



Rapidly Achieving Measurable ROI Using Early Defect Detection

**NDIA 2005 CMMI Technology Conference
November 16, 2005**

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Presentation Objectives

“Raise the standard”: describe best-in-class early defect detection and measurable results.

Provide motivation for performing early defect detection.

Describe early defect detection principles, and describe a best-in-class early defect detection process.

Describe how to estimate and measure ROI using defect dollarization.

Answer any questions.



Agenda

Why use Early Defect Detection?

World-Class Early Defect Detection

What are In-Process Inspections?

Defect Dollarization and ROI

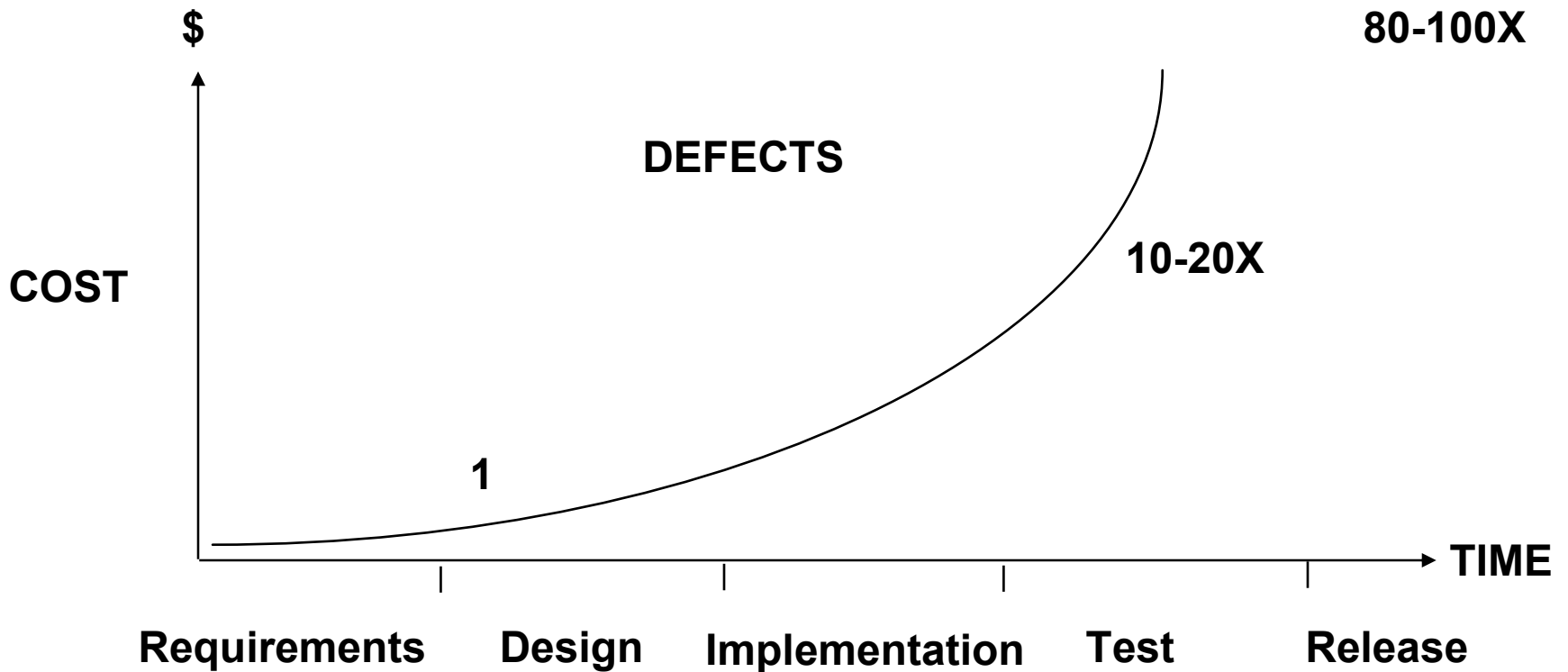
Summary

Questions and Answers



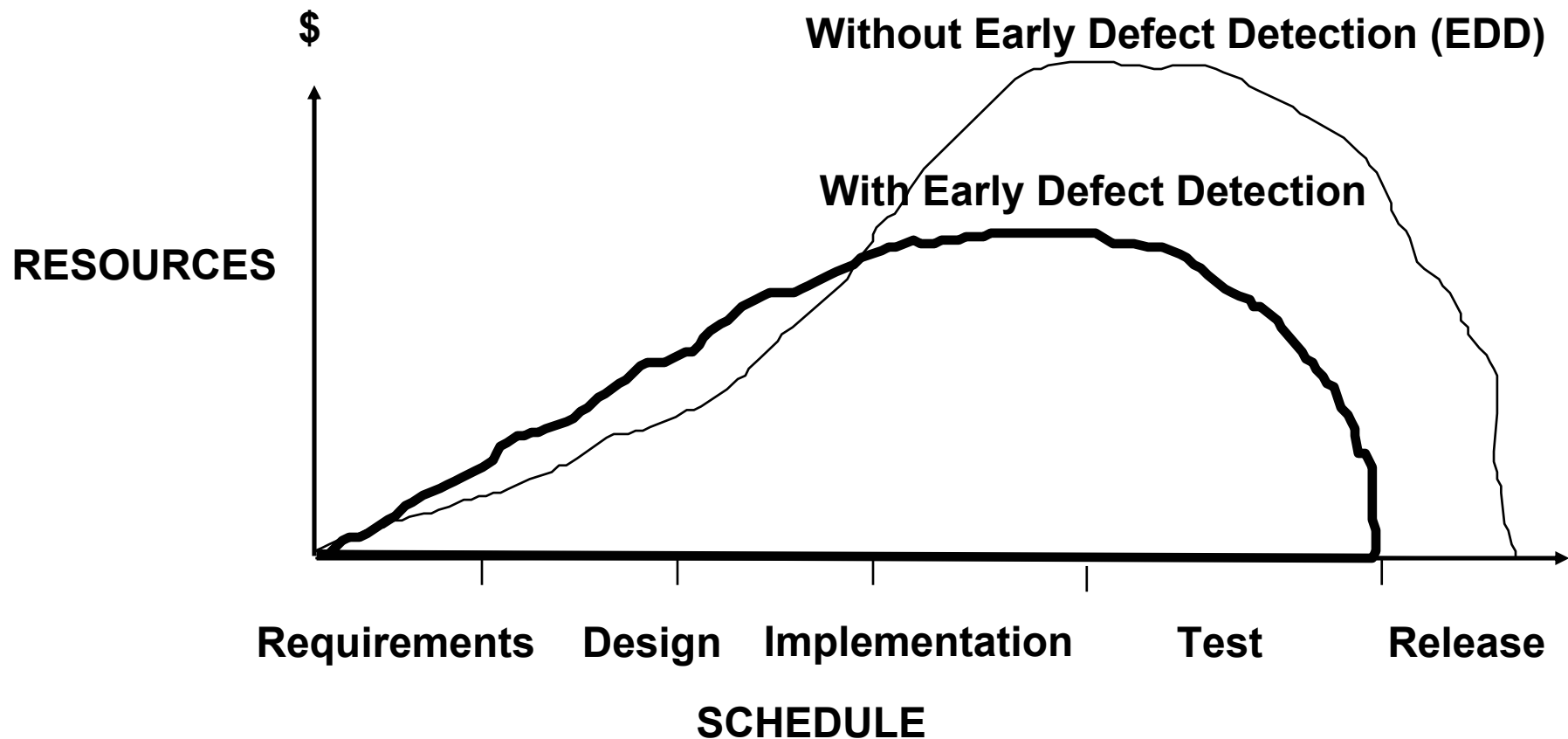
Industry Standard Cost Ratio to Fix a Defect

Defects cost less to fix when detected earlier in the process





EDD Shortens the Schedule



• Adapted from Fagan, M. "Advances in Software Inspections", IEEE Transactions on Software Engineering, July 1986



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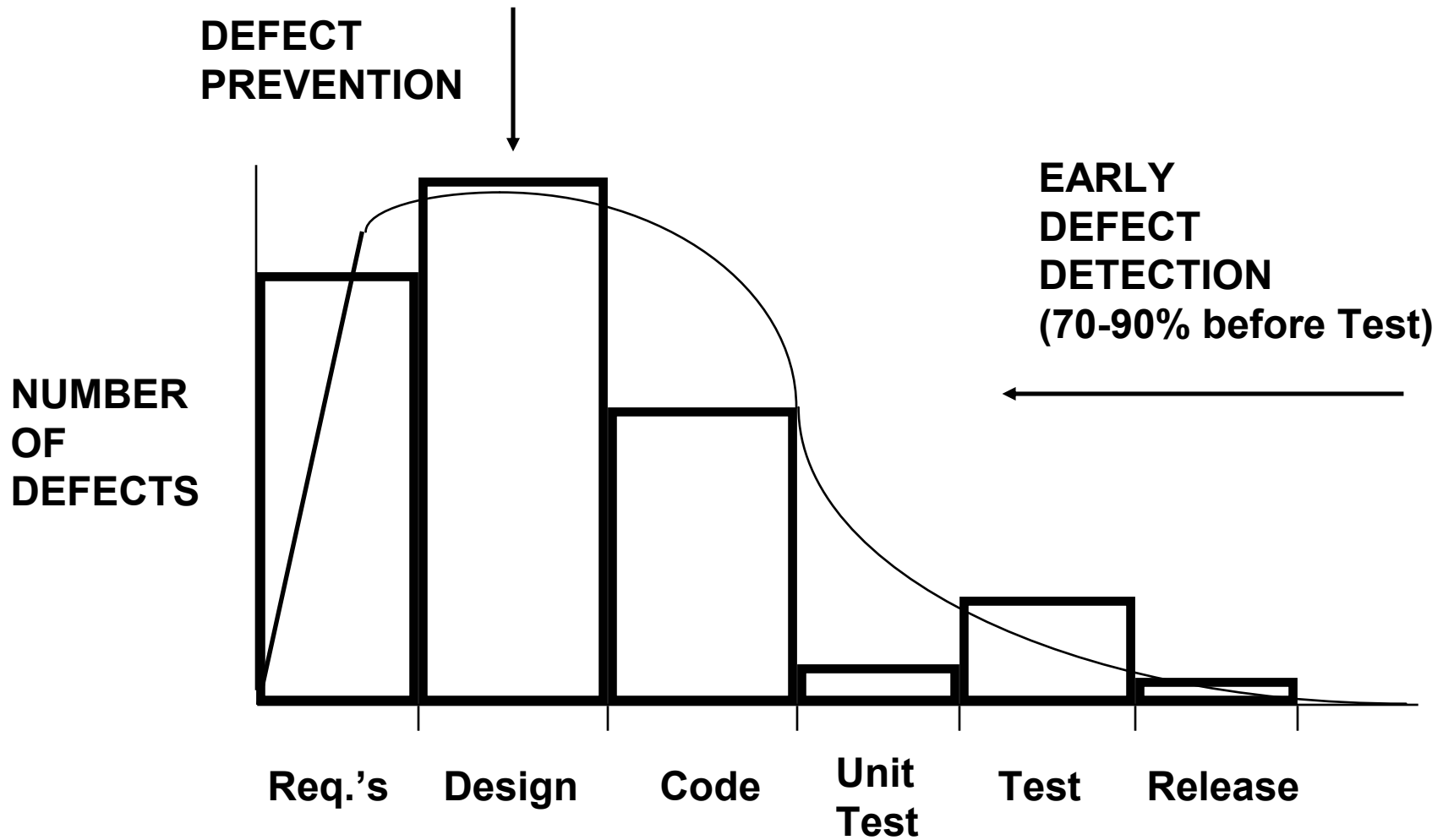
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World-Class Strategies



- Slide adapted from Olson, "A Software Quality Strategy for Demonstrating Early ROI", SSQ Journal, May 1995.



Best-In-Class EDD Benchmarks

MEASUREMENT	WORLD-CLASS BENCHMARK
Costs of Poor Quality (COPQ)	Reduced from 33% to under 10% (Goal: Cut COPQ in half in 5 years)
Defect Removal Efficiency	70-90% defect removal before test
Post-Release Defect Rate	Six Sigma (3.4 defects per million) Software Benchmark: 0.01 Defects per KSLOC)
Productivity	Doubled (e.g., in 5 years at ~20% a year)
Return on Investment	5:1 - 15:1 ROI
Schedule / Cycle Time	Reduced by 10-25% (e.g., per year)



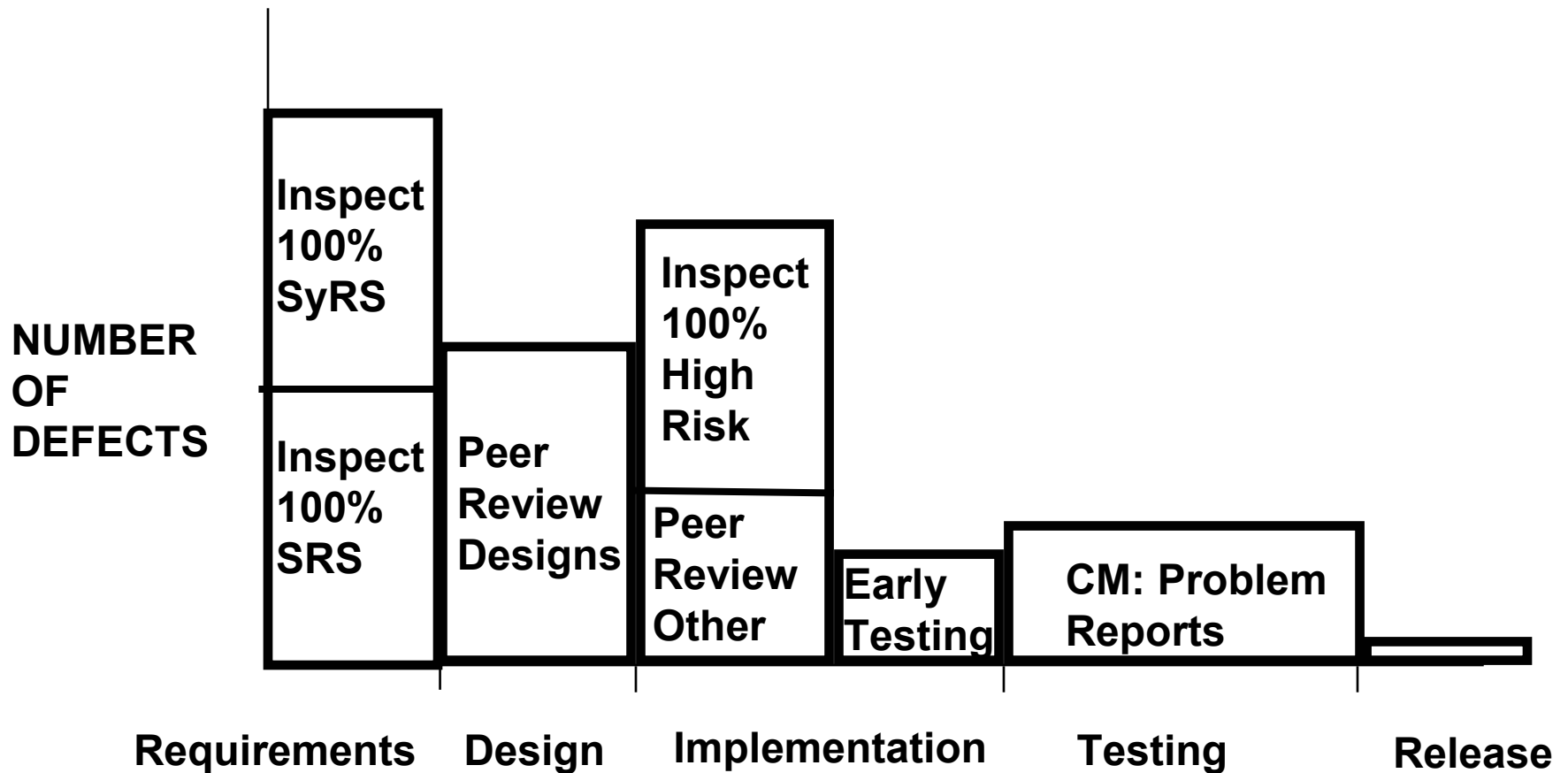
EEVVA Model

EEVVA	Review Purpose/Type
Education	Communication; Raise Issues (e.g., Walkthroughs)
Evaluation	Raise issues; Consensus (e.g., Peer Reviews)
Verification	Verify req.s; Remove defects (e.g., Inspections)
Validation	Meet user needs (e.g., User Groups)
Assurance	Product and process assurance (e.g., Audits)

•Adapted from Ebenau, *Software Inspection Process*, McGraw Hill, 1994



Example EDD Strategy: Defect Removal Efficiency (DRE)



- Slide adapted from Olson, "A Software Quality Strategy for Demonstrating Early ROI", SSQ Journal, May 1995.



EDD Strategies

Use the EEVVA Model to ensure that all reviews have a clear objective.

Use multiple EDD processes to achieve early defect detection and track defects to closure (e.g., CM, Peer Reviews, Inspections, Walkthroughs, Audits, Early Testing, etc.)

Requirements are critical documents. Formally inspect all requirement documents to remove as many defects as possible.

Formally inspect all high risk designs and code to remove as many defects as possible.

Other documents (e.g., design, code) may be peer reviewed and/or sampled.



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What are In-Process Inspections?

The purpose of in-process inspections is to detect defects early in the process in order to reduce rework and costs, and to increase quality and productivity.

In-Process Inspection:

A formal process for verifying intellectual products (in-process) by manually examining a work product, a piece at a time, by small teams of trained peers to detect defects, to ensure that the product is correct and conforms to standards, product specifications, and requirements.

•Adapted from Ebenau, *Software Inspection Process*, McGraw Hill, 1994

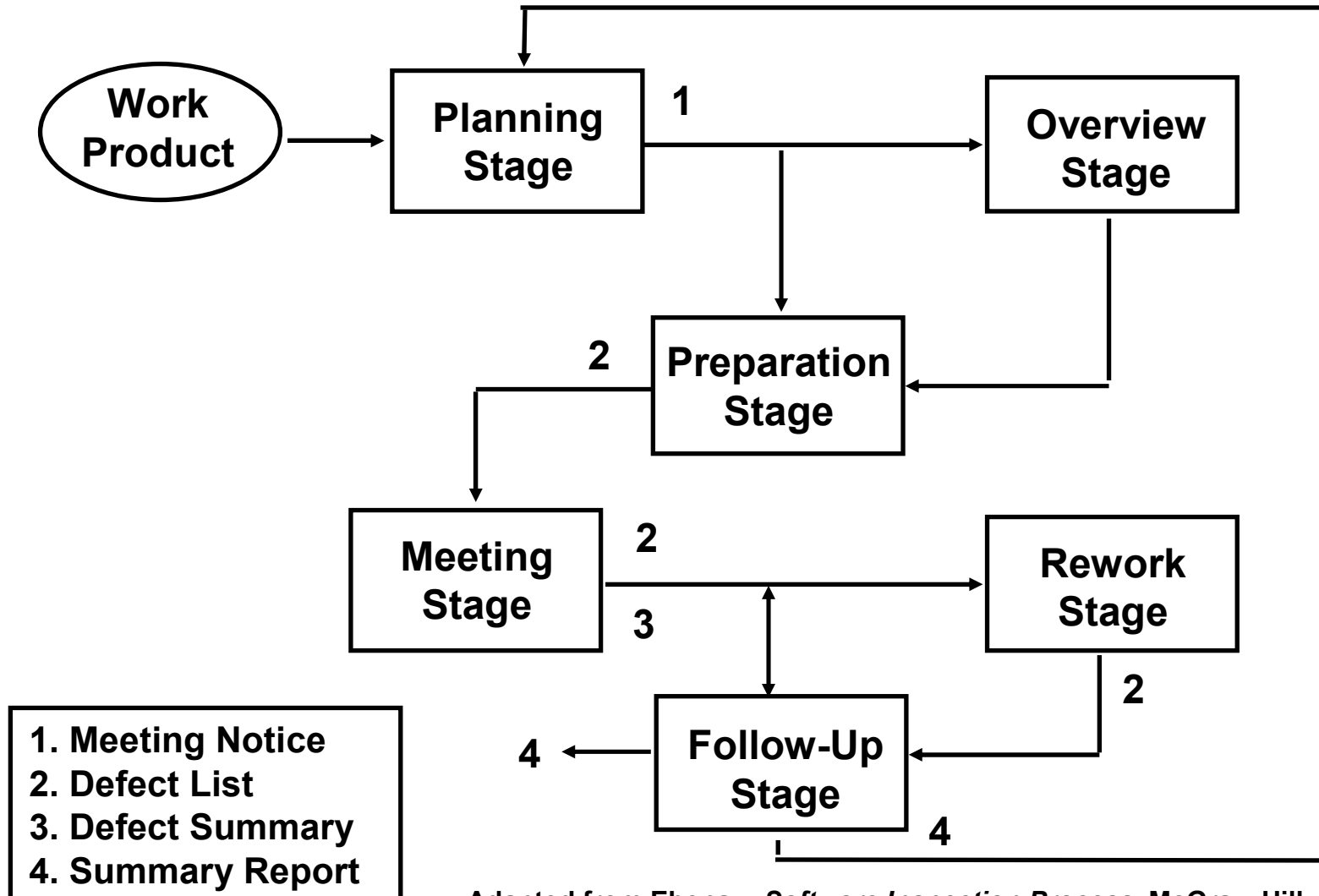


What's the Difference?

Characteristics	Inspections	Reviews	Walk-throughs
Goal	Identify defects	Reach consensus Raise issues	Reach consensus Raise issues
State of Work Product	Final draft	Work in progress	Work in progress
Process/ Measurements	Formal/ Required	Informal/ None required	Informal/ None required
Checklists/ Error Detection	Required/ Defects classified	Not required/ Not required	Not required/ Not required
Participants	Moderator; Reader; Recorder; Author; Inspectors	Author; Reviewers	Author; Reviewers
Process Owner	Moderator; Independent verification	Author	Author



Inspection Process Model



•Adapted from Ebenau, *Software Inspection Process*, McGraw Hill, 1994



World-Class Characteristics

Some world-class EDD characteristics are:

- **Well-Defined process (e.g., roles)**
- **Process models (e.g., Role/Flow, ETVX, SADT)**
- **Well-Defined measurements**
 - Internal metrics (e.g., preparation rate)
 - External metrics (e.g., productivity)
- **Data driven checklists**
- **Tailored to the organization and to the projects**
- **Data analysis, statistics, and reliability**
- **Interfaces to other processes (some examples):**
 - Configuration Management
 - Defect Prevention

• Reference: World-Class Inspection Process Guide, Olson, Timothy G., 1994



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EDD ROI Assumptions

According to industry data, in-process inspections average about **7:1 ROI**.

Historically, industry **tests in quality** (e.g., 80% of all defects are found in test).

According to industry data, defects cost **10-20 times** more when found in test.

Once a defect is identified, testing processes can take **5-20 hours** to fix and verify per defect.

Once a defect is identified, in-process inspections take about **0.5-1 hours** to fix and verify per defect.



ROI Goal/Questions/Metrics

Goal: Measure ROI (both estimated and actual)

Key Questions:

- 1. How much does a defect cost in each phase of the process (e.g., design vs. test vs. release)?**

- 2. What is the defect removal rate of the verification processes for each phase (e.g., inspections, peer reviews, testing)?**

- 3. For each project:**
 - how many total defects (estimated and actual)?**
 - how many total defects in each phase of the process (estimated and actual)?**



Key ROI Metrics

Key ROI metrics to compare verification processes:

- Total percentage of project (effort or cost)
- Work product size by phase (e.g., total pages, KSLOC, etc.)
- Number of defects (total and by phase)
- Defect density (e.g., defects per page or KSLOC)
- Effort (person hours) per page or KSLOC
- Effort per defect (fully loaded processes)
- Effort per defect (after defect is identified)
- Defect removal efficiency (DRE)
- ROI = Cost Reduction/Investment (annually)



Simple ROI Example

Calculate ROI using defect dollarization for 100 similar small projects (100 projects per year).

Defect ratio is 10X (0.5 hours to fix defect early in the process and 5 hours to fix a defect in test).

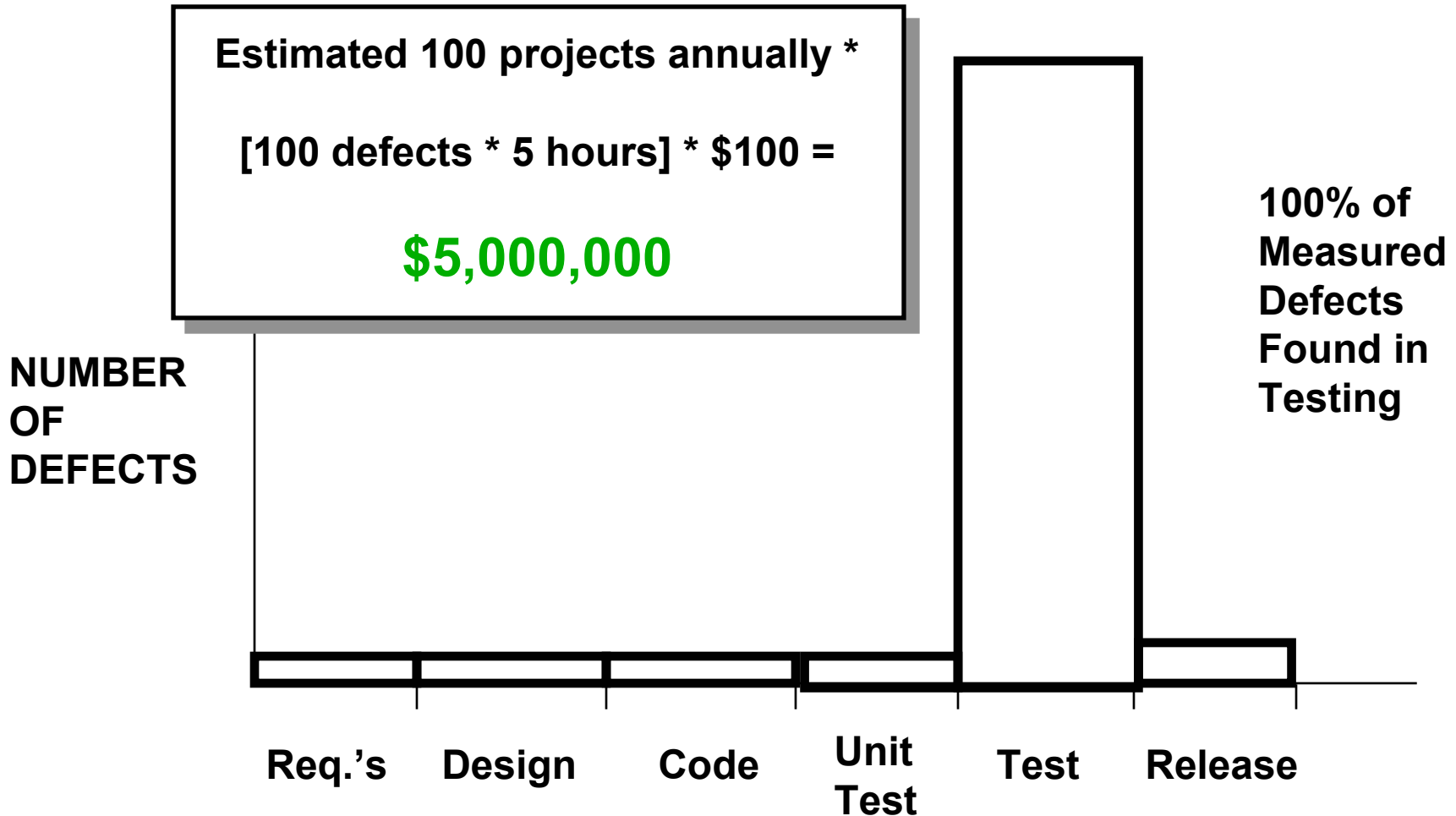
NOTE: 10X is usually the best case. Many times it is 15X or 20X.

Our simple example will assume no previous EDD, and 75% defect removal efficiency after installing EDD.

Our example will assume \$100,000 was spent on EDD training.



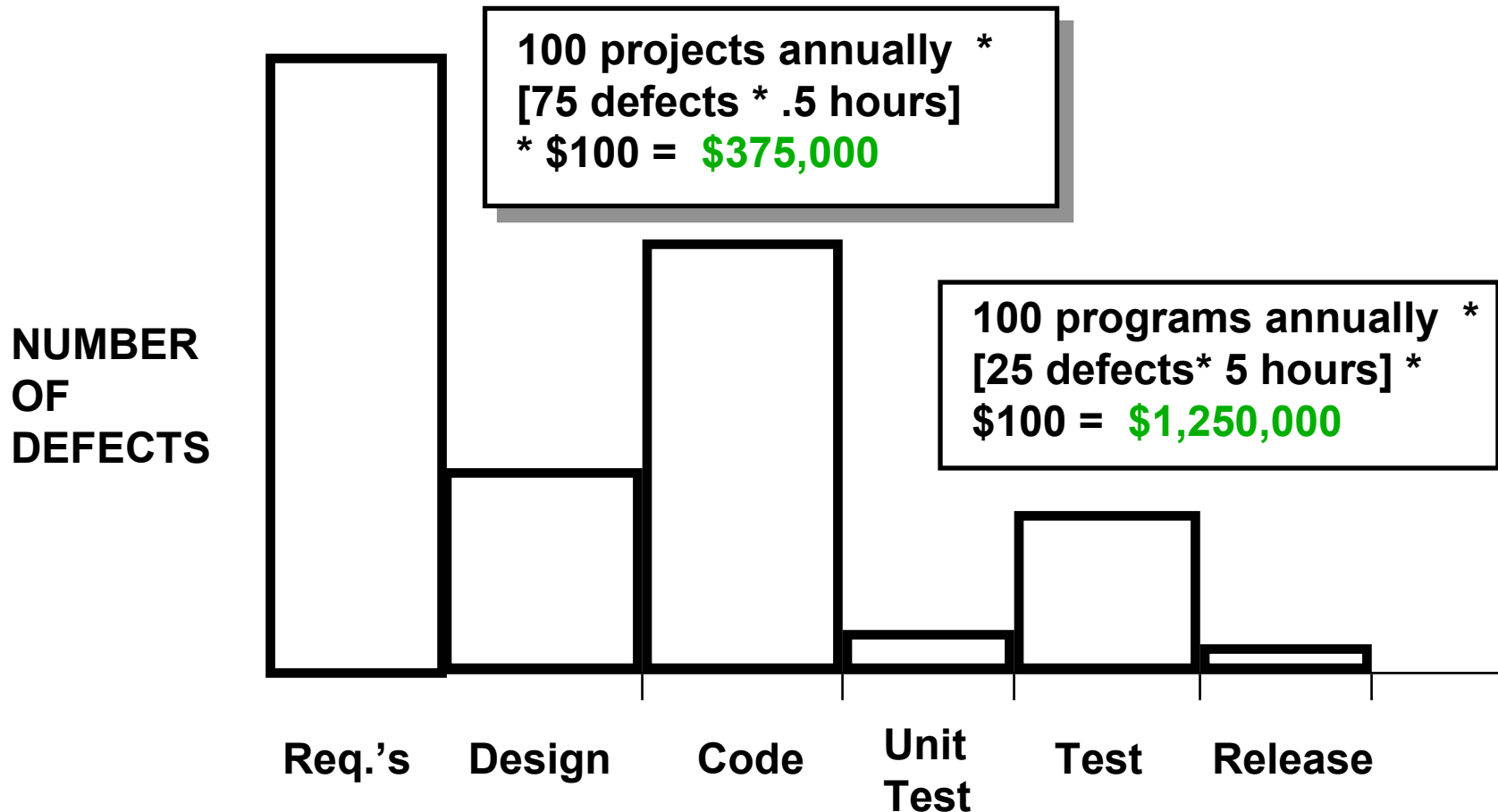
Example Pre-EDD (0% DRE): Defect Dollarization



- Slide adapted from Olson, "A Software Quality Strategy for Demonstrating Early ROI", SSQ Journal, May 1995.



Example Post-EDD (75% DRE): Defect Dollarization



- Slide adapted from Olson, "A Software Quality Strategy for Demonstrating Early ROI", SSQ Journal, May 1995.



Average 7:1 ROI

Pre-EDD (100 Projects):

- 100 defects * 5 hours = 500 hours (50,000 hours)
- 500 hours * \$100 = \$50,000 (\$5,000,000)

Post-EDD (100 Projects):

- 75 defects * 0.5 hours = 37.5 hours (3,750 hours)
- 37.5 hours * \$100 = \$3,750 (\$375,000)

- 25 defects * 5 hours = 125 hours (12,500 hours)
- 125 hours * \$100 = \$12,500 (\$1,250,000)

Investment: \$475,000 (\$100K Training + EDD Process)

Return: \$5,000,000 - \$1,725,000 = \$3,275,000

ROI: \$3,275,000 / \$475,000 = 7:1 (100 Projects Annually)



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Most of industry “tests in quality”, and testing in quality is expensive.

Early defect detection saves money, improves productivity, and reduces cycle time.

Best-in-class results are defect removal efficiency of 70-90% before testing.

In-Process inspections average 7:1 ROI which can be realized in less than 6 months.

Early defect detection and defect prevention are world-class strategies.



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