What We'll Discuss

TOPIC OUTLINE

Assessment of Safety and Risk

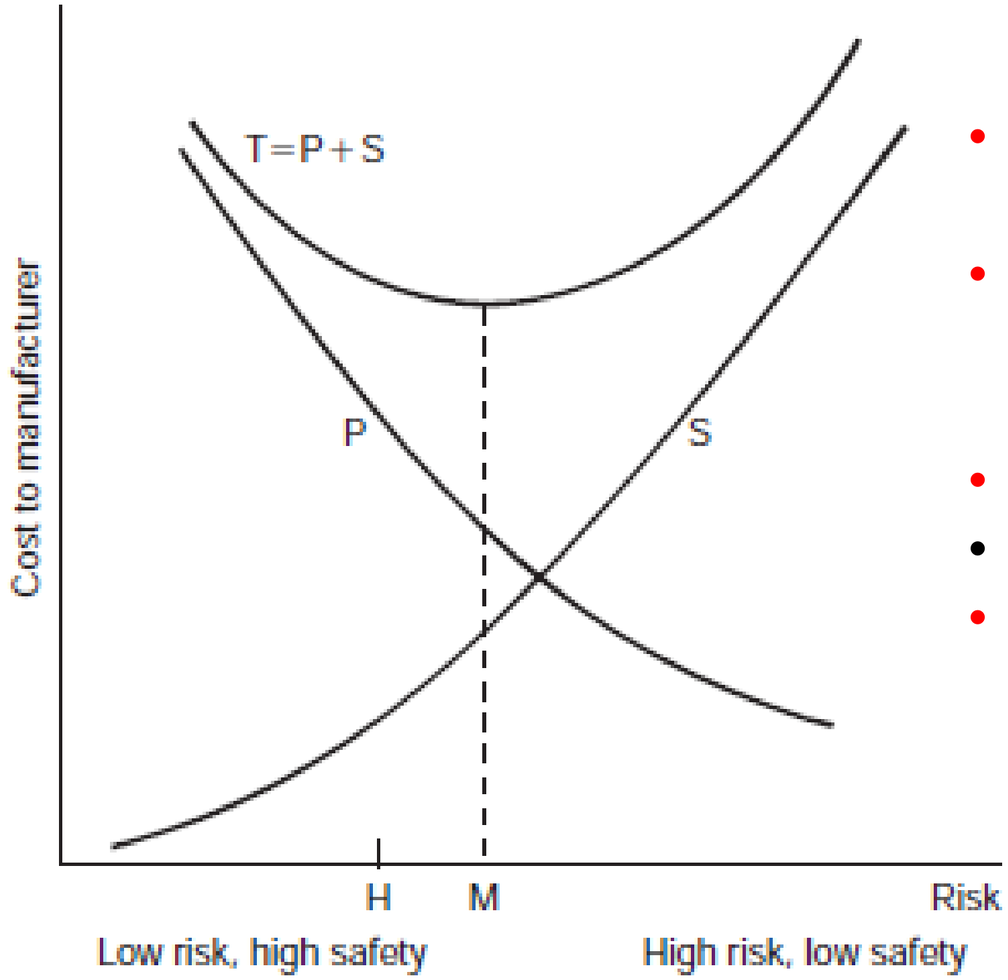
Uncertainties in Design

Risk Benefit Analysis

Assessment of Safety and Risk

- Any improvement in safety as it relates to an engineered product is often accompanied by an increase in the cost of that product.
- Conversely, products that are not safe incur secondary costs to the manufacturer beyond the primary (production) costs that must also be taken into account.
- Costs associated are: warranty expenses, loss of customer goodwill and even loss of customers, litigation, and possible downtime in the manufacturing process.
- It should now be clear that ‘safety comes with a price’ only.

Assessment of Safety and Risk



- P - primary cost of product, including cost of safety measures
- S- secondary costs, including warranties, loss of customer goodwill, litigation costs, costs of downtime, and other secondary costs.
- T – Total Cost (T=P+S)
- Minimum total cost occurs at M
- H- Highest acceptable risk may fall below risk at least cost (M),

Assessment of Safety and Risk

- The aim of the risk assessment process is to remove a hazard or reduce the level of its risk by adding precautions or control measures, as necessary.
- By doing so, you have created a safer and healthier workplace.

Uncertainties in Design

- Uncertainties regarding materials and skills required in the manufacturing
- Changing economic realities.
- Unfamiliar environmental conditions like very low temperature
- A decision on maximizing profit or maximizing the return on investment.
- Uncertainties about applications like dynamic loading instead of static loading, vibrations, wind speeds.
- The available standard data on items like steel, resistors, insulators, optical glass, etc are based on statistical averages only.

Testing strategies for safety

Some commonly used testing methods:

- Using the past experience in checking the design and performance.
- Prototype testing: Here the one product tested may not be representative of the population of products.
- Tests simulated under approximately actual conditions to know the performance flaws on safety.
- Routine quality assurance tests on production runs.

Testing strategies for safety

The above testing procedures are not always carried out properly. Hence we cannot trust the testing procedures uncritically.

In such cases, a simulation that traces hypothetical risky outcomes could be applied.

Scenario Analysis (Event -> Consequences)

Failure Modes & Effects Analysis (Failure modes of each component)

Fault Tree Analysis (System Failure -> Possible Causes at component level)

Example of Testing for safety

Failure modes and effect analysis (FMEA) :

- This approach systematically examines the failure modes of each component, without however, focusing on relationships among the elements of a complex system.

Fault Tree Analysis (FTA) :

- A system failure is proposed and then events are traced back to possible causes at the component level. The reverse of the fault-tree analysis is ‘event – tree analysis’.

THANK YOU