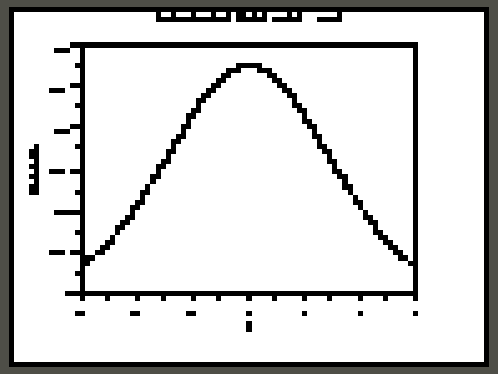
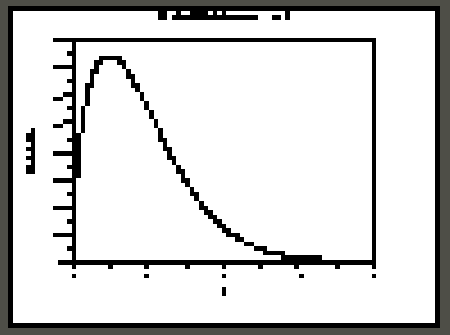
Project Risk





Overview
&
Methods Comparison

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What's Project Risk?

- Project Risk is the likelihood that a project outcome will vary substantially from it's original goal.
  - The goals are usually categorized as scope, cost, and time goals.
  - Rarely does a project conclude with exactly meeting its original goals; indicating that risk exists in virtually all (if not all) projects.
  - Project Risk is the sum of a virtually infinite number of possible risk events

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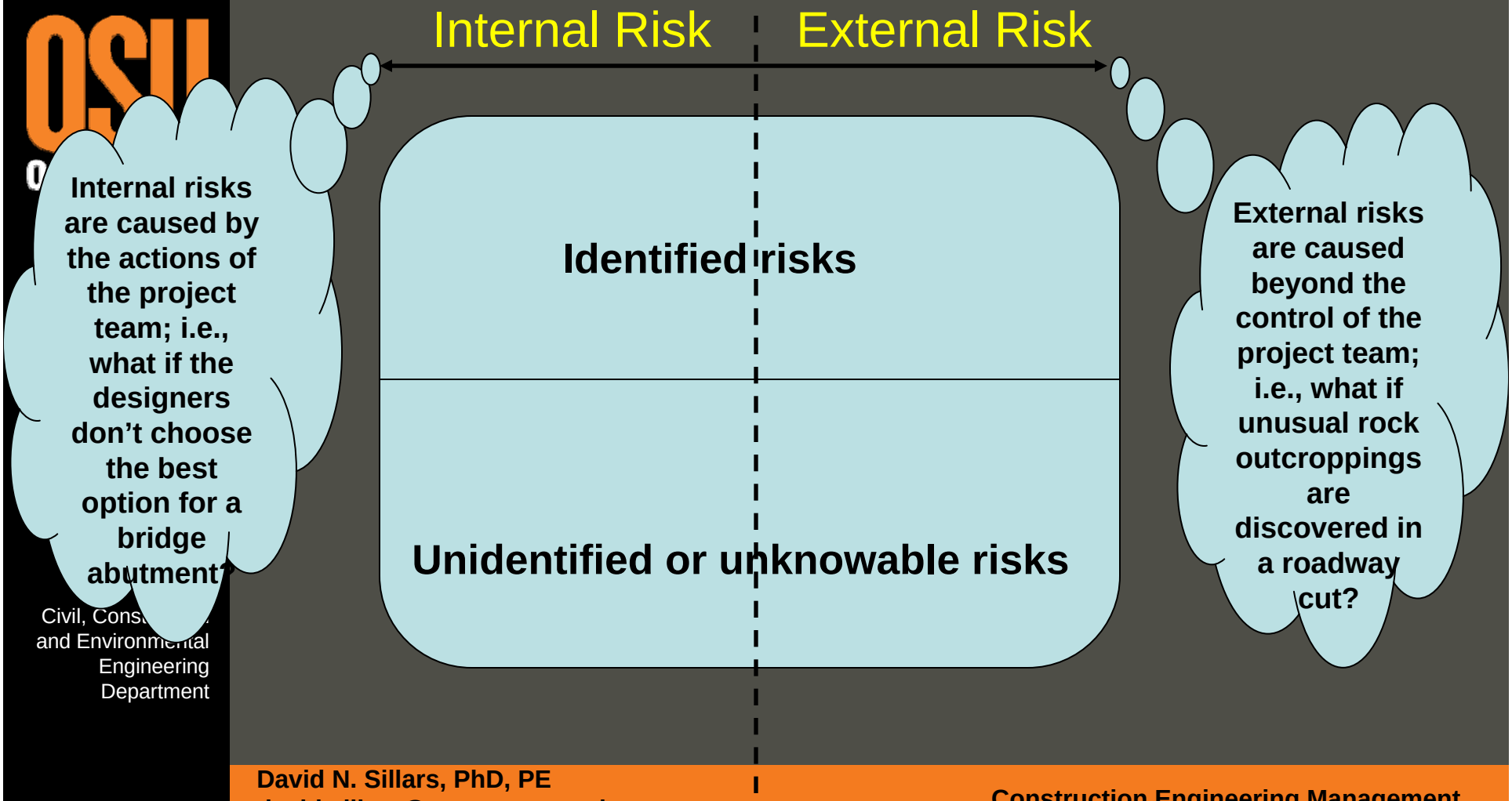
The Risk Picture



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Risk management

- What is risk management?

The process of identifying risk situations, for which outcomes are likely to vary in amounts that may significantly affect the project's goals; evaluating the likelihood and magnitude of such variance; establishing plans for minimizing hazard and maximizing gain; and managing the delivery of those plans.

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Risk management techniques

- There are several methods that have emerged to deal with risk:

  Passive

  – Use of contingencies

  Pro-active

  – Bottom-up (Risk register/Monte-Carlo methods)

  – Top-down risk analysis (Risk range methods)

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Project Development Risk Contingencies

Contingencies (short for contingency funds) are commonly used methods of dealing with risks; generally there are two kinds:

- Allocated and unallocated
  - Allocated contingencies are those that are specified to a particular element of a project; for example, rock excavation may have a special contingency included in the cost
  - Unallocated contingencies are usually included as a general added cost, often characterized as a percentage of the total "known" costs (say, 5% or 10% of the total project costs)

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Risk Contingencies

- Allocated contingencies may be exposed or hidden
  - Exposed (Patent) contingencies are those that are shown as separate line items in the body of a project schedule or cost estimate
  - Hidden (Latent) contingencies are not visibly separated in a project estimated, but are usually added by experienced estimators or schedulers to time/cost units or quantities to cover risks that they expect on a project

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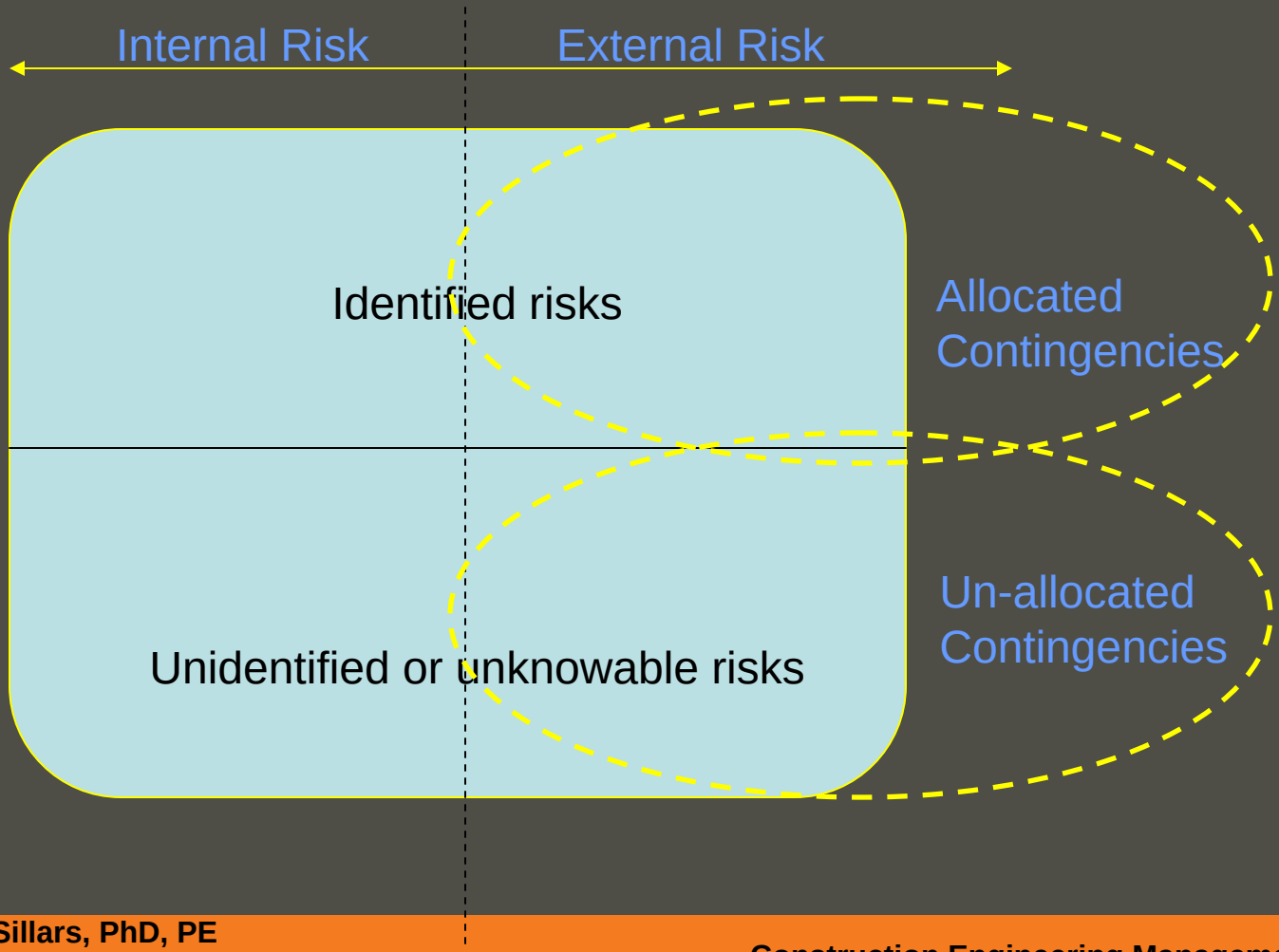
The Risk Picture Contingencies



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Risk Contingencies

- Advantages:
  - Provide protection when events occur that exceed estimated amounts
  - Usually applied by individuals who have significant experience
  - “Standard” rules have developed over time
- Disadvantages
  - Passive in nature—just waiting for events to occur
  - Standard rules don’t cover extraordinary project-specific events
  - Hidden contingencies don’t expose potential problem areas
  - Forecast only a single-point estimate

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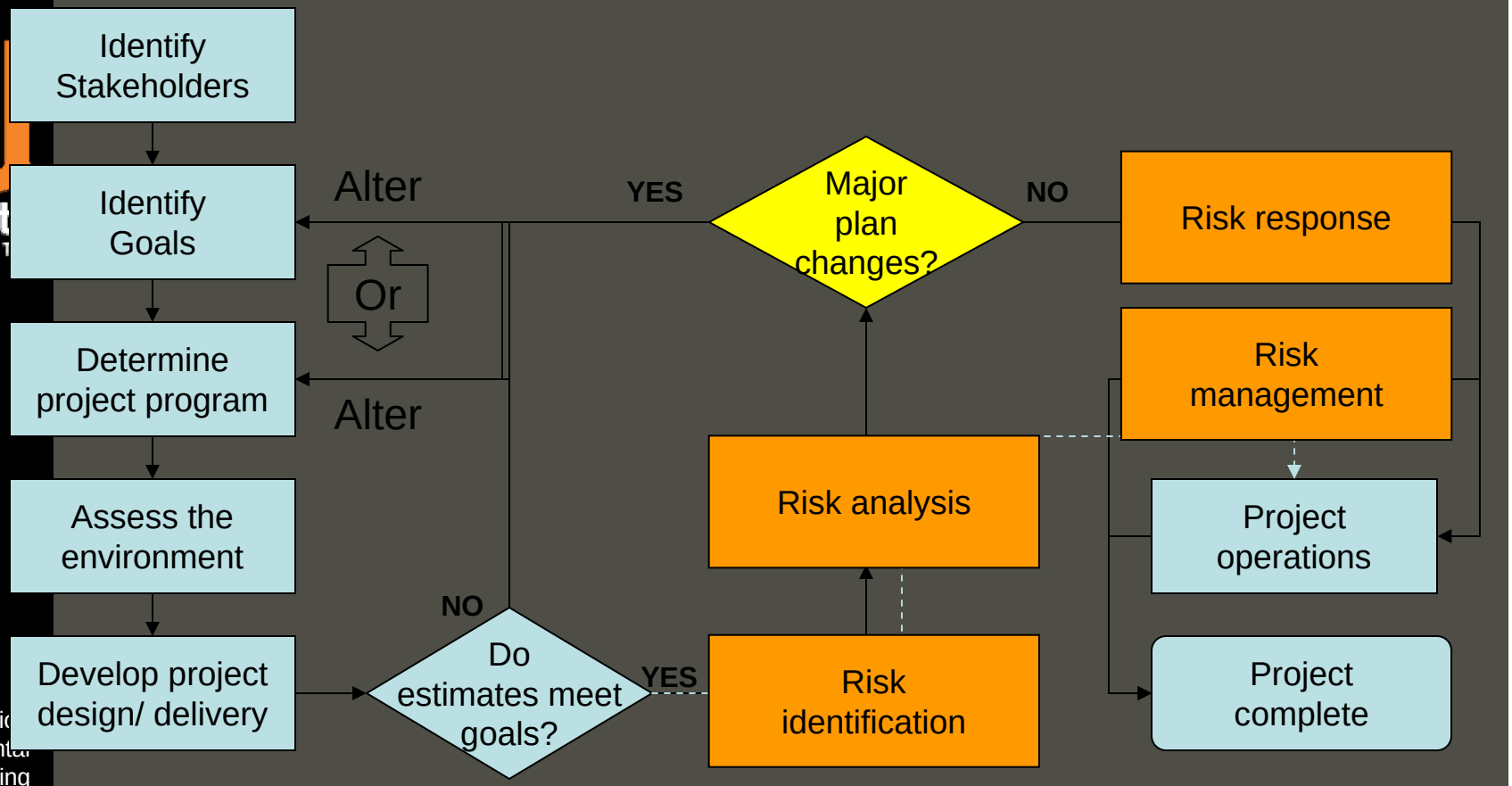
& Pro-active Risk

Project Management



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Risk management through the project life-cycle

- Pro-active risk management works best when viewed across the project life-cycle
  - Conceptualization
  - Design
  - Construction
  - Close-out, occupancy

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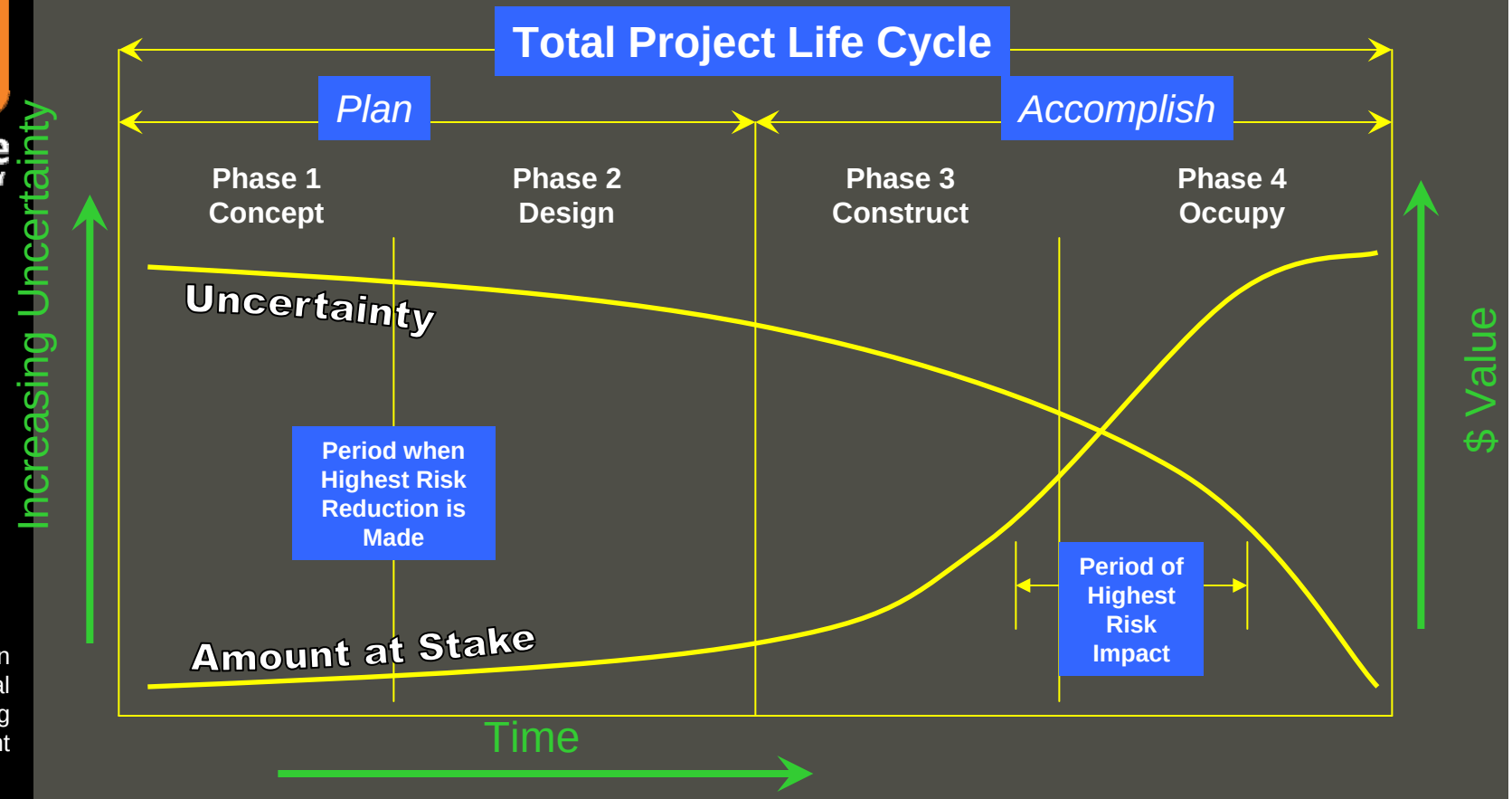
Risk management through the project life-cycle



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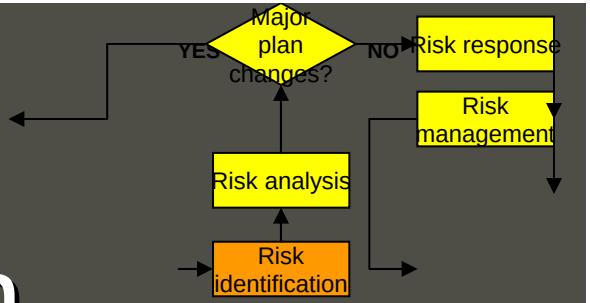

Risk identification

- Common categorizations:
  - Enterprise vs. project
  - Controllable vs. uncontrollable
  - Technical vs. managerial
  - Project vs. environmental
  - By team member responsibility

A listing of potential risks is often called a Risk Register

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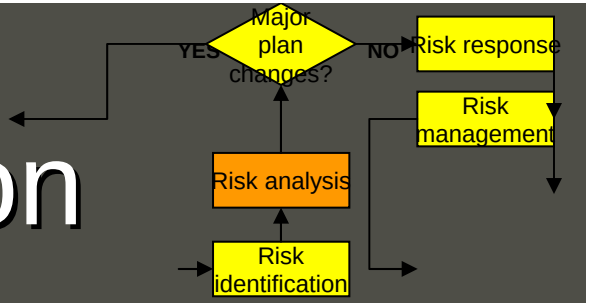
Risk Identification



- Bottom-up risk identification:
  - A preliminary risk register is developed by a select team of project leaders
  - A larger team is assembled that consists of project experts and some outside subject-matter experts; the risk items are vetted for coverage, and for likelihood and magnitude
  - A detailed list of possible risks events are developed for all future phases of the work

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Risk Factoring

An initial evaluation of the expected value of each risk is made using a simple, initial factoring approach

	Risk Factoring				
	Identification		Assessment		
	Source	Outcome	Probability (3=high 2=medium 1=low)	Magnitude (3=high 2=medium 1=low)	Overall Score
1					
2					

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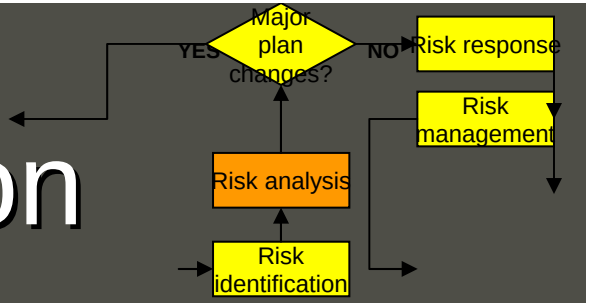
Risk Identification



- Top-down risk identification:
  - A separate consultant team is hired to evaluate the project program, the project team, and the project scope, schedule and estimate
  - A preliminary risk listing is developed and the risk items are vetted with the project team for coverage and likely magnitude
  - Historic cost ranges are applied to categories of cost and are adjusted, based on the risks exposed in this process
  - The ranges forecast 10% to 90% likely magnitudes for each category

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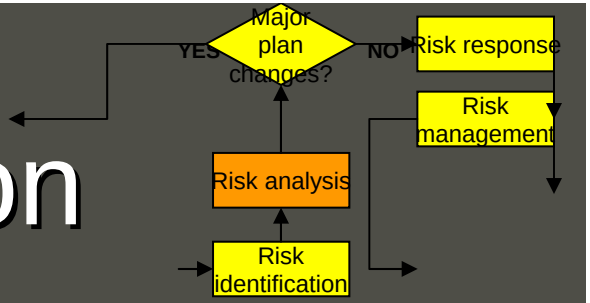
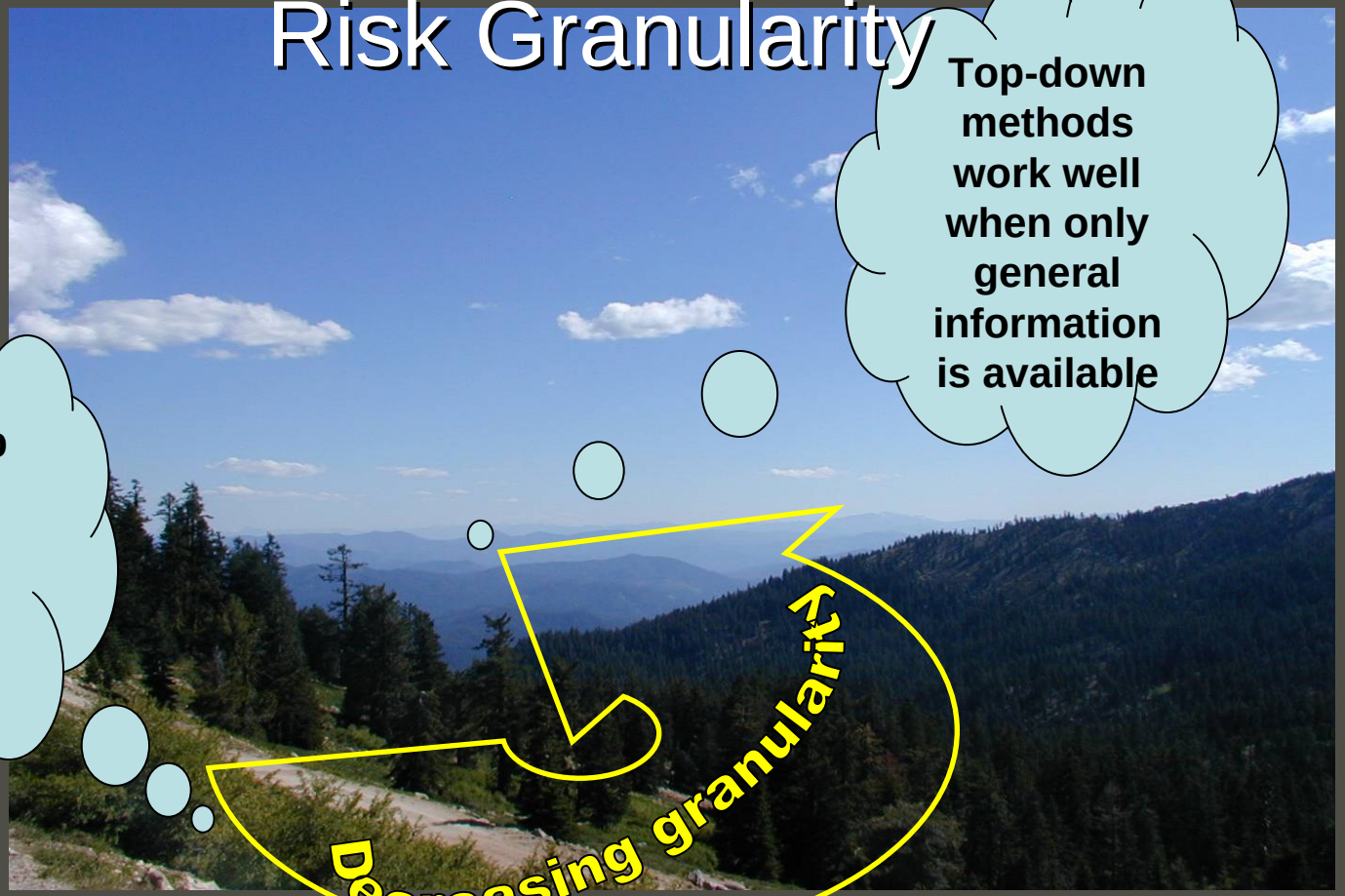
Risk Identification



Risk Granularity



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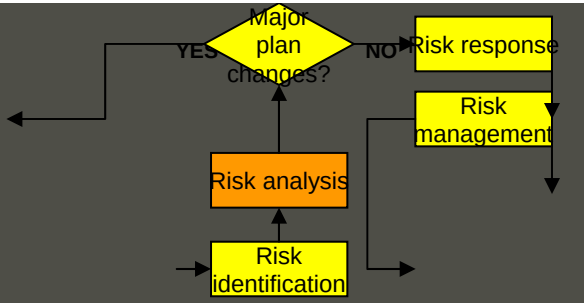
Risk Analysis



- Probabilistic techniques:
  - Improve on the use of passive, “rule-of-thumb” contingency
  - Utilize probabilistic mechanics
  - Many software programs have emerged to simplify the math and bring the focus on the work
- Two broad methods:
  - Bottom-up (discreet event based); and
  - Top-down (pattern-based)

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Project Development Risk Bottom-up Analysis

- Bottom-up risk analysis is frequently used in highway transportation
  - The risk events from the risk register are assigned probability profiles and amounts, and a factor is added to various categories of the work to account for base uncertainty that may not have been accounted for in the detailed risk analysis
  - A computer simulation is performed that provides a probable outcome of costs for the whole project; it produces ranges of possible outcomes at the total project level

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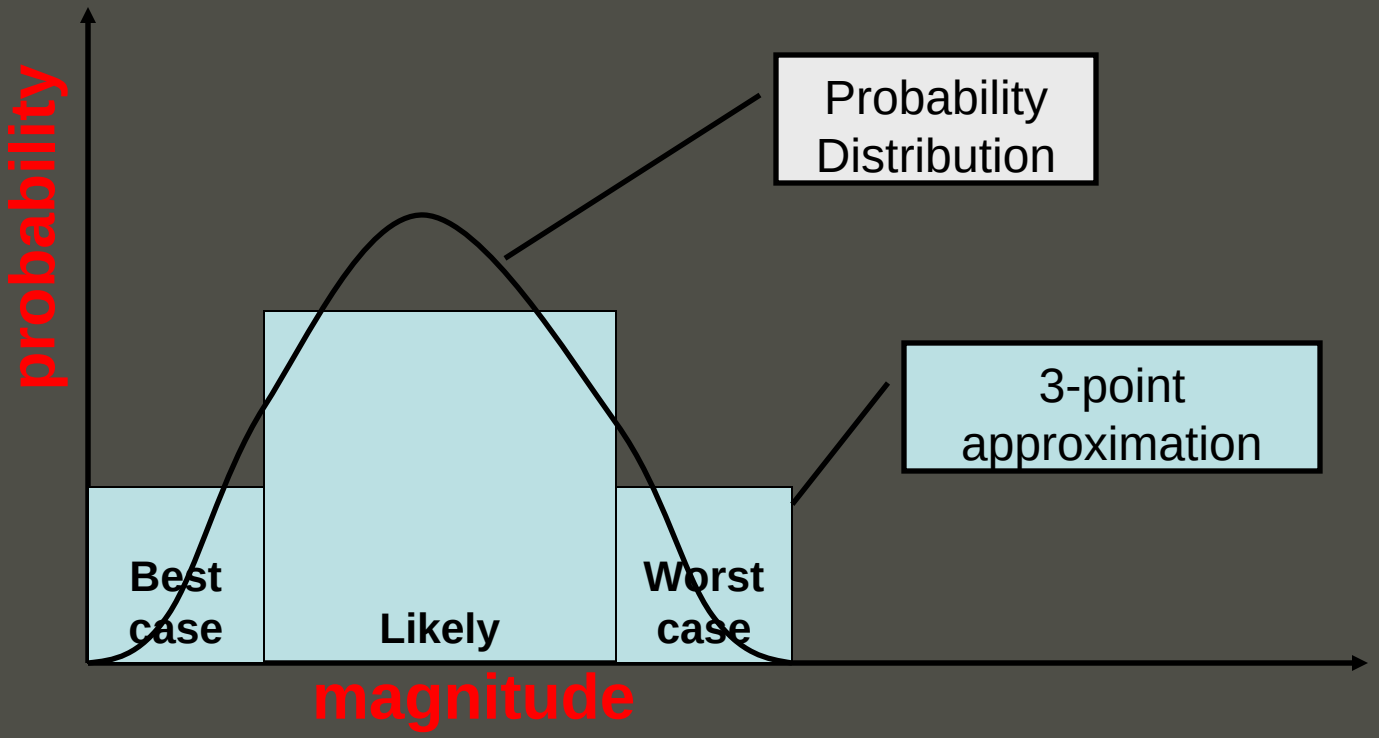
Risk profiles



A detailed analysis of each risk event will include a range of magnitude, often expressed as a probability distribution function

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Project risk

Project risk is the sum of risks present in a project

- While many risks may be identifiable, what's difficult is understanding the interplay and summation among a complicated set of risks with varying risk profiles
- Computerized Monte Carlo simulation is used for risk accumulation

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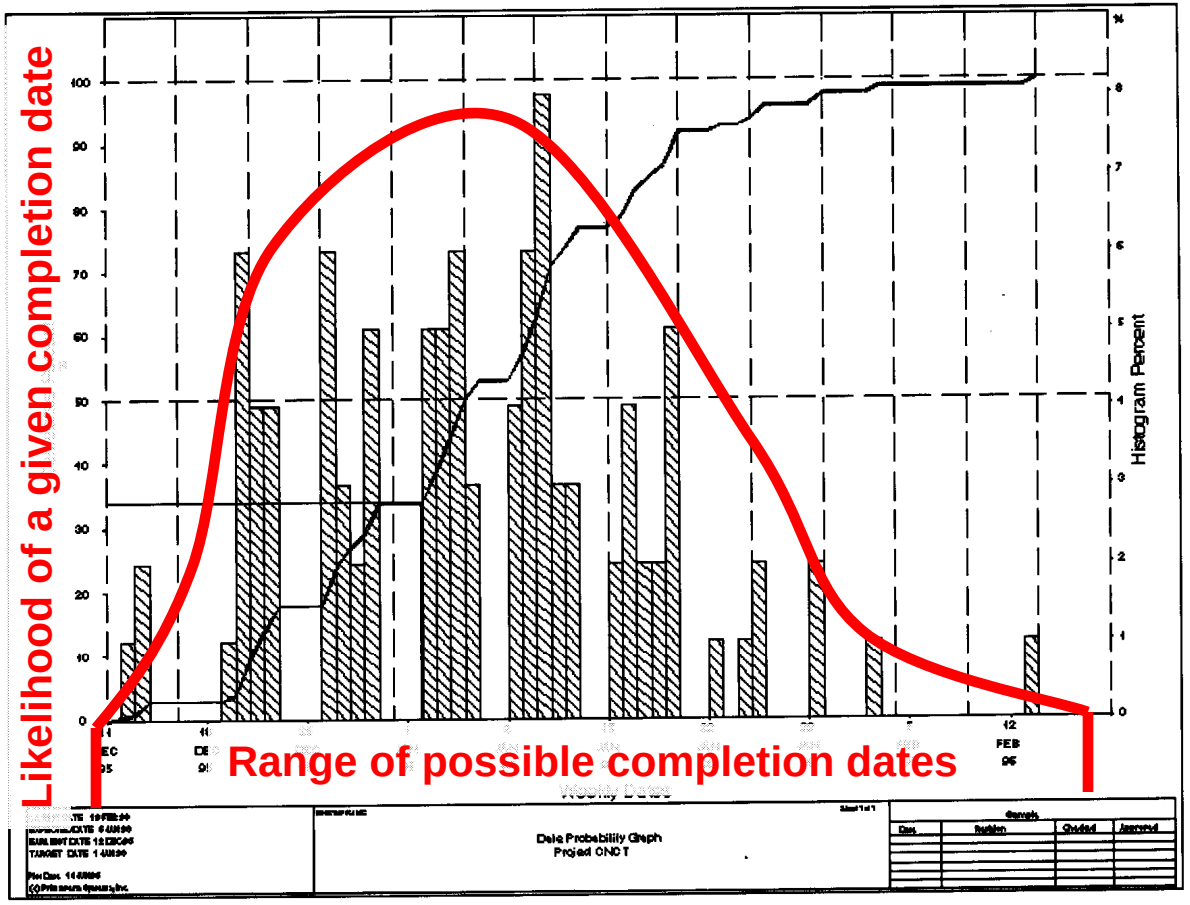
Project Development Risk
Bottom-up Analysis



Date Probability Graph *The probability that the project will be completed on or before the week of January 1, 1996 (the P3 target date) is less than 35 percent.*

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Project Development Risk Bottom-up Analysis

- The base schedule and estimate are stripped of all contingencies
- The risk-related costs discovered in the simulation (whether dollars or time) are added to the base estimate and schedule

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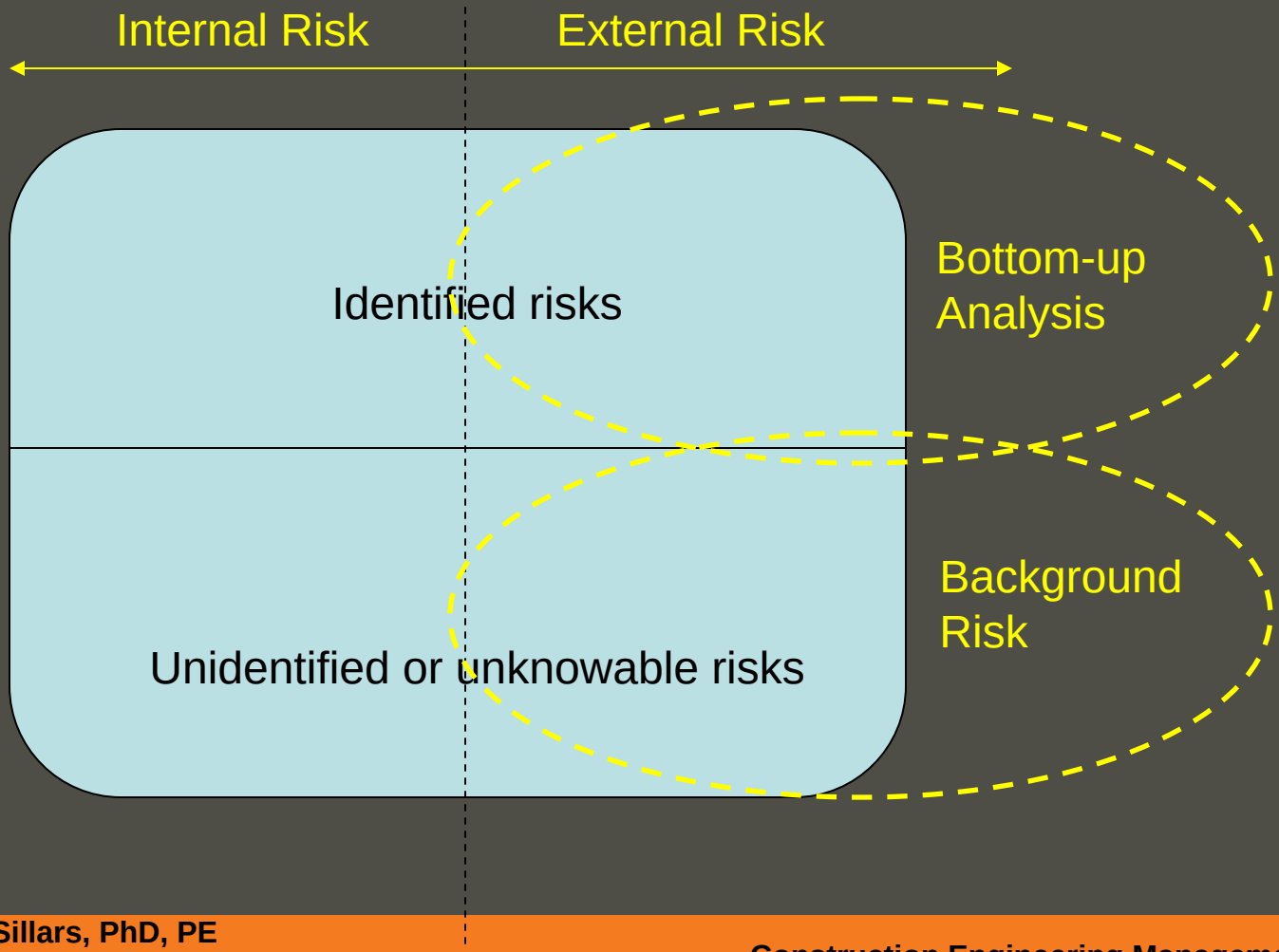
Use of contingencies
Bottom-up Analysis
Top-down risk analysis

Project Development Risk
Bottom-up Analysis



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Risk
Bottom-up Analysis

Advantages

- Is pro-active; identifies and exposes risks before an event occurs
- Establishes a range of cost expectations—more realistic than use of static contingencies
- Causes the project team to think about risk response
- Creates action items

Disadvantages

- Focuses on identifiable risks, may not identify some risks, especially those far in the future
- Relies largely on project team for risk identification
- Identifies external risks, may not identify internal performance risks
- Somewhat complicated to execute analysis; requires understanding probability theory

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Project Development Risk Top-down Risk Analysis

Top-down risk analysis approaches risk management by:

- Adjusting for the inherent optimistic bias of the project team
- Recognizing that team performance is a significant source of risk
- Recognizing that identification of far-futured risks may be difficult
- Providing a methodology for forecasting risk reduction through the entire project development process
- Adding an “arms-length” evaluation

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Project Development Risk
Top-down Risk Analysis

Top-down analysis follows these steps:

1. "Scrubbing" the schedule and estimate of all exposed and hidden contingencies
   - The remaining schedule and estimate are assumed to be the most optimistic (10% likely)
2. A "range multiplier" is applied to the "scrubbed" estimate, on a category-by-category basis, to yield the range from most optimistic to most pessimistic, assuming one risk profile
   - The range multiplier varies depending on the phase of project development
3. The categories of project are then summed probabilistically to yield likely project outcomes

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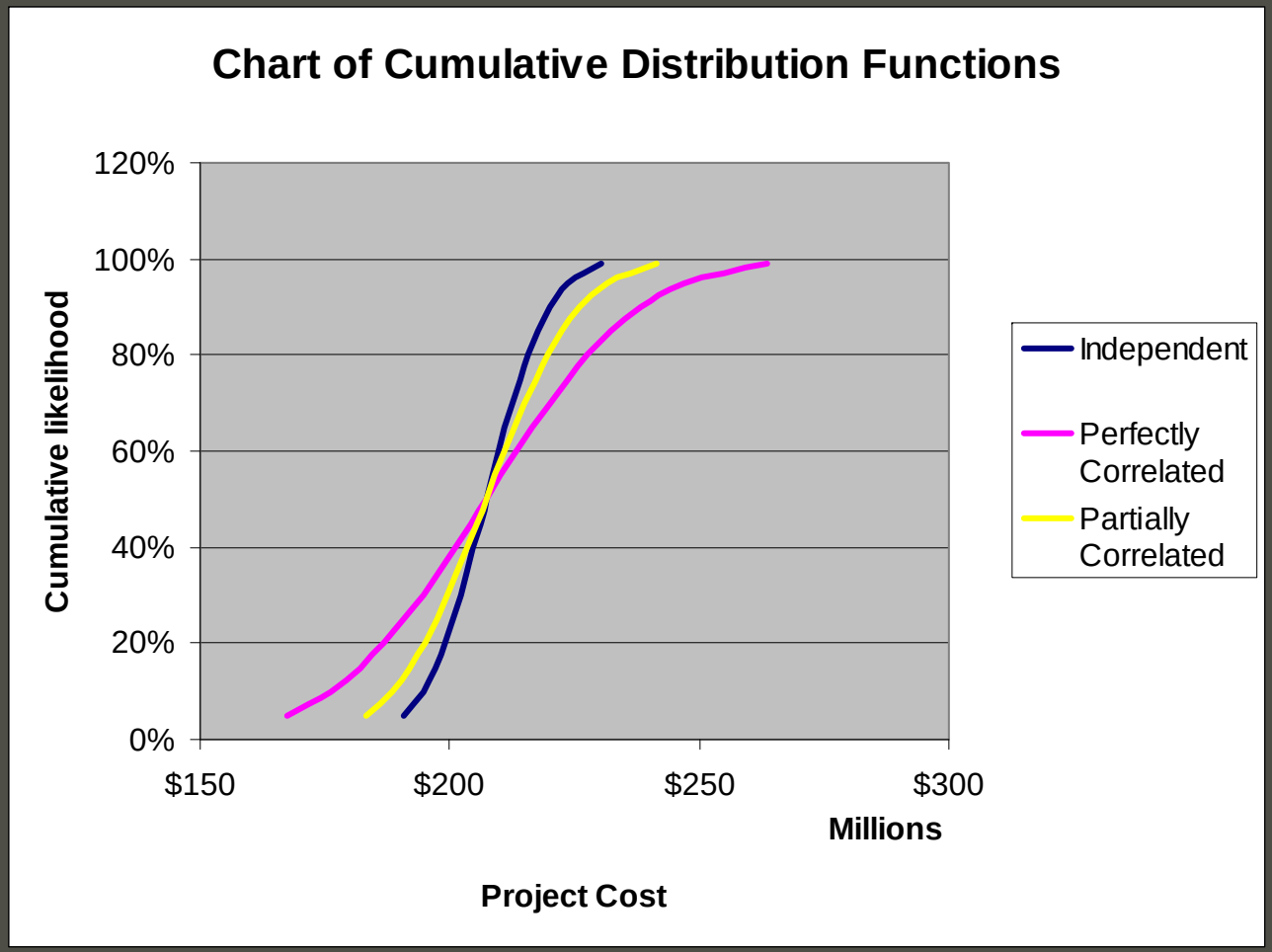
Project Development Risk
Top-down Risk Analysis

Use of contingencies
Risk register/Monte-Carlo Methods
Top-down risk analysis



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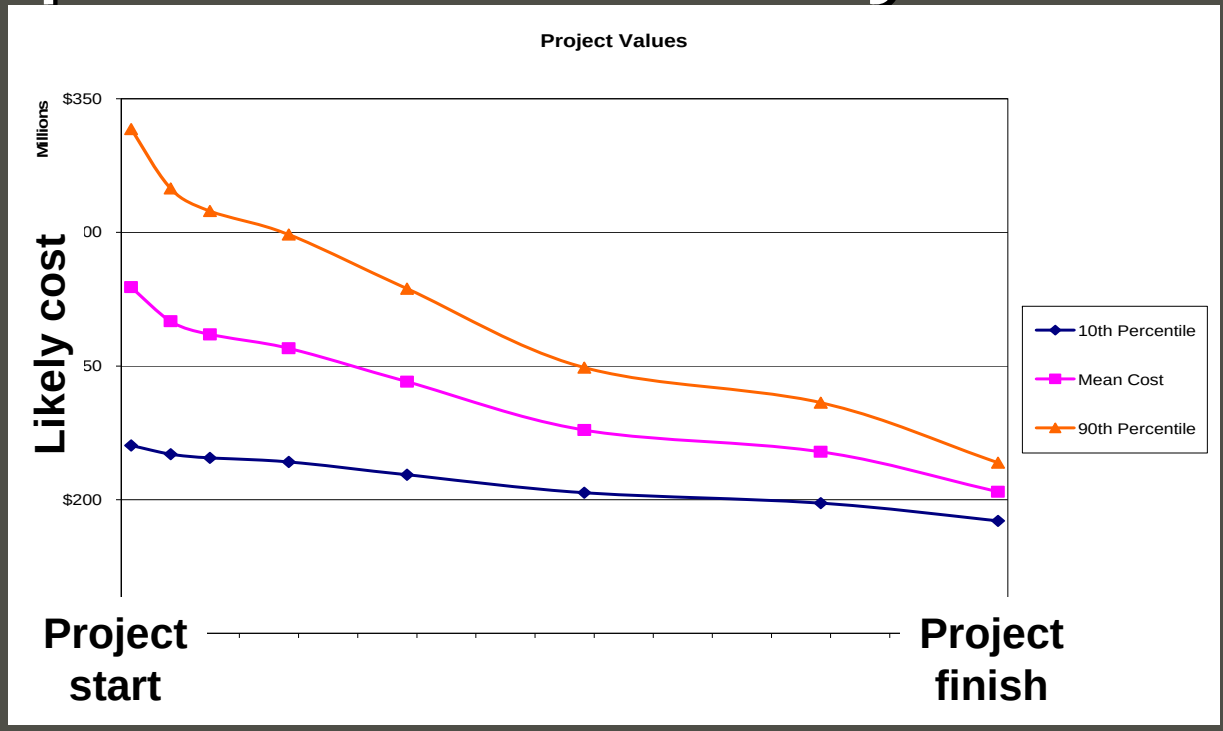
Use of contingencies
Risk register/Monte-Carlo Methods
Top-down risk analysis

Project Development Risk
Top-down Risk Analysis



The project is re-evaluated at each stage of development to forecast potential risk reduction, and the results are plotted across the project life-cycle

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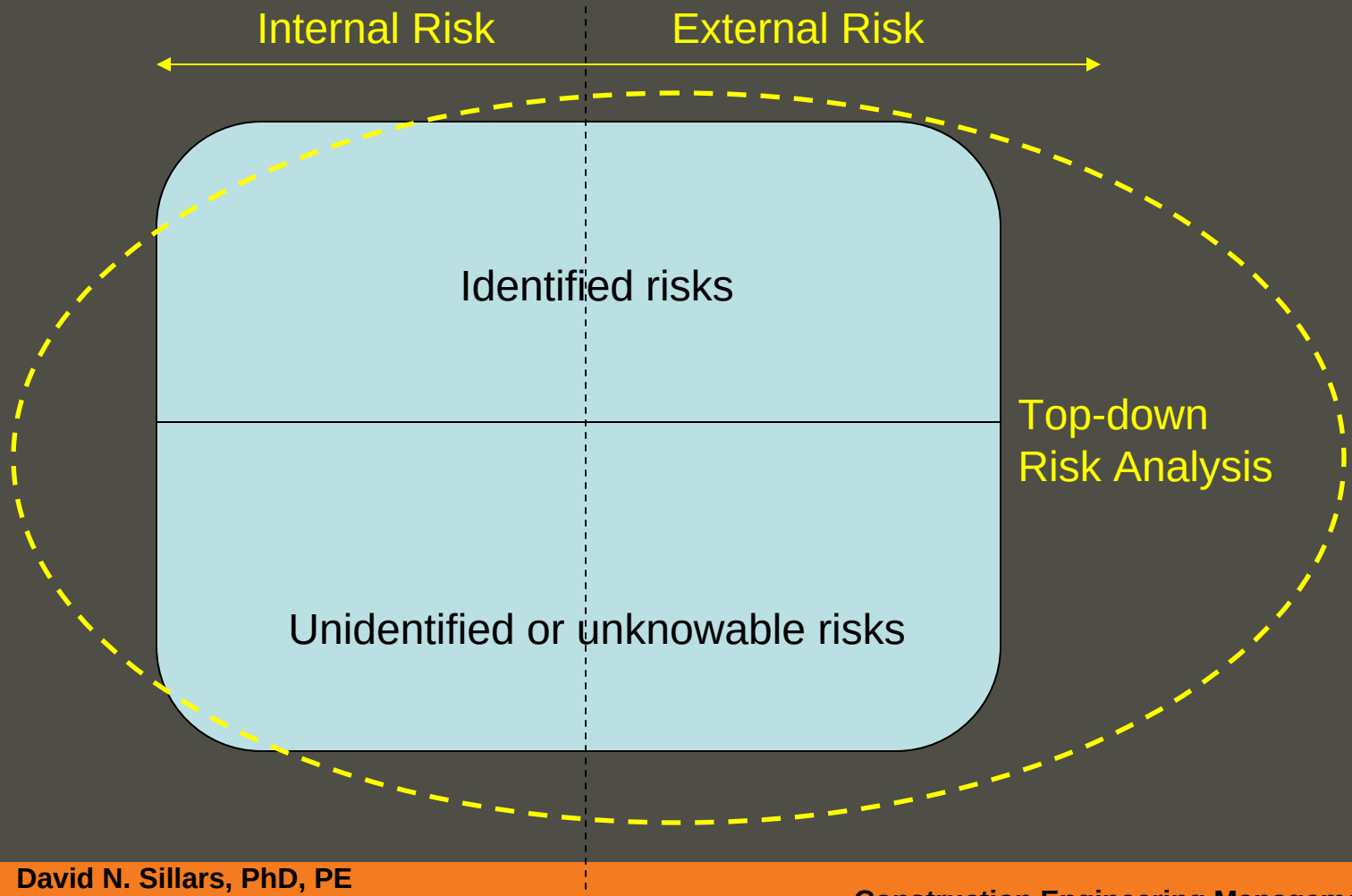
Project Development Risk

Top-down Risk Analysis

Use of contingencies
Risk register/Monte-Carlo Methods
Top-down risk analysis



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Project Development Risk
Top-down Risk Analysis

Advantages

- Establishes a range of cost expectations—holistically captures risk range for future phases
- Causes the project team to think about risk mitigation at all project stages, including the risk of its performance
- Is initially developed through an arms-length project review
- Focuses on both identifiable risks and unidentifiable risks
- Identifies both external risks and internal performance risks

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Project Development Risk
Top-down Risk Analysis

Disadvantages

- Range factors used are based on recent experience
- Including all risk (especially the risk of project team non-performance) creates very high top-end ranges in the earliest project stages—these are difficult to communicate to outside parties
- May be too broad for evaluation of very near-term risks
- Somewhat complicated; requires some understanding probability theory (but doesn't require a detailed understanding of risk profiles)

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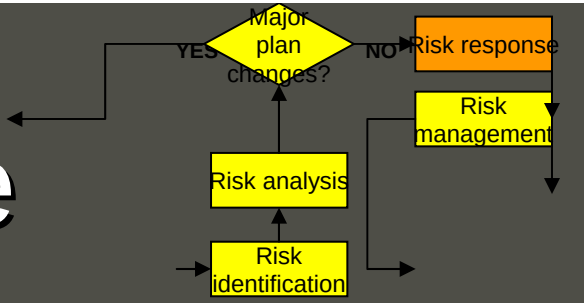
Risk Response



In both Bottom-up and Top-down methods, risk response is considered for the discovered risk events:

Four responses

- Avoid
- Transfer
- Reduce
- Retain/Absorb

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Risk Response

Risk Avoidance

- Pursue a different project or project element
- Alternatives analysis is used here

Risk Transfer

- By contract or agreement with the performing parties
- Two major concepts should be considered:
  - **Efficient** allocation of risk, and
  - **Equitable** allocation of risk.

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Risk Response

Risk Reduction

- By modifying either the probability or magnitude, or both;
  - By modifying the design;
  - By modifying the project management plan;
  - By influencing the project's environment;
- Insurance may used

$$E = p * m$$

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Risk Retention

- Retention
  - Recognize a risk event but take no action
    - **If it appears to be of minimal consequence**
  - Retain it and absorb it, especially when little can be done to reduce it
    - **By an appropriate contingency reserve allowance, for both time and money**

In both bottom-up and top-down methods, contingencies are re-introduced into the project to account for the safety position of the agencies involved and to adjust for broad industry experience

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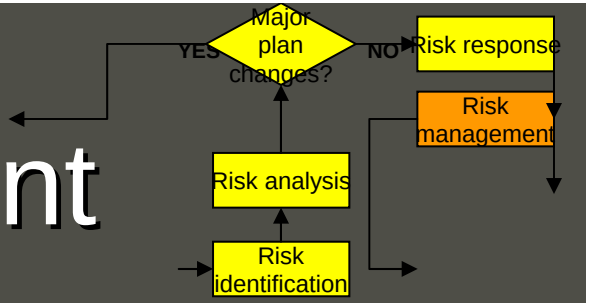
Risk Management



- Documentation of the various analyses
- A listing of major project risks, their description and the nature of their consequences;
- How they are to be handled (selected response)
  - **By whom, when**
- A "Watch List"
  - **A list of secondary and/or residual minor risks that need to be kept an eye on**
- The timing for re-examination of the Risk Management Plan

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Risk Management

The process of identifying risks, for which outcomes are likely to vary in amounts that may significantly affect the project's goals; evaluating the magnitude of such variance; establishing plans for minimizing hazard and maximizing gain; and managing the delivery of those plans.

A rational means for working in an uncertain world

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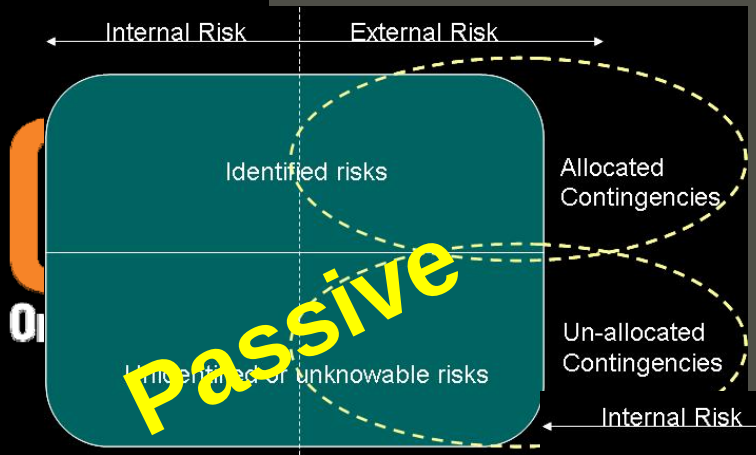
Project Development Risk

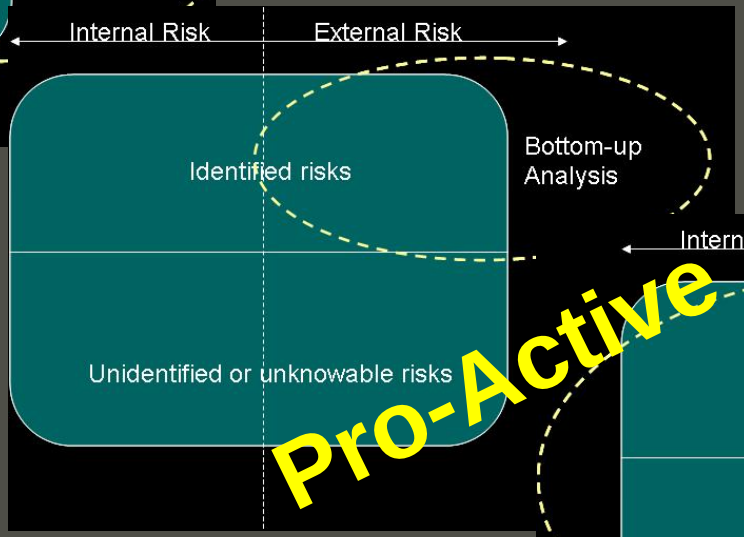
Summary



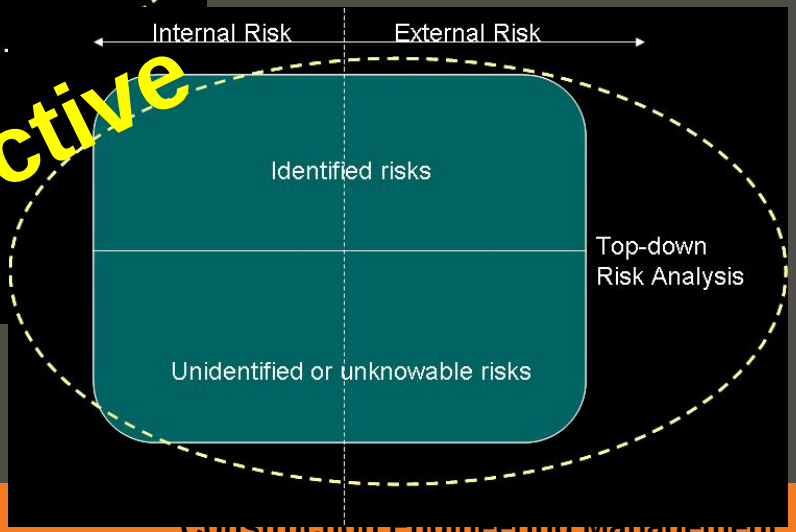
Contingency

Many projects could benefit from a reasoned combination of the three major approaches to project risk

Bottom-up



Top-down



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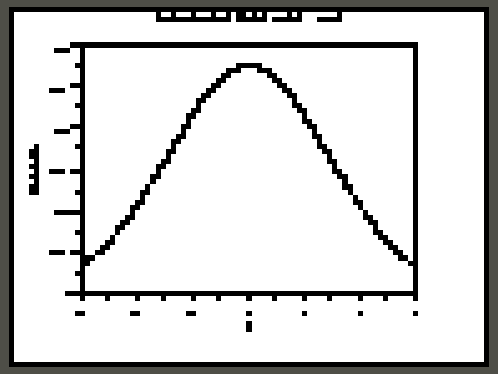
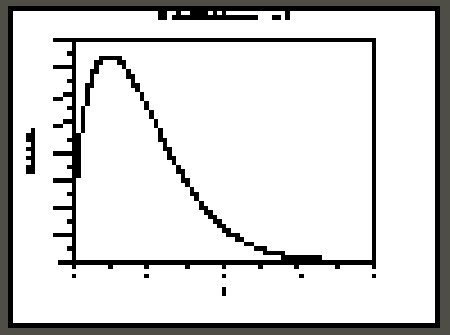
Project Risk





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