DEVELOPING & MANAGING CONTIGENCY ON THE BASIS OF RISK

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Presentation Outline

- Review of Basic Project Risk Management Concepts
- Approaches for Determining Contingency
- Managing the use of Contingency Funds
- The Need for Continuous Issue and Risk Management
- Conclusions
Base Cost, Budget and Contingency

Typical Spending Curve

Cost
Available Funds
Budget
Base Cost
Management Reserve
Contingency
Time

Project Risk Management Concepts
Definitions and Differences

**Contingency:**
Fund ($ or Time) with which to mitigate or bear the consequences of unplanned, unanticipated, or unbudgeted events or non-events.

*Risk-based:* Greater the Risk, the bigger the fund.

**Management Reserve:**
Discretionary Fund available to appropriate person or persons with which to accommodate project enhancements, change, or modifications.

**Allowance:**
Fund applied for inclusion of known scope or events, the extent, count, or quantity of which cannot be accurately determined at time of Baseline Estimate.
Project Success: dependent upon Assumptions

That certain things **are correct:**
- Basis of Estimate/Accuracy of Estimate
- Task durations
- Resource need analysis

That certain things **will occur:**
- Benchmarking analogs are and will be repeatable
- Resource availability
- Vendor cooperation & Compliance

That certain things **will not occur:**
- Strikes
  - Key supplier bankruptcy
  - Interest rate increases
  - Calamitous weather
Review/Validate Baseline Estimate & Plan

Prepare Cost Estimate

BOE/BOP Documentation

Note Timing & Sequence of Risk Assessment!

Conduct Risk Assessment Session

1st – but not last - session!

Determine Contingency Allocation

Determine Contingency

Develop Contingency Drawdown Curve

Risk-Weighted Contingency Metrics
Two techniques:

**Non simulation:** Empirical - collective wisdom & experience, knowledge, & ‘gut instinct’

**Simulation:** Modeling and simulating repeatable experiences. Statistical methods
Non - Simulation Approach

- **Identify Risks:** What *could* happen? Workshop with all stakeholders
- **Assess Risks:** Probability vs. Impact scorecard
- **Quantify Impact:** Two methods
  - Estimated Cost to mitigate, avoid, transfer, or ‘take the hit’
  - Calculated Contingency from Scorecard
## Probability vs. Impact Scorecard

<table>
<thead>
<tr>
<th>Risk</th>
<th>Impact</th>
<th>None</th>
<th>Minimal</th>
<th>Moderate</th>
<th>Large</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Slight (&quot;could happen&quot;)</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Moderate (50-50)</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>High (has happened)</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Near Certain</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

**How? Experience, judgment, and intuition – of many stakeholders with many perspectives**
Calculating Contingency

For each: WBS or Project Element

<table>
<thead>
<tr>
<th>WBS Or Phase</th>
<th>Identified Risks</th>
<th>Score (Probability x Impact)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase n</td>
<td>Risk 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk n</td>
<td></td>
</tr>
</tbody>
</table>

Consider:
A 5% Contingency level for every 4 points of Phase Risk Factor

Total Score = \( \sum \text{Phase Risk Factor} = \frac{\sum}{\# \text{identified risks}} \)
## Simulation Approach

<table>
<thead>
<tr>
<th>Description</th>
<th>Base Cost X1000 In US$</th>
<th>1 Design Uncertainties</th>
<th>2 Testing Uncertainties</th>
<th>3 Schedule Conflicts</th>
<th>4 Contract Uncertainties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DESIGN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Investigations</td>
<td>545</td>
<td>- 65</td>
<td></td>
<td>0</td>
<td>75% (0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 150</td>
<td></td>
<td>1,500</td>
<td>25% (1300)</td>
</tr>
<tr>
<td>Electrical Design</td>
<td>500</td>
<td>- 150</td>
<td></td>
<td>120</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 200</td>
<td></td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Relay Design</td>
<td>500</td>
<td>- 100</td>
<td></td>
<td>600</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 495</td>
<td></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Relay Settings</td>
<td>1,355</td>
<td>- 110</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 380</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONSTRUCTION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Work</td>
<td>1,540</td>
<td>-</td>
<td>85</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+</td>
<td>390</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Equipment Installation</td>
<td>275</td>
<td>-</td>
<td>500</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+</td>
<td>275</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commissioning</td>
<td>285</td>
<td>- 200</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 142</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect on Total Estimate</td>
<td>5,000</td>
<td>- 625</td>
<td>785</td>
<td>1,030</td>
<td>75% (0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 1,267</td>
<td>865</td>
<td>2,270</td>
<td>25% (1300)</td>
</tr>
</tbody>
</table>
Risk Analysis Models

Simple Monte Carlo Model

Risk-Weighted Cost Estimate = Base Cost + I1 + I2 + I3 + I4 + I5

Considerations

• Correlation
• Number of Iterations

For Factored estimates, correlation between Influence Factors must be considered.
Using Results to Set Contingency

Contingency = Budget - Base

Cost ($x1000) vs. Probability

Mean

Base

Budget

30 60 45 75

0.00 0.04
Tornado Diagram

Sensitivity Chart

-100.0%  -50.0%   0.0%  50.0%  100.0%

- Schedule Conflicts
- Contract Uncertainties
- Design Uncertainties
- Testing Uncertainties
- Labor Uncertainty
Allocating Contingency

- Allocation of Contingency across Project
  - Not linear! (except for those risks that are!)
  - By WBS or Phase or Deliverable, etc
And Risk-based Contingency is NOT equally allocated!
Higher risk activities - and processes failures that can affect Time/Costs *usually* occur early in project.
Managing Contingency Funds

- **Recognize:** Changing Project Status = Changing Risks = Changing Contingency

- **Decide & Agree:** Who *owns* Contingency?

- **Business Rules:** For What/When is Contingency used? Who decides?

- **Unspent:** Where does Contingency ‘go’ if not used?
Contingency Drawdown Plot

Contingency linked to *Project Elements and Time* (Resource loaded into Execution Plan)
Risk Assessment is Ongoing…

As a Project evolves and/or is executed, the nature and type of risks change:

- Some disappear or are diminished
- New risks appear, or old ones increase

As Risk changes – Contingency needs change!

Risk and ‘To-go’ Contingency should be reevaluated at appropriate times and at appropriate Project stages!
Q: Who ‘Owns’ Contingency?

A: Whomever is ‘at risk’ and will bear the consequences of a risk’s occurrence.
Managing Contingency Funds

The party ‘at risk’ is often dependent upon the contract type and contractual relationship.

<table>
<thead>
<tr>
<th>Contract Type</th>
<th>Features</th>
<th>‘At Risk’</th>
<th>Contingency ‘Owner’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lump Sum</td>
<td>Overrun to CM</td>
<td>CM</td>
<td>CM</td>
</tr>
<tr>
<td>GMP</td>
<td>Overruns to CM, Underrun to Owner</td>
<td>CM &amp; Owner</td>
<td>CM &amp; Owner</td>
</tr>
<tr>
<td>T&amp;M</td>
<td>Overrun to Owner, Underrun to Owner</td>
<td>Owner</td>
<td>Owner</td>
</tr>
<tr>
<td>Target w/ incentives</td>
<td>Shared participation of under/over</td>
<td>CM &amp; Owner</td>
<td>CM &amp; Owner</td>
</tr>
</tbody>
</table>
Managing Contingency Funds

Using Contingency

- It’s there for a reason - and OK to spend
- It should be spent only against its allocated risk category, Project Phase, or WBS category
- NOT a ‘rolling slush fund’ – use it or lose it!
- NOT for ‘late in the project’ scope enhancements
### Managing Contingency Funds

<table>
<thead>
<tr>
<th>Option</th>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Push Along&quot;</td>
<td>Hedge against future risk</td>
<td>Delays optimal use of capital</td>
</tr>
<tr>
<td>Project Enhancement</td>
<td>New ‘goodies’</td>
<td>Misuse of Contingency</td>
</tr>
<tr>
<td></td>
<td>Some stakeholders happier</td>
<td></td>
</tr>
<tr>
<td>Return of Capital</td>
<td>Expanded Capital Plan</td>
<td>Less PM bargaining power</td>
</tr>
</tbody>
</table>
Conclusions

- Contingency should be related to risk
- Rational techniques should be used to determine contingency amounts
- ‘Business Rules’ regarding management of contingency should be defined and agreed upon
- Risk – and contingency – should be reevaluated at appropriate project intervals