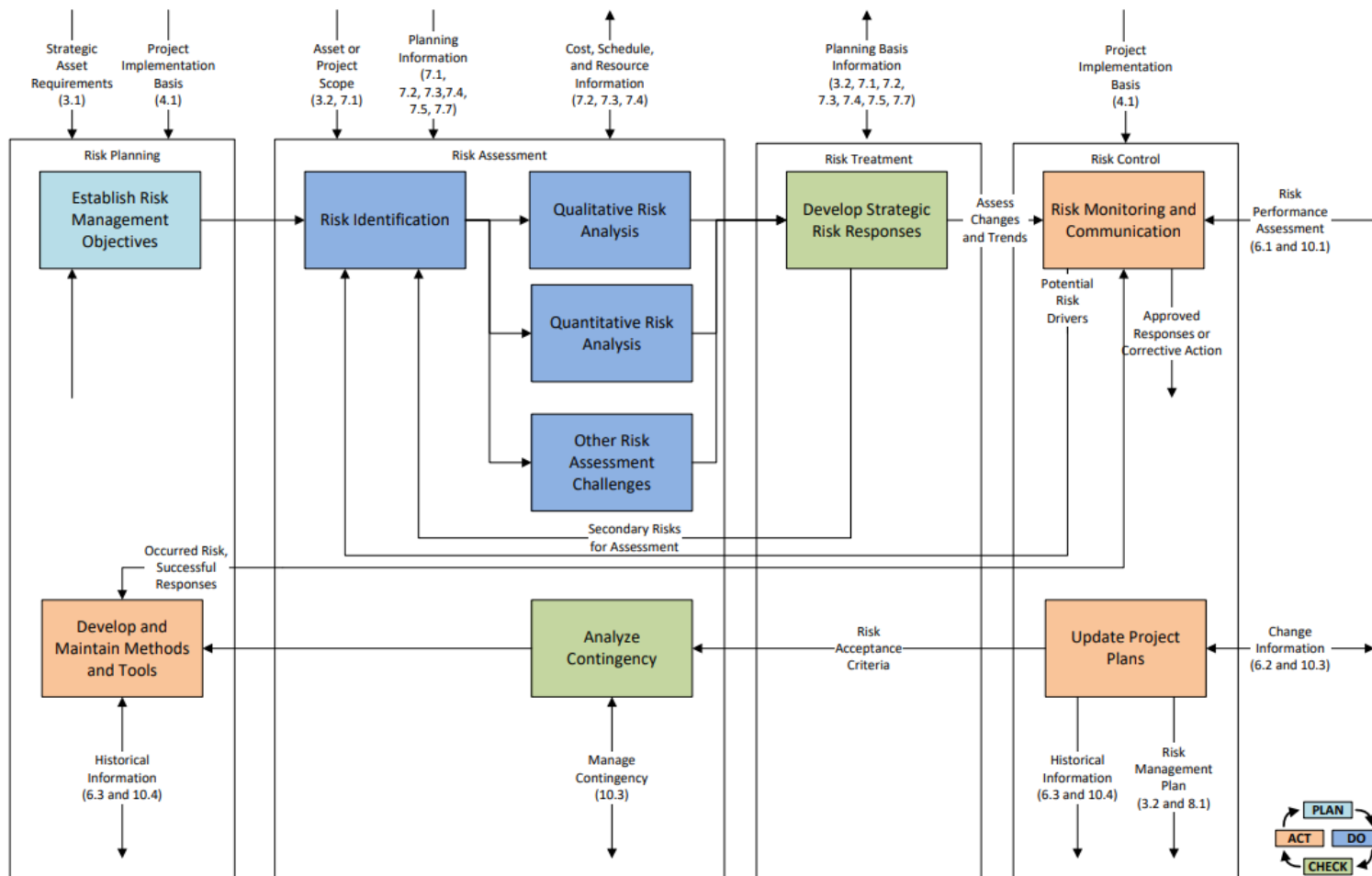


Figure 7.6-1 Process Map for Risk Management

Risk treatment

- ☐ The **risk owner** is responsible for
 1. devising and implementing **risk response plans** on behalf of the project,
 2. monitoring and reporting on both the **status** of their **identified risks** and **response plan**.

- ☐ **Such reporting** should encompass the **identification** of secondary risks as response plans are implemented.

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Risk treatment

- ❑ For clarity, **risk response plans** simply aim to either
 1. Maximize opportunities or minimize threats,
 2. Optimizing the chances of project success.

- ❑ In addition, the risk owner should be **one individual** and **not a department or group**.
 - ❖ **Having a single point** of responsibility aids effective communication and helps maintain accountability.

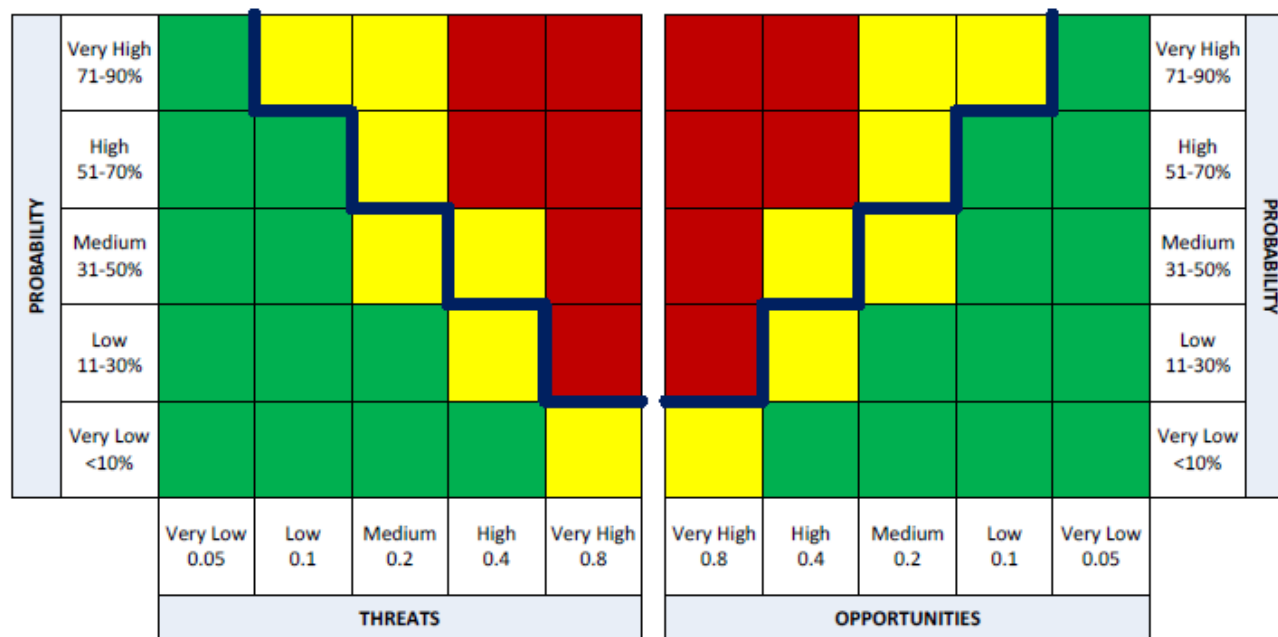
Risk treatment

- ❑ Although it is good practice to have in place **risk response plans for every risk**, it is often **prudent to prioritize** this effort based on the severity or qualitative ranking of the risks.

How?

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Risk treatment



Legend:



Red zone highlights major risks that require immediate action (in this example, those that score more than 0.2).



Yellow zone highlights moderate risks that require heightened action (in this example, scoring between 0.08 and 0.2).



Green zone highlights minor risks that are "business as usual" (in this example, scoring less than 0.08).



Risk threshold line

Figure 7.6-2. Double Probability vs. Impact Matrix

Risk treatment

Figure 8 – Partial Risk Register with Impacts and Overall Risk Scores

Project Name Project Risk Register Rev: 5 (Advanced qualitative analysis) Date: April 9, 2024				Score	± 1	± 2	± 3	± 4	± 5
				Probability	< 10%	10%-49%	50%-74%	75%-90%	> 90%
				Cost	< \$30k	\$30k - \$99k	\$100k - \$299k	\$300k - \$1m	> \$1m
				Time	< 2 weeks	2-4 weeks	1-2 months	2-4 months	> 4 months
				Quality	Minimal rework	< 5% rework	5%-14% rework	15%-30% rework	> %30 rework
				Overall Score	< ± 3 (low)		± 3 - ± 9.5 (medium)		> ± 9.5 (high)
Risk ID	RBS	Risk Name	Risk Description	Threat/Opportunity	Probability Score	Cost Impact	Schedule Impact	Quality Impact	Overall Risk Score
ID-2	Construction/Scope	Construction scope change	The owner is unfamiliar with construction, which could lead to scope changes during the construction phase that could create delays, cost overruns, and quality issues	Threat	5	5	4	3	20
ID-1	Procurement/Market Conditions	Pre-purchase curtain wall	Long lead of the curtain wall system could delay the curtain wall's arrival, which could delay the critical path and the completion date	Threat	4	5	3	1	12
ID-4	Political/Approvals	Senior stakeholder support	The state's governor and several legislators are highly-engaged and want to show the project is a success, so these officials could help expedite the approval process and allow design and construction to begin sooner	Opportunity	(-5)	(-3)	(-3)	(-1)	(-12)
ID-3	Design/Schedule	Deficient drawings	Due to the tight design schedule, the drawings could be deficient, resulting in more change orders/RFIs/claims	Threat	3	4	4	3	11
ID-5	Real Estate/Acquisition	Purchase available adjoining lot	An empty lot next to the jobsite is for sale below the market rate and purchasing it would improve site access and staging, which could also shorten the construction schedule	Opportunity	(-3)	(-3)	(-2)	(-1)	(-6)
ID-6	Construction	Certificate of occupancy	An administrative delay could delay the certificate of occupancy's signoff at the end of the project, which would delay substantial completion and move-in	Threat	2	1	1	1	2

Risk treatment

- ❑ Depending on the **approach** cited in the **risk management plan**, **risk treatment** may be focused on **those risks with both** very high impact and probability (i.e. those that are the **worst** threats and the best opportunities).
- ❑ In this example, the **major risks score** more than 0.2 and are shown in the **central red zone**.

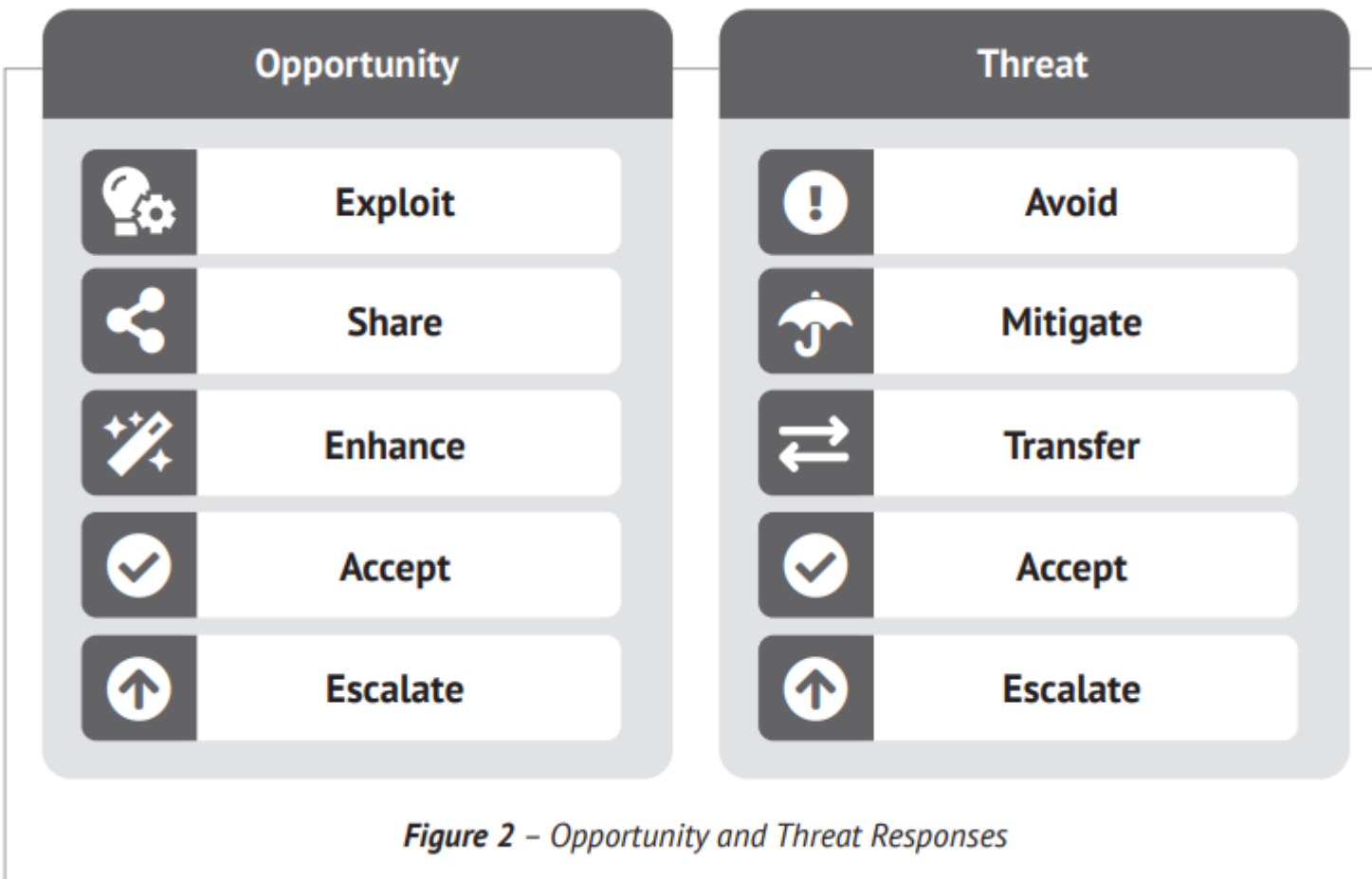
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Risk treatment

❑ Key actions performed **during** the risk treatment phase include:

- ❖ **Evaluating** all appropriate response strategies.
- ❖ **Selecting** an appropriate risk response plan strategy (or combination of strategies).
- ❖ **Developing** action items in support of the selected response.
- ❖ **Validating** proposed actions with assigned actionees, including dates for implementation.
- ❖ **Ascertaining** post-response targets and gains.
- ❖ **Ascertaining** response plan resource requirements.
- ❖ **Updating** project schedule or budget if the anticipated treatment value gain is positive.
- ❖ **Identifying** any secondary threats or opportunities that may arise from the response.

Risk treatment



Risk treatment

❑ **Response strategies** for threats, listed in order of preference are:

- ❖ **Avoid** – involves eliminating either the probability or impact. Can be done by either clarifying requirements, acquiring expertise or changing the project management plan.
- ❖ **Reduce** – involves mitigating key drivers to reduce probability and/or impact.
- ❖ **Transfer** – involves transferring the threat to a competent third party who is better able. Could be through insurance or contractual transfer (via indemnity, exclusion or hold harmless clauses).
- ❖ **Accept** – no proactive action is to be taken because cost either outweighs benefit or there is already an adequate contingency provision that will protect the project objectives.

Risk treatment

❑ Response strategies for opportunities, listed in order of preference are:

- ❖ **Exploit** – involves taking steps that guarantee the opportunity will arise (e.g. changing specification, scope or supplier).
- ❖ **Share** – involves sharing the risk with a third party better able to manage it (perhaps by applying a pain/gain formula).
- ❖ **Enhance** – involves increasing the probability and/or impact of key risk drivers.
- ❖ **Accept** – no proactive action is to be taken because cost either outweighs benefit or there is already an adequate contingency provision that will protect the project objectives.

Risk Owner and Deadlines

Risk owner and deadlines

- ❑ **After** the team identifies and analyzes a risk in the **risk register**, the **risk manager** (CM or risk specialist) must **assign** that risk to a team member with a **realistic deadline**.

The **assignee(s)** become(s) the **risk's owner**.

- ❑ As much as possible, this should be a **collaborative discussion** during risk meetings.
 - ❖ The **risk manager** documents these decisions in the **risk register**.

Risk owner and deadlines

❑ The **designated person(s)** is/are responsible for developing and implementing a risk **response plan** for that risk,

so the **risk owner** must be the entity **who is best** able to manage that risk.

❖ For example, **someone on the design team** would logically be responsible for a design risk and

a construction team member would be responsible for a construction risk, not the other way around.

Risk owner and deadlines

❑ **Note that** the team member(s) best able to respond to a risk **may vary from project to project.**

❖ The **owner's** risk tolerances, delivery method, project/program type, size, location, budget, etc., may all determine which entities are best able to respond to each risk.

✓ For example, an **owner's representative** may normally **respond to schedule risks** in multiple prime contracting,

but the **design-builder** would usually be **more appropriate** for handling those risks in design-build.

❑ **Large or complex projects/programs** may also involve **more team members**, so **some schedule risks** could go to **more junior** team members, consultants, or trade partners.

Risk owner and deadlines

- ☐ As much as possible, **during risk meetings** the team should **discuss the steps** involved for responding to each risk and agree on a realistic deadline.
- ☐ This **discussion helps** the team
 1. Identify the entity best able to manage a risk,
 2. Plan actions, and
 3. Share updates more easily.
- ☐ Based on this discussion, the **risk manager** should **assign a deadline** to develop and implement the risk response.
- ☐ If a **risk response** involves **multiple steps**,
the **risk manager** may set a **deadline for each step**.
- ☐ **Deadlines** must be realistic, reflect any contract requirements, and **follow the RMP**.

Risk owner and deadlines

❑ If the **CM is the risk manager**, the CM must

1. facilitate these conversations and
2. help the team reach consensus on which team member is best able to manage each risk,
3. offer suggestions, and
4. establish realistic deadlines.

❖ However, the contract documents and RMP should give the **risk manager** the **authority to assign responsibility and set deadlines**.

❑ If the team uses a **separate risk specialist**,

the CM should **still**

1. **Participate** in these conversations and
2. **Ensure** that the team is responding appropriately.

Risk Response Plans

Risk response plans

- ❑ After the **risk manager assigns** a risk and a deadline,
the **assignee** must **develop** a risk response plan.
- ❑ A **risk response plan** includes actions that **attempt** to
 - ❖ maximize the impact(s) of opportunities or
 - ❖ minimize the impact(s) of threats.
- ❑ A risk response plan's length and complexity must be **appropriate** to
the risk, the RMP, and any contractual requirements.
 - ❖ *For example, a simple risk response plan may be one sentence while a complex risk response plan may be several pages.*

Risk response plans

- ❑ If applicable, a **risk response** plan may involve **changes** to scope, schedules, budgets, and quality.
 - ❖ For example, the **team may respond** to a schedule risk by lengthening the schedule.
- ❑ The **impact of change** usually grows as a project or program **progresses**, so the team must **continuously manage risk**.

For more on risk impacts of changes, see Section 5.

Risk response plans

- ❑ The **CM (and risk specialist, if a separate entity)** must hold the **assignee(s)** **accountable** during risk **meetings**.
 - ❖ However, the **risk manager** must recognize that **some risks are external** to the team,
so the **personnel responsible** may have **little or no control** over the threat or opportunity.
- ❑ **After** the team members **develop a risk response** plan,
the **risk manager documents** the plan in the risk register.

Opportunity responses

- ☐ When the **risk manager** assigns an **opportunity**,
the **personnel responsible** for that risk **develop** a plan with actions
that **attempt to maximize** the opportunity's positive impact on the project
or program.
- ☐ Recall from Section 1 that there are **four typical risk response categories** for an
opportunity: exploit, share, enhance, and accept.

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Opportunity responses

- ❑ **During risk analysis**, the team **estimates** the probability that each risk will occur, but **risks naturally** have some **uncertainty**.
- ❖ In other words, just because the **team identifies** a risk does **not mean** it will **always happen**.
 - ✓ This **uncertainty** includes **opportunities**.
 - **Even though** the project/program may have an **opportunity to benefit** the budget, schedule, quality, etc., the **opportunity** may **never materialize** on its own.

Opportunity responses

- ❑ When the team implements an **“exploit” risk response**, the team **removes** the **uncertainty** that the **opportunity will occur**.
 - ❖ *For example, the team may identify an opportunity to complete a critical path activity early and finish the project ahead of schedule.*
- ❑ The team may be **uncertain** that this activity will **finish early** and **assign** the **opportunity to the builder**.
 - ❖ In **response**, the builder might **assign more workers** and **resequence** the critical path to **remove uncertainty** and exploit the opportunity.



Exploit

Exploiting responses are actions that ensure that the opportunity materializes.

Opportunity responses

- ☐ The team should track the **“exploit”** response in the **risk register** (not the issue log) to document **how the team** managed the **uncertainty**.

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Opportunity responses

- ☐ A “**share**” response is a **collaboration** between two or more stakeholders to help the entire team succeed.
- ☐ In other words, **only certain entities** may **share responsibility** for the risk, but the **whole** project or program may **benefit**.
- ☐ This **response** may include an external stakeholder who can share the risk with a team member.



Share

Sharing responses help another stakeholder take advantage of an opportunity to benefit the project/program.

Opportunity responses

- ❑ An “**enhance**” response increases the odds that an opportunity will **materialize** but **does not guarantee** that it will happen.
- ❑ In other words, an “**enhance**” response may reduce an opportunity’s uncertainty, but **it does not eliminate** it (unlike “exploit” which eliminates uncertainty).



Enhance

An **enhancing** response increases the opportunity’s likelihood or impact.

Opportunity responses

- ❑ Consider the **earlier example** in which the team **exploited an opportunity** to complete a **critical path activity early** and finish the project **ahead of schedule**.
- ❖ In a **slightly different scenario**, the activity could be **dependent on another** predecessor activity on the critical path that has **its own risks** (which would add uncertainty).
 - ✓ The **team may assign** the opportunity to the **builder** and the builder could **assign more workers** to increase the **chances of the opportunity**,
but the **opportunity event** may **not materialize** if the predecessor activity encounters a delay.



Opportunity responses

- ☐ Enhancing may also **maximize an opportunity's positive impact** on the project or program.
- ☐ Remember that any risk may have a **range of potential impacts** on the project or program.
- ☐ The **team's response** to an opportunity may help the team **move the opportunity's impact** to a higher point on that range.

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Opportunity responses

- ❑ For example, the team may **identify an opportunity to expedite permitting**, which would help **construction begin earlier** and finish sooner.
 - ❖ The **team may do nothing** and still **receive permits early**, but the **lead designer** could **enhance this opportunity** and **help the team receive permits** earlier by **developing a design** that is **easy** for the permitting agency to **review**.
- ❑ The **CM could also enhance** this opportunity and help the team **receive permits even earlier** by **submitting** the permit application as soon as it is ready.

Opportunity responses

- ❑ Recall that a team may have **little or no control** over certain project/program risks.
- ❑ If the team identifies an opportunity but has no way to influence it, an **“accept” response** may be necessary.
 - ❖ For example, the team may have **no control over certain supply** chain risks.
 - ❖ The team **may need to accept** that they have no influence over **certain material** prices, shipping times, etc.



Accept

An **accepting** response means the team will wait and take advantage of the opportunity if it happens.

Opportunity responses

- ❑ Similarly, an **“accept” response** may be more appropriate **if the effort required** to exploit, share, or enhance an opportunity is **greater than** the **opportunity’s benefit**.
 - ❖ For example, the **team may** have an **opportunity for some small cost savings** but must **hire a consultant** to share it.
 - ❖ If the consultant would **cost more than** the team **would save**, the team might be **wiser to accept** the risk.
- ❑ The **opportunity’s value** may also **fall below** the **thresholds** that the **RMP established**.



Threat responses

❑ After the risk manager **assigns a threat**,

the **personnel responsible** for that risk develop a plan **with actions** that attempt to **minimize** the **threat's negative impact** on the project or program.

❖ Remember from Section 1 that there are **four typical risk response** categories for a threat: avoid, mitigate, transfer, and accept.

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Threat responses

- ❑ Sometimes it is possible to **prevent certain threats** from affecting the team **through** design, engineering, and management decisions.
- ❑ An “**avoid**” **response changes** some of the project’s/program’s characteristics and risk impacts.
- ❑ Note that an “avoid” response to a risk would not necessarily eliminate the risk, but it would **eliminate the potential impact** on the project or program.

! Avoid

An **avoiding** risk response removes the threat’s impact on the project or program.

Threat responses

- ❑ For example, a **project's jobsite** may be in an area that **experiences catastrophic hurricanes**.
- ❑ The owner **might avoid** this threat by **relocating** the project to an **area that does not** experience hurricanes.
- ❑ The **original jobsite** is still in a **hurricane zone**,
but this **no longer** has any **impact** on the project.
- ❑ In **another example**, the team may identify a **threat that a material in a critical component will fail**.
- ❑ The **lead designer** might **avoid** the threat by **redesigning the component** with a **different material** that will not fail.

Threat responses

- ☐ The team should track the **“avoid” response** in the risk register to document **how the team managed** the uncertainty.

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Threat responses

- ❑ A “mitigate” response helps the team lower a **threat’s possible negative** consequences or odds.
- ❖ However, **mitigation does not eliminate** the potential negative impact on the project or program.



Mitigate

Mitigating involves actions that reduce the threat’s severity or likelihood.



Threat responses

- ❑ Consider the **previous examples** of a project jobsite in a **hurricane zone** and **failure** of a material in a critical component.

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Threat responses

- ☐ In the **first scenario**, **relocating** the project may be impossible,
so the **builder could mitigate** the potential negative consequences by
finishing construction before hurricane season.
- ☐ **This response** lowers the threat,
but it is **still possible** to encounter a **hurricane**, and
the **completed structure** would still be in the **path of a future**
hurricane.

Threat responses

- ❑ In the **second scenario**, the team may **need to use a certain material** that could **fail** in a **critical component**,
but the **designer** could **mitigate** the threat by **adding redundancy** to the component's design.
- ❑ The **critical component** would **no longer** have a **single point of failure** because **multiple pieces** of material would **have to fail before** the component stops functioning.

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Threat responses

- ❑ The team may **recognize** that they **have little** or **no control** over certain threats, **but if another entity** is better able to manage the threat, the team may have the option to “transfer” some or all the risk to that entity.
- ❑ **Transferring the risk** involves the new entity assuming some responsibility for the risk’s potential impact.



Transfer

Transferring moves the threat’s impact to another entity that is better able to manage it.

Threat responses

- ❑ **This separate entity** may be external to the team and have **its own resources** to avoid, mitigate, or accept the threat.
 - ❖ For example, if the **team identifies** a threat of community opposition to the project,
the **owner may be able** to transfer the threat to a **public official** (such as a mayor or governor) who can **better manage public opinion**.

Threat responses

❑ **Note** that this **does not necessarily eliminate** the threat, and the team may still have **some exposure** to the threat.

❖ For example, **team members** are always responsible for the **safety of their own** employees on the jobsite.

✓ **Even if** the team members purchase

1. Workers' compensation and
 2. Professional liability insurance
- to transfer financial risk,

jobsite accidents could still expose the team to delays.

Threat responses

- ☐ An “**accept**” response may be necessary
 1. When a **threat is beyond the team’s control**, there are **no entities** better able to manage the risk, or
 2. When avoiding, mitigating, or transferring the threat are **not worth the effort**.
- ☐ The **team** would also usually **accept threats** with **values** that are **below the minimum** threshold in the RMP.



Accept

Lastly, **accepting** means the team will respond to the threat if it happens.

Threat responses

- ❑ Note that the **team usually** has a **plan for what to do** if the risk event **occurs**, but the **team accepts** that the threat is **present and does not** take any **proactive steps** to avoid, mitigate, or transfer it.
 - ❖ For example, the **jobsite** may be in a **hurricane zone** and the **construction team** must work during **hurricane season**.
 - ✓ The **prime builder** could **develop a plan** for an **orderly demobilization** if a hurricane comes and then remobilize after the storm.
- ❑ **This response does not change** the threat's impact, but the team is ready if the risk event occurs.

Escalation

❑ **Escalation** is a **less common risk response** that involves **assigning a risk to another part** of a team member's organization

when the risk is beyond the project's/program's scope.

❖ **Escalation may apply** to opportunities or threats.

Note that escalation in this context is separate from contract escalations.

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Escalation

- ❑ **Escalated risks** are risks that are **outside** the project's or program's scope and **another part** of a team member's organization is **better able to manage** it.
- ❖ Usually these **risks involve** other projects and programs for **one of the organizations** on the team.
 - ✓ **Escalating** is similar to **sharing** and **transferring** (in fact, some parts of the industry use “**share**” and “**transfer**” interchangeably with “escalate”).
- ❑ The **key differences** are the nature of the risk and the appropriate risk owner.

Escalation

- Share** → Opportunity is in scope, share it with another stakeholder to benefit the team
- Transfer** → Threat is in scope, transfer to a party that is better able to manage it
- Escalate** → Opportunity/threat is out of scope, escalate to another part of a team member's organization that is better able to manage it

Escalation

- ❑ Rarely, a **risk might impact** the project/program but **still be out of scope**.
- ❖ **Another part** of a team member's organization would be **better able to manage** the risk.
 - ✓ For example, the program team may **identify a threat** that **one of the owner's other programs** could disrupt the **owner's cash flow**.
The **other program** might be **completely out of scope**.
- ❑ **Accepting** the threat or **transferring** it to the other team may **threaten** both programs,
so the **team might escalate** the risk to the owner's program management office to **coordinate funding**.

Escalation

- ❑ **This type of risk** usually has no impact on the current project/program, but may **still affect another part** of a team member's organization.
 - ❖ For example, a project team may **find soil conditions** that will **not impact** the **current project** but provide an **opportunity to one** of the owner's future projects.
 - ❖ There may be **no way** to exploit or share the risk because the **other project** has **not started**, and **accepting it might not be** in the **owner's best interests** if the owner's organization could **maximize** the opportunity (e.g., change the future project's design).
- ❑ **Escalating** the risk to **another part** of the owner's organization that is **responsible** for the future project would be **more appropriate**.

Risk Register Updates

Risk register updates

- ❑ **After** the team assigns a risk and **develops a risk response plan**, the risk manager documents these decisions in the risk register.
- ❑ **Figure 11** shows the same risk register from **Sections 2 and 3**, but with additional fields for the risk owner, response category, notes (e.g., a summary of the risk response plan), and due date.

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Risk register updates

Figure 11 – Partial Risk Register with Risk Response Plan Documentation

Score	± 1	± 2	± 3	± 4	± 5
Probability	< 10%	10%-49%	50%-74%	75%-90%	> 90%
Cost	< \$30k	\$30k - \$99k	\$100k - \$299k	\$300k - \$1m	> \$1m
Time	< 2 weeks	2-4 weeks	1-2 months	2-4 months	> 4 months
Quality	Minimal rework	< 5% rework	5%-14% rework	15%-30% rework	> %30 rework
Overall Score	< $ \pm 3 $ (low)		$ \pm 3 $ - $ \pm 9.5 $ (medium)		> $ \pm 9.5 $ (high)

Project Name
Project Risk Register

Rev: 6 (Updates for risk responses)
Date: April 30, 2024

Before Response													
Risk ID	RBS	Risk Name	Risk Description	Threat/ Opportunity	Probability Score	Cost Impact	Schedule Impact	Quality Impact	Overall Risk Score	Risk Owner	Response Category	Notes	Due Date
ID-2	Construction/ Scope	Construction scope change	The owner is unfamiliar with construction, which could lead to scope changes during the construction phase that could create delays, cost overruns, and quality issues	Threat	5	5	4	3	20	Hector R.	Mitigate	Meet with owner to review scope	5/15/2024
ID-1	Procurement/ Market Conditions	Pre-purchase curtain wall	Long lead of the curtain wall system could delay the curtain wall's arrival, which could delay the critical path and the completion date	Threat	4	5	3	1	12	JoAnn C.	Mitigate	Pre-purchase curtain wall system with an early procurement package	6/30/2024
ID-4	Political/ Approvals	Senior stakeholder support	The state's governor and several legislators are highly-engaged and want to show the project is a success, so these officials could help expedite the approval process and allow design and construction to begin sooner	Opportunity	(-5)	(-3)	(-3)	(-1)	(-12)	Lisa M.	Enhance	Meet with governor's and legislators' staff	5/31/2024
ID-3	Design/Schedule	Deficient drawings	Due to the tight design schedule, the drawings could be deficient, resulting in more change orders/RFI's/claims	Threat	3	4	4	3	11	Salah M.	Mitigate	Have the CM and PM review the drawings in detail before bid	6/15/2024
ID-5	Real Estate/ Acquisition	Purchase available adjoining lot	An empty lot next to the jobsite is for sale below the market rate and purchasing it would improve site access and staging, which could also shorten the construction schedule	Opportunity	(-3)	(-3)	(-2)	(-1)	(-6)	Rupesh J.	Exploit	Meet with owner to authorize funding	5/15/2024
ID-6	Construction	Certificate of occupancy	An administrative delay could delay the certificate of occupancy's signoff at the end of the project, which would delay substantial completion and move-in	Threat	2	1	1	1	2	Keith L.	Mitigate	Pre-plan inspection schedule	9/15/2024

Risk register updates

- ❑ Risk management is a **continuous process**,
so **after responding** to a risk the team should **re-analyze the risk** and **note any changes** to the **risk's qualitative status** or **quantitative impact scores** in the risk register.
- ❑ **Remember** that risk is **dynamic**, so a risk may **change after the team implements a** risk response plan.
 - ❖ The risk's impact(s) could change or disappear.
 - ❖ New risks may also emerge.

Risk register updates

- ❑ As a **best practice**, the risk register should log **how each risk's impacts** change.
- ❑ **One way** to show this is to **add new columns** when the **team implements** a risk response plan and **reanalyzes** the associated risks.
- ❑ **Figure 12** shows the previous risk register with **additional fields** that document the **team's analysis** after the team implemented risk responses.
- ❑ **Note that two risk responses are not yet implemented**, so the team could **leave those after response fields blank**.



استراتژی مدیریت ریسک در طول چرخه حیات پروژه (بر اساس سند مهمی از CMAA) پاسخ ریسک (Risk Response) در پروژه‌های صنعت ساخت

Risk register updates

Project Name Project Risk Register Rev: 7 (Updates for risk responses) Date: May 31, 2024										Cost	< \$30k	\$30k - \$99k	\$100k - \$299k	\$300k - \$1m	> \$1m														
										Time	< 2 weeks	2-4 weeks	1-2 months	2-4 months	> 4 months														
										Quality	Minimal rework	< 5% rework	5%-14% rework	15%-30% rework	> %30 rework														
										Overall Score	< ± 3 (low)		± 3 - ± 9.5 (medium)		> ± 9.5 (high)														
										Before Response										After Response									
Risk ID	RBS	Risk Name	Risk Description	Threat/ Opportunity	Probability Score	Cost Impact	Schedule Impact	Quality Impact	Overall Risk Score		Risk Owner	Response Category	Notes	Due Date	Probability Score	Cost Impact	Schedule Impact	Quality Impact	Overall Risk Score										
ID-2	Construction/ Scope	Construction scope change	The owner is unfamiliar with construction, which could lead to scope changes during the construction phase that could create delays, cost overruns, and quality issues	Threat	5	5	4	3	20		Hector R.	Mitigate	Met with owner to review scope	5/15/2024	3	5	4	3	12										
ID-1	Procurement/ Market Conditions	Pre-purchase curtain wall	Long lead of the curtain wall system could delay the curtain wall's arrival, which could delay the critical path and the completion date	Threat	4	5	3	1	12		JoAnn C.	Mitigate	Pre-purchased curtain wall system with an early procurement package, curtain wall is on route	6/30/2024	1	2	3	1	2										
ID-4	Political/ Approvals	Senior stakeholder support	The state's governor and several legislators are highly-engaged and want to show the project is a success, so these officials could help expedite the approval process and allow design and construction to begin sooner	Opportunity	(-5)	(-3)	(-3)	(-1)	(-12)		Lisa M.	Enhance	Met with governor's and legislators' staff	5/31/2024	(-5)	(-4)	(-4)	(-1)	(-15)										
ID-3	Design/Schedule	Deficient drawings	Due to the tight design schedule, the drawings could be deficient, resulting in more change orders/ RFIs/claims	Threat	3	4	4	3	11		Salah M.	Mitigate	Have the CM and PM review the drawings in detail before bid	6/15/2024	TBD	TBD	TBD	TBD	TBD										
ID-5	Real Estate/ Acquisition	Purchase available adjoining lot	An empty lot next to the jobsite is for sale below the market rate and purchasing it would improve site access and staging, which could also shorten the construction schedule	Opportunity	(-3)	(-3)	(-2)	(-1)	(-6)		Rupesh J.	Exploit	Met with owner to authorize funding	5/15/2024	(-5)	(-3)	(-4)	(-2)	(-15)										
ID-6	Construction	Certificate of occupancy	An administrative delay could delay the certificate of occupancy's signoff at the end of the project, which would delay substantial completion and move-in	Threat	2	1	1	1	2		Keith L.	Mitigate	Pre-plan inspection schedule	9/15/2024	TBD	TBD	TBD	TBD	TBD										

Figure 12 – Risk Register after Risk Responses



استراتژی مدیریت ریسک در طول چرخه حیات پروژه (بر اساس سند مهمی از CMAA)

بخش پنجم: پایش ریسک (Risk Monitoring) در پروژه‌های صنعت ساخت

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

CMAA Authorized Trainer

دانشگاه Illinois Tech آمریکا



What we will learn?

- ☐ Introduction
- ☐ Risk Control (AACE TCM)
- ☐ Change Impact
- ☐ Risk Meetings by Phase
- ☐ Risk Resolution
- ☐ Final Report

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Introduction



Introduction

- ❑ After the team **implements** a risk response plan,
the team still **continuously**
 1. **Tracks** the risks in the risk register and
 2. **Adjusts** them when needed.
- ❑ This **risk monitoring** must continue **throughout all phases** because risks may change or new risks may surface at any time.
- ❑ **Continuous risk monitoring** helps the team respond to changes in the risk environment as soon as possible, attempting to minimize threats and maximize opportunities.

Introduction

- ❑ The **team follows** the **RMP** and meets on a **regular basis** to **review** the risk register.
- ❑ The **consequences** of some **risk events grow** in later phases,
so the **RMP** should **establish** that the team will **meet more frequently** in later phases as design and construction progresses.
- ❑ The **risk manager (CM or risk specialist)** **updates** the risk register to reflect any changes, such as
 1. new risks, any new or updated risk analysis, and
 2. details about risk responses.

Introduction

❑ **Most risks** reach some **sort of resolution**.

❖ For example, the risk event (opportunity or threat) may occur.

❑ Alternatively, **at a certain point** the risk may **no longer apply** because the project/program **finishes or enters** a new phase.

When a **risk resolves**,

the **risk manager updates** the **risk register** to **document** the risk management process.

Risk Control

(AACE TCM)

Process map for risk management

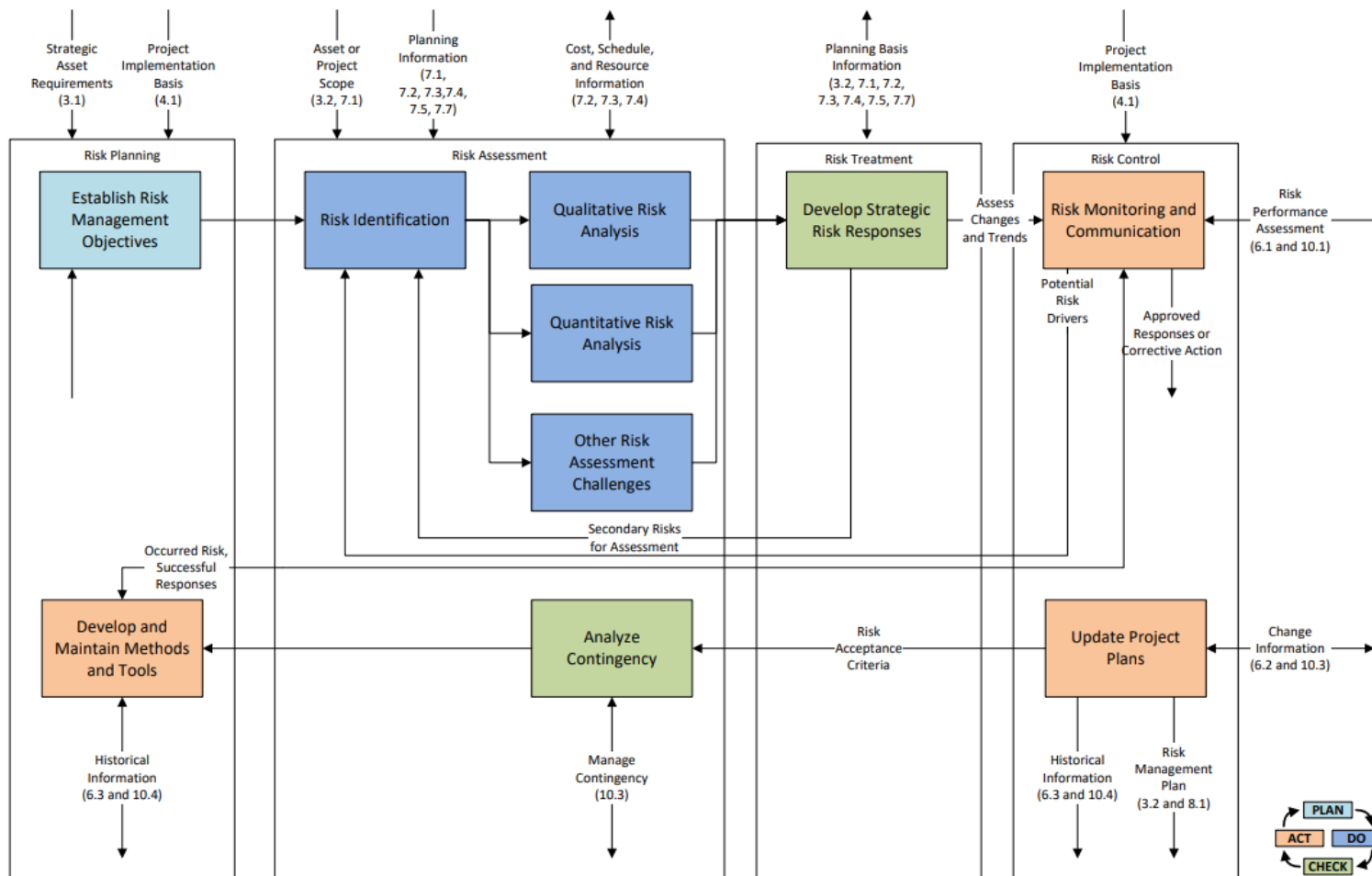


Figure 7.6-1 Process Map for Risk Management

Risk control

❑ The **risk management process** will be **worth nothing**

if all that has been **discussed and planned** during the earlier steps is **not implemented**.

❖ For this reason, **monitoring** is an **essential component** of risk control.

❑ **Each response strategy** and any **associated actions** must be **monitored** by both

1. The risk owner and
2. Review committee

to **ensure** that they are **executed in a timely manner**, and above all, with the **intended effect**.

Risk control

☐ The **review committee** must decide

if **response planning** must end prematurely and,

guided by the risk owners,

they must make the final decision as to when it is appropriate to

close a risk.

☐ Conversely, they **must decide** if it is **appropriate to add** any **new risks** to the register.

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Risk control

- ❑ After a new risk has been clearly **described** and **coded** by **RBS**,
benefit can also be gained by **categorizing** the affected areas of the project by **work breakdown structure (WBS)**.
 - ❖ By comparing
 - ✓ the **most common causes** of risk by RBS, against
 - ✓ the most commonly affected areas by WBS,it is **possible to identify hot spots**.

Such information can be **invaluable** when **prioritizing** effective risk responses.
- ❑ **Visibility** of an **initiative's hot spots** may also influence the overall management of the project.

Risk control

- ☐ The **review committee** must be satisfied with the **quality of data available** to them.
- ☐ A **review committee** of **four to six key stakeholders** should ensure that it is their **consensus** of opinion that is communicated.
- ☐ **Reports** may take the form of the **probability versus impact matrix**, they may **simply highlight the trends** of the 'headline' risks or highlight areas of the scope that give rise for concern or show promise.
- ☐ **Reporting requirements** are variable so benefit can be gained if these are **clearly prescribed** in the risk management plan.

Risk control

❑ **Outputs** from the risk control process step will help inform **contingency analysis**.

❑ In **contingency analysis**,

the **estimated cost** and **schedule impacts** derived from **quantitative risk analysis** for residual risks must reflect an **assumed contingent response** where applicable.

❖ For example, if the project has a **schedule-driven objective**,

a **delay risk** may be **responded** to by spending money to salvage the schedule;

alternatively, a **cost-driven project** may allow the schedule to slip and incur nominal increases in **time-driven costs**.



Risk control

- ☐ An organization that **strives to achieve the highest level** of risk management maturity will work **towards continual improvement**.
- ☐ At the **close of the project**, one key action will be to **capture historical data** regarding risk drivers and their impacts in the project database.

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Change Impact

Change impact

- ❑ Remember that **risk is dynamic** and may **involve changes** to scope, time, cost, and quality.
 - ❖ For example, the **team may need** to respond to a risk by **changing** the **schedule** or **budget**.
- ❑ The **impacts** and **relationships** between **different risks** can change, which could affect **how the team responds**.
- ❑ When **certain risk events** materialize, that might also change the odds or severity of other mutually-inclusive or mutually-exclusive risks.

Change impact

- ☐ The **team must monitor** how risk events that are **early in the schedule** use contingency, which could **limit** the **available contingency** for risk events that are later in the schedule.
- ☐ As risk events **occur** or **fail to occur**, the team will naturally **draw down contingency**.
- ☐ The **reduced contingency** typically constrains the team's ability to **respond to change** as work progresses.

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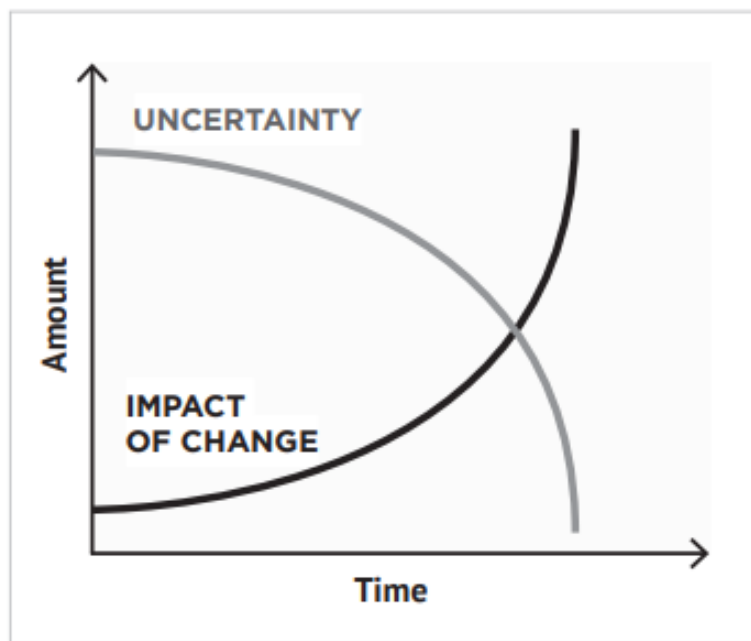
Change impact

- ❑ **New risks** can also emerge at **any time**, which the **team must manage**.
- ❑ The **circumstances** that surround a project or program can change in ways that the team might not have expected the first time that they **met to identify risks**.
- ❑ If the **conditions** in which the team operates change, **new risks** can also interact with other risks on the risk register, which might change the **team's risk response plans**.
 - ❖ *For example, imagine how changes in market conditions may create new risks and force the team to reevaluate the risks already in the risk register.*
- ❑ A **change in market conditions** might
 1. Increase the severity of a **separate procurement risk** or
 2. Create a new quality risk.

Change impact

- ❑ As **design** and **construction** proceed, **uncertainty decreases** because **details become more certain**,
but the **impact of change** usually grows.
- ❑ As **work progresses**,
if the **team encounters** a risk event that will **require a change** (e.g., rework, extra time, increased costs, etc.),
the **impact on** the project/ program is usually greater.

Change impact



Change impact

- ❑ For example, during the design phase on a **highway project** near a **chemical manufacturing plant**,
the **team identifies a risk of hazardous waste** on the jobsite that would **require remediation** and a **partial redesign**.
- ❑ The **team encounters the threat** during construction when the roadway is **80% complete**.
- ❑ **Cleanup begins** and the owner (or agency CM) issues a **change order** to redesign the **remaining 20% of road**.



Change impact

- ❑ In this example, the **threat's severity** is **greater late** in the schedule than if the team had encountered the risk during the initial jobsite walkthrough in the design phase.
- ❑ The **team probably encountered** other risk events that used contingency during design, procurement, and the **early part of construction**.
- ❑ The **team** may have also had **early indicators** that this threat was **likely to occur**.
 - ❖ However, if the team did **not continuously monitor risk**, the team may not be **fully prepared to respond**.

Change impact

- ❑ Therefore, the team must **continuously monitor risk** to manage scope, time, cost, and quality.
- ❖ The **risk manager (CM or risk specialist)** facilitates this process and updates the risk register.
- ❖ If the CM is not the risk manager, the **CM should still participate and understand** how changes may affect risk.

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Risk Meetings by Phase

Risk meetings by phase

- ☐ Since **risk is dynamic** and changes can have **greater impacts** as the work progresses, the team should **follow the RMP** and meet on a **regular basis** to review the risk register.
- ☐ **These meetings** help the team monitor risk and **usually occur more frequently** in later phases.
- ☐ **Even if the team** uses a **separate risk specialist**, the **CM should participate** in these meetings.

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Risk meetings by phase

- ❑ The **following** are **factors** that a **CM** should consider during each phase, and the **personnel** to include in **risk meetings**.
 - ❖ Ideally, the **CM** joins the project or program during the **pre-design phase** and works throughout **all phases**.
 - ✓ However, the CM **must tailor** the **details below** to **fit the needs** of a particular project/program and the CM's scope of services.
- ❑ **On an actual** project or program, **some phases may overlap** or activities may occur in a different order.
- ❑ As a best practice, the **CM** **generally follows these steps**, even if the team includes a **risk specialist**.

Pre-design phase

- ❑ The **pre-design phase** is the **CM's first opportunity** to demonstrate construction management's value to the owner.
- ❑ The **pre-design phase's goal** is to
 1. develop the owner's requirements,
 2. initiate overall coordination with various project/program participants, and
 3. select the design team.

Pre-design phase

☐ Pre-design phase risk meetings should review

- ❖ design concepts,
- ❖ preliminary studies, and
- ❖ any potential external challenges, such as
 - ✓ funding,
 - ✓ schedules,
 - ✓ the impact on the surrounding community,
 - ✓ etc.

☐ These reviews should include

the CM, risk specialist (if separate from the CM), owner, designer(s), and any other major stakeholders.

Design phase

❑ The **team's design phase** goal is to

finish a set of documents that define an on-time, cost-effective project/program which can be **bid** in the **current local market** and that **meets** the **owner's requirements**.

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Design phase

☐ The **design phase's risk meetings** should review

- ❖ the construction plans and specifications,
- ❖ proposed schedule(s),
- ❖ estimated costs,
- ❖ utility relocations and coordination,
- ❖ environmental concerns,
- ❖ permitting,
- ❖ constraints, and
- ❖ site access.

☐ **Risk meetings** during design should include

the CM, risk specialist (if a separate entity), owner, designer(s), consultants, and construction representative(s), if possible.

Procurement phase

- ☐ The **procurement phase** relies on the **documents** that the team created in the pre-design and design phases to **meet the owner's requirements**.
- ☐ The **team acquires** products and services that meet those requirements in the **procurement phase**.

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Procurement phase

❑ Risk meetings during **procurement** should

- ❖ **review** questions from bidders for possible unidentified risks,
- ❖ **discuss** if the number of bidders is adequate, and
- ❖ **consider** any necessary addenda.

❑ This **phase's meetings** should include

the CM, risk specialist (if separate), owner, the owner's contracting officer(s), personnel familiar with the technical aspects of the design, and relevant consultants.

Construction phase

- ☐ The **construction phase** is when the team **implements** and **checks** the work.
- ☐ During construction, **risk meetings** should **review** previously identified risks to ensure they are **appropriately managed** and any **unforeseen risks** that may affect scope, budgets, schedules, or quality.
- ☐ **These reviews** should include the CM, owner, designer(s), builder(s), consultants, and any other stakeholders with **critical input**.

Post-construction phase

□ Finally,

the post-construction phase's goals are to

1. Complete and accept the work,
2. Facilitate owner occupancy,
3. Finish any required documentation, and
4. Issue final payment and
5. Release of retention to the contractor(s).

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Post-construction phase

❑ **Post-construction** phase risk **meetings** should review

- ❖ warranties,
- ❖ the operation and maintenance plan,
- ❖ any outstanding construction items, and
- ❖ potential claims.

❑ **Post-construction** risk **meetings** should include

the CM, risk specialist (if separate), owner, the owner's operation and maintenance staff, and a builder's representative (when necessary).

Risk Resolution

Risk resolution

- ☐ Over the **full lifecycle** of a project or program, **most risks** eventually either occur or become irrelevant.
- ☐ A **resolved risk** is
 1. a risk that **occurred**, or
 2. the **associated risk event** no longer applies to the project/program.

Either way, the risk is in the past.

- ☐ Some teams may use the term “**closed**” or “**retired**” instead, but the process is the same.

Risk resolution

- ❑ If a risk resolves, it will **typically resolve** in one of the following ways:
1. The risk event occurs, the team follows the risk response plan, and the risk resolves.
 2. The risk is only relevant to a certain phase (e.g., construction), the risk event does not occur before the team enters the next phase (e.g., post-construction), and the risk resolves.
 3. The risk never occurs before the project/program finishes, so it no longer applies and the risk resolves.

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Risk resolution

- ☐ The team **never removes** a risk from the risk register, **even after it resolves**.
- ☐ When a risk resolves, the CM or risk specialist **updates the risk register** to document the **resolution**.
- ☐ This risk documentation provides:
 - ❖ Coordination with other project/program control tools (e.g., cost management, time management, etc.);
 - ❖ Clear reporting and communication for stakeholders; and
 - ❖ Lessons learned for future teams.

Risk resolution

- ☐ **Resolved risks** are **not** the same as **issues**.
- ☐ **Recall** that risk involves **uncertainty**, while an issue is certain.
- ☐ The **team** should **track each risk's uncertainty** in the risk register and include information about how the risk resolved (e.g., the team's risk response, the project ended before the risk occurred, etc.).
- ☐ **Meanwhile**, an issue will occur and has a **known impact**, so the team **follows separate processes** for issues.

For more, see Section 3.

Risk resolution

- ❑ **Figure 13** shows **updates** to the **hypothetical risk register** from earlier sections.
- ❑ Again, note that an **owner's risk register** requirements may **vary**.
- ❑ The risk register in **Figure 13** and in the earlier examples in this COURSE show one possible way to organize a risk register.
- ❑ **Teams** may use **additional fields** (e.g., sustainability impact) or different ranges (e.g., “1 to 10”) to **track risk**.
- ❑ In this example, the **risk manager updated** the “Notes” fields for five risks to show that the team resolved them.

Project Name Project Risk Register Rev: 12 (Updates for risk resolutions) Date: September 3, 2024										Cost	< \$30k	\$30k - \$99k	\$100k - \$299k	\$300k - \$1m	> \$1m				
										Time	< 2 weeks	2-4 weeks	1-2 months	2-4 months	> 4 months				
										Quality	Minimal rework	< 5% rework	5%-14% rework	15%-30% rework	> %30 rework				
										Overall Score	< ± 3 (low)		± 3 - ± 9.5 (medium)			> ± 9.5 (high)			
					Before Response										After Response				
Risk ID	RBS	Risk Name	Risk Description	Threat/ Opportunity	Probability Score	Cost Impact	Schedule Impact	Quality Impact	Overall Risk Score		Risk Owner	Response Category	Notes	Due Date	Probability Score	Cost Impact	Schedule Impact	Quality Impact	Overall Risk Score
ID-2	Construction/ Scope	Construction scope change	The owner is unfamiliar with construction, which could lead to scope changes during the construction phase that could create delays, cost overruns, and quality issues	Threat	5	5	4	3	20		Hector R.	Mitigate	RESOLVED: Met with owner to review scope, team has reached substantial completion without any major scope changes	5/15/2024	3	5	4	3	12
ID-1	Procurement/ Market Conditions	Pre-purchase curtain wall	Long lead of the curtain wall system could delay the curtain wall's arrival, which could delay the critical path and the completion date	Threat	4	5	3	1	12		JoAnn C.	Mitigate	RESOLVED: Pre-purchased curtain wall system with an early procurement package, curtain wall arrived without delaying construction	6/30/2024	1	1	1	1	1
ID-4	Political/ Approvals	Senior stakeholder support	The state's governor and several legislators are highly-engaged and want to show the project is a success, so these officials could help expedite the approval process and allow design and construction to begin sooner	Opportunity	(-5)	(-3)	(-3)	(-1)	(-12)		Lisa M.	Enhance	RESOLVED: Met with governor's and legislators' staff, the project is approved	5/31/2024	(-5)	(-4)	(-4)	(-1)	(-15)
ID-3	Design/Schedule	Deficient drawings	Due to the tight design schedule, the drawings could be deficient, resulting in more change orders/ RFIs/claims	Threat	3	4	4	3	11		Salah M.	Mitigate	RESOLVED:The CM and PM reviewed the drawings in detail before bid, no major design changes or claims during construction	6/15/2024	1	1	1	1	1
ID-5	Real Estate/ Acquisition	Purchase available adjoining lot	An empty lot next to the jobsite is for sale below the market rate and purchasing it would improve site access and staging, which could also shorten the construction schedule	Opportunity	(-3)	(-3)	(-2)	(-1)	(-6)		Rupesh J.	Exploit	RESOLVED: Met with owner to authorize funding, empty lot purchased which expedited the construction schedule and staging is now complete	5/15/2024	(-5)	(-3)	(-4)	(-2)	(-15)
ID-6	Construction	Certificate of occupancy	An administrative delay could delay the certificate of occupancy's signoff at the end of the project, which would delay substantial completion and move-in	Threat	2	1	1	1	2		Keith L.	Mitigate	Pre-planned inspection schedule, punchlist inspections to begin in several days	9/15/2024	1	1	1	1	1

Figure 13 – Risk Register with Resolved Risks

Risk resolution

- ❑ In some cases, an **owner may inherit** a risk that **did not resolve** during the project or program.
 - ❖ In other words, **some risks** might **carry over** into a **structure's operational lifespan**.
 - ❖ This situation **occurs when**
 1. The **team does not experience** the risk **event's full impact** and
 2. The **risk is still applicable** to the owner.
- ❑ **At the end** of a project/program, the **team must provide** the owner with all the **relevant information** for these risks.
- ❑ The **exact process** for providing this information to the **owner will vary**, but the **CM must always at least monitor** these steps.

Risk resolution

- ❑ For example, consider the **scenario** of a **project located** in a **hurricane zone**.
 - ❖ The **risk of a catastrophic hurricane** may **remain after** the project **ends**,
but it will impact the owner's operations and maintenance staff
instead of the construction team.
 - ❖ **Before** final closeout,
the **owner's operation and maintenance staff** should understand
how a **hurricane** may **impact** the completed structure.
 - ❖ The **builder** is typically **responsible** for
providing and documenting this training, which the **CM monitors**.

Final Report

Final report

☐ After substantial completion,

the CM should **prepare** a final report with **future recommendations** for the owner and other team members the owner deems appropriate.

❖ This **report** must be **appropriate** to the project/program and the owner's requirements.

☐ The CM must **summarize** the project/program, including

1. General descriptions of the work,
2. Lessons learned,
3. The final version of the risk register, and
4. The CM's recommendations.

Final report

❑ If the **team uses** a **separate risk specialist**,

the risk **specialist** may **prepare** their own report regarding risk.

❖ The **owner's requirements** may **vary** in this situation,

but the **best practice** is the **CM's final report** should **reference** the risk specialist's report.

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Final report

- ❑ Note that the CM's final report **addresses all pertinent aspects** of the project or program.
- ❖ The report should **include** information relevant to other project/program **controls** (e.g. quality, sustainability, etc.).

For more about final reports,

see

the CMAA Construction Management Standards of Practice and
CMAA Quality Management Guidelines.



استراتژی مدیریت ریسک در طول چرخه حیات پروژه (بر اساس سند مهمی از CMAA)

بخش ششم: جمع‌بندی و الحاقیه‌های پروژه‌های صنعت ساخت

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

CMAA Authorized Trainer

دانشگاه Illinois Tech آمریکا



What we will learn?

- ☐ Conclusion
- ☐ Appendix

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Conclusion

Conclusion

- ❑ **Risk management** is a **continuous process** to identify, analyze, respond to, and monitor risks throughout all phases of a construction project or program.
- ❑ A risk is an **uncertain event** or **condition** with the **potential** to impact a construction project or program negatively or positively.
- ❑ A **negative risk** is a **threat**, which has the potential for loss, damage, or any other undesirable event.
- ❑ A **positive risk** is an **opportunity**, which has the potential to reduce costs, save time, or improve quality

Conclusion

- ❑ **Risk identification** is when a **team evaluates** a project/program to **discover** its **potential** threats and opportunities.
 - ❖ During risk identification, teams
 1. Should be objective,
 2. Use and collect a variety of well-informed judgements,
 3. Make realistic assumptions,
 4. Refer to appropriate outside resources, and
 5. Understand each risk's potential impact(s).
- ❑ The team should include risks that are **external** to the team, over which they may have **little or no control**.
- ❑ The team **records** each risk in the risk register.

Conclusion

- ❑ After a **team identifies** threats and opportunities,
they analyze those **risks' potential impacts**.
- ❑ This analysis helps a **team prioritize** the risks because stakeholders can **see which risks**
 1. could have the greatest impact and
 2. are the most likely to occur.
- ❑ The **team** then **uses** this **information** to
 1. create a status or
 2. score for each risk and adds the results to the risk register.
- ❑ Teams may **respond** to threats or opportunities through
design, engineering, or management decisions.

Conclusion

- ☐ Finally, the team should **continuously**
 1. **track** the **risks** in the risk register and
 2. **adjust** them when needed.
- ☐ This **risk monitoring** must continue throughout **all phases** because
 1. risks may change or
 2. new risks may surface at any time.
- ☐ **Continuous risk monitoring** helps the team
 1. respond to changes in the risk environment as soon as possible,
 2. attempting to minimize threats and maximize opportunities

Appendix

Appendix

- ☐ This appendix provides the following samples only as guides.
- ☐ They are not a comprehensive list of all the documents that may apply to a project or program, nor are they necessarily appropriate for all projects/ programs.
 1. Risk Management Plan (RMP) Outline
 2. Sample Project Risk Checklist
 3. Sample Technical Risk Checklist

Prepared by Dr. Alavipour
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Appendix

- ☐ The **RMP** is project- or program-specific.
- ☐ The outline in this **appendix** is **only an example**.
- ☐ This **example** may **not necessarily reflect** the owner's specific requirements.
- ☐ If the **CM** is the **risk manager**,
 - the CM **must customize** the RMP to the specific project/program and owner's requirements.
- ☐ If the **CM** is **not the risk manager**,
 - the CM should **still**
 1. **understand** the project's/program's unique,
 2. applicable risks and
 3. monitor the team's risk management processes.

Appendix

- ☐ The **following checklists** are also **not** comprehensive, complete, nor necessarily appropriate for all projects and programs.
- ☐ **They list** some of the **most common types** of risk, but **teams may discover** that some of these risks do **not apply** to their current project/program or that other risks apply that are **not on these lists**.

A CM must remember that every project/program is unique.

Sample Project Risk Checklist

Organizational and Project Management Risks

- ☐ Project purpose and objectives are insufficiently defined
- ☐ Project scope definition is unclear or incomplete
- ☐ Design to cost or cost to design
- ☐ Sufficient project management staff over design, acquisition, and construction
- ☐ Skilled staff able and prepared to manage to cost and schedule: earned value of design/construction
- ☐ Unanticipated project manager workload
- ☐ Control over sufficient staff sizing and project priorities
- ☐ Product development by several sources or entities (virtual or remote efforts)
- ☐ Project competing with other projects, funding, and resources
- ☐ Functional and Technical labor available or overloaded (design and construction)
- ☐ Coordination/communication difficulties
- ☐ Insufficient time to plan, accelerated schedules (design/ acquisition/construction)
- ☐ Timely response to critical decisions by PM and/or management
- ☐ A/E/C Consultant or contractor delays
- ☐ Unexpected requirements causing delays in obtaining approvals, decisions
- ☐ Multiple agencies/regulator issues
- ☐ Priorities change on existing program
- ☐ Other:

Political Risks

- ☐ Funding profile for schedule of events: design, acquisition, construction
- ☐ Multiple government agencies
- ☐ Political factors change at local, state or federal level
- ☐ Government changes
- ☐ Project approvals made in a timely manner

Procurement Risks

- ☐ Lack of acquisition planning support/involvement
- ☐ Undefined acquisition strategy
- ☐ Requirements for SDB and 8(a) contracts and subcontracts

Sample Project Risk Checklist continued

- ☐ Acquisition planning to accommodate funding stream or anticipated strategy
- ☐ Numerous separate contracts
- ☐ Acquisition strategy or mega-project decreasing competition
- ☐ Acquisition strategy results in greater scope risk (Design-Build, performance specs, best-value, cost-plus, contractor bonding...)
- ☐ Market conditions and anticipated bidding climate
- ☐ Other:

Real Estate/Right of Way

- ☐ Real Estate plan defined (status, purchases, agreements, easement acquisition)
- ☐ Ancillary owner rights, ownerships in question
- ☐ Confidence in estimated cost and schedule to acquire/resolve
- ☐ Right-of-way analysis in question
- ☐ Freeway, railroad agreements and impacts
- ☐ Relocations identified
- ☐ Vagrancy
- ☐ Other:

Regulatory Environmental Risks

- ☐ Established requirements for initial project studies and potential impacts
- ☐ Status of critical environmental and regulatory studies
- ☐ Wetlands permits
- ☐ Endangered species
- ☐ Work restrictions for migration seasons
- ☐ State historical preservation concerns (Landmark buildings, historical, cultural sites)
- ☐ Status of permits
- ☐ Lack of specialized staff (biology, anthropology, archeology, etc.)
- ☐ Reviewing agencies delayed or take longer than expected
- ☐ Community protests
- ☐ New permits or new information required
- ☐ Pressure to compress the study and permitting activities
- ☐ Other:

Sample Project Risk Checklist continued

Construction Risks

- ☐ New Facility or Rehabilitation
- ☐ Innovative or complex project construction
- ☐ Occupancy during construction, partial habitation
- ☐ Functioning utilities intact
- ☐ People management
- ☐ Protection from construction impacts
- ☐ Backup utilities
- ☐ Accelerated contract schedule
- ☐ Unforeseen site conditions
- ☐ Weather conditions
- ☐ Skilled staff to manage contractor/subcontractors
- ☐ Inefficient contractor and/or subcontractors
- ☐ Conflicts with other contracts
- ☐ Congested site access, staging areas, and restrictions
- ☐ Site security
- ☐ Scope changes during construction
- ☐ Timely coordination, approvals, and delivery of critical owner equipment to support design/construction
- ☐ Permits, licenses, submittal approvals
- ☐ Inadequate housing/utilities to support labor force
- ☐ Special equipment and equipment availability
- ☐ Material logistics – availability, staging and delivery
- ☐ Differing site conditions, contract modification and claim potential
- ☐ Contractor resources
- ☐ Labor disputes
- ☐ Sufficient construction schedule durations (sequencing, phasing, concurrent activities, float, production rates)
- ☐ System testing and commissioning
- ☐ Other:

Sample Project Risk Checklist continued

Estimate and Schedule Risks (E/S)

- ☐ E/S captures scope for all project features
- ☐ E/S addresses potential for partial occupation (personnel, utilities, interior, exterior)
- ☐ Estimate basis: parametric models or project specific detailed development
- ☐ E/S reflects contract strategy/structure
- ☐ E/S Considers specialties in construction and electrical/ mechanical systems
- ☐ Consideration for testing and commissioning of systems prior to customer receipt
- ☐ E/S Developed for current scope and design level
- ☐ Parametric estimates adequate for design complexity
- ☐ E/S Developed in sufficient detail (level of confidence)
- ☐ Estimate confidence in large and critical quantities
- ☐ Estimate confidence of lesser designed features
- ☐ Estimate(s) quality and confidence when developed by others
- ☐ E/S inclusion of hidden contingency
- ☐ Estimate includes exceptions, exclusions, or qualifications
- ☐ Estimate includes escalation on long term contracts: labor and materials
- ☐ Estimate includes waste, excess & drop off quantities
- ☐ Estimate reflects local or imported labor (market-bearing, overtime & subsistence)
- ☐ Estimate reasonableness of crews, productivities, multiple subcontractors
- ☐ Estimate reflects local material and delivery costs
- ☐ E/S considers long-lead items
- ☐ Estimate includes local quotes for special material and equipment
- ☐ Prime and subcontractor structure matches likely acquisition strategy
- ☐ E/S considers potential for multi-tiered subcontractors
- ☐ Adequate schedule depicting all major/critical project features
- ☐ Schedule matches project management plan
- ☐ Schedule portrays critical construction features, matching estimate productivity
- ☐ Schedule depicts logical construction sequencing, phasing and parallel activities
- ☐ Estimate and schedule reflecting "most likely" occurrence
- ☐ Other:

Sample Project Risk Checklist continued

Third Party Risks

- ☐ Adequacy of project funding (incremental, phasing or full funding)
- ☐ Project scope, criteria, or design change potential (design and construction periods)
- ☐ Phased construction (swing space)
- ☐ Conflicts with other projects, contracts and/or utilities
- ☐ Stakeholders request late changes
- ☐ New stakeholders emerge and demand changes
- ☐ Influential stakeholders request additional needs to serve other purposes
- ☐ Stakeholders demand schedule or quality over funds available
- ☐ Market conditions and bidding competition
- ☐ Unexpected escalation on key materials
- ☐ Labor disruptions
- ☐ Consideration for unknown/unidentified risks
- ☐ Other:

Sample Technical Risk Checklist

General Technical Risks

- ☐ Overall design development stage, incomplete or preliminary
- ☐ Ongoing work (contracts) as compared to future work
- ☐ Innovative designs, highly complex, first of a kind, or prototypes
- ☐ Inexperienced design team (in over their heads)
- ☐ Latest confirmed criteria
- ☐ Hazardous waste
- ☐ Design confidence by external review and others
- ☐ Inaccurate or risky design assumptions on technical issues
- ☐ Need for design exceptions or waivers
- ☐ Security requirements
- ☐ Other:

Architectural

- ☐ Design phase (%) and confidence
- ☐ Sufficient funding
- ☐ Exterior facade meets local community requirements/ restrictions.
- ☐ Interior spatial layout meets requirements and is deemed acceptable by occupant management.
- ☐ Furnishings & finishes
- ☐ Flooring and IT considerations
- ☐ Elevators and pedestrian conveyance
- ☐ Medical/Hazard Waste and disposal areas
- ☐ Flexibility and potential for future additions
- ☐ Includes interior security requirements
- ☐ Other:

Sample Technical Risk Checklist continued

Civil/Site Design

- ☐ Design phase (%) and confidence
- ☐ Geotechnical sampling sufficiency
- ☐ Building site layout accommodates all needs (layout, utilities, drainage, traffic)
- ☐ Utilities (water, sewer, drainage)
- ☐ Level coordination with other projects in area, and coordination with the campus masterplan.
- ☐ Unknown utilities
- ☐ Site info (site age, as-builts, utilities, cultural resources, site hazardous waste)
- ☐ Potential for future additions
- ☐ Site security/force protection
- ☐ Other:

Structural

- ☐ Design phase (%) and confidence
- ☐ Design complexity impacts
- ☐ Environmental (weather, wind, seismic, etc.)
- ☐ Other:

Electrical

- ☐ Design phase (%) and confidence
- ☐ Power demands (lighting, communications, IT systems, safety, and alarms)
- ☐ UPS requirements
- ☐ Special systems
- ☐ Flexibility to adjust to technology changes
- ☐ Includes interior security requirements
- ☐ Other:

Sample Technical Risk Checklist continued

Mechanical

- ☐ Design phase (%) and confidence
- ☐ Utility demands (HVAC, plumbing, fire suppression, water, sewer demands)
- ☐ Fire suppression
- ☐ Special systems, medical support, gas
- ☐ Special mechanical equipment
- ☐ Controls
- ☐ Flexibility to adjust to technology changes
- ☐ Maintenance access
- ☐ Requirement and design confidence
- ☐ Other:

Equipment

- ☐ Design phase (%) and confidence
- ☐ Government furnished equipment, design, purchase, and install
- ☐ Medical, kitchen, administrative, maintenance, other
- ☐ Surgery, and laboratory equipment. Risk of equipment change due to technology advances, or changing requirements.
- ☐ Design flexibility to support changing technologies
- ☐ Communications and information technologies (IT)
- ☐ Conveyance systems
- ☐ Compatibility and equipment sources
- ☐ Sufficient space, sizing, and utility requirements/redundancies
- ☐ Equipment deliveries
- ☐ Other:

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دفتر آموزش



تهران، بلوار فردوس شرق، مجتمع آبگینه، طبقه سوم اداری، واحد C42



+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۴۵



+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۵۰



info@dralavipour.com



www.dralavipour.com



@alavipour_pm



@acemi_social



@alavipour_pm



@IRANACEMI

