GE105: Introduction to Engineering Design

Need Analysis – 1/2

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The Role Of The Design Engineer

in a civil engineering context

Design Engineer
(Civil)

Owner
(Landlord)

User/Operator
(Tenant)

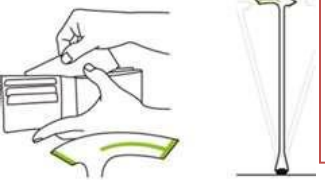
Manufacturer
(Builder)

Design Process

Customer needs a solution to a problem

Requirement analysis

System Design
(Conceptual Design + Preliminary Design)

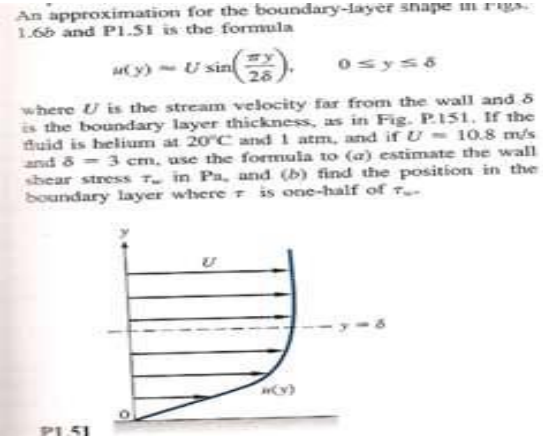


Detailed design and test

System integration and product test

Properly functioning system

Requirement Analysis is usually done by upper management



Exam Problem Definition

So What are my Requirements?

Requirement analysis

Customer needs a solution to a problem

↓

Assess needs

↓

Statement of problem

↓

Specify design requirements

↓

Requirement specifications

Requirement Analysis

What Do I Need?!

Customer needs a solution to a problem

↓

Assess needs

↓

Statement of problem

↓

Specify design requirements

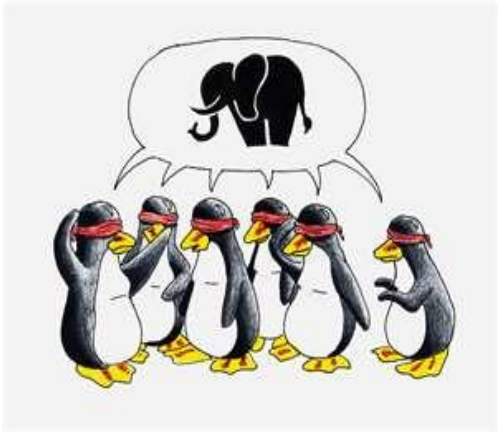
↓

Requirement specifications

Needs Assessment

- **The aim is not to solve the problem but to understand what the problem is.**
  - **What does this client want?**
  - **What is the problem that the design is to solve?**

- **The objectives (goals) and constraints of the problem should be identified.**
  - **Objectives: summary of the needs that the design is to satisfy.**
  - **Constraints: the design must satisfy (takes logical values, 0 or 1, helps to decide acceptable or not)**



Whose my Neighbor?!

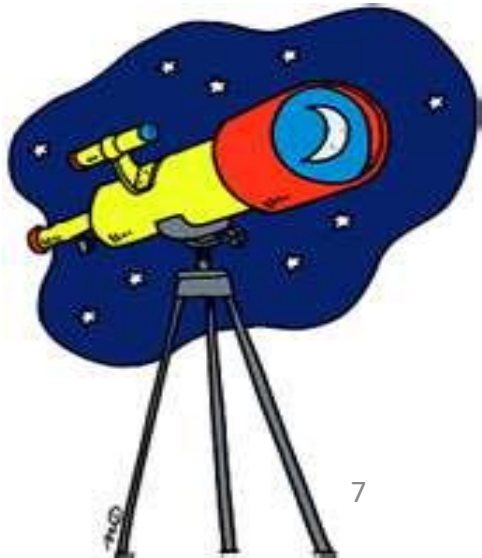
Human Target!

Constraints!

How to Assess Needs? (1/2)

- Question the customer
  - To define the design problem
  - To understand budget and schedule constraints
  - Reliability and maintenance constraints

- Explore resources
  - Expertise (knowledge and experience)
  - Technical literature (books, journals,www)
  - Measurement and testing equipments (equipment suppliers)
  - Similar designs (competitors, patent search)



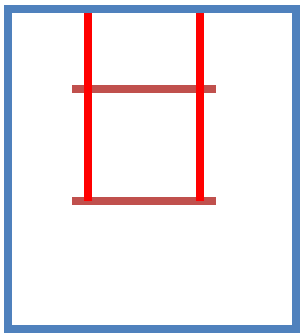
How to Assess Needs? (2/2)

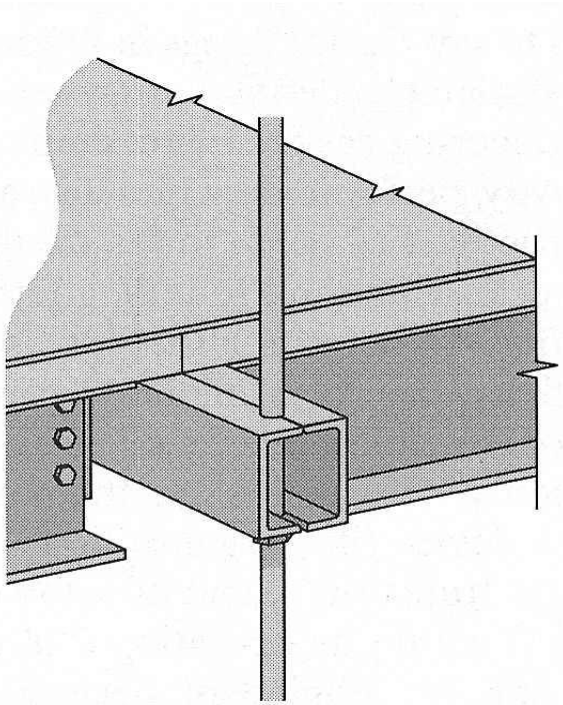
- Search legal and regulatory restrictions
  - Allocation of frequency bands
  - Restriction on tower heights
  - Environmental impacts
  - Safety

- Manufacturability issues

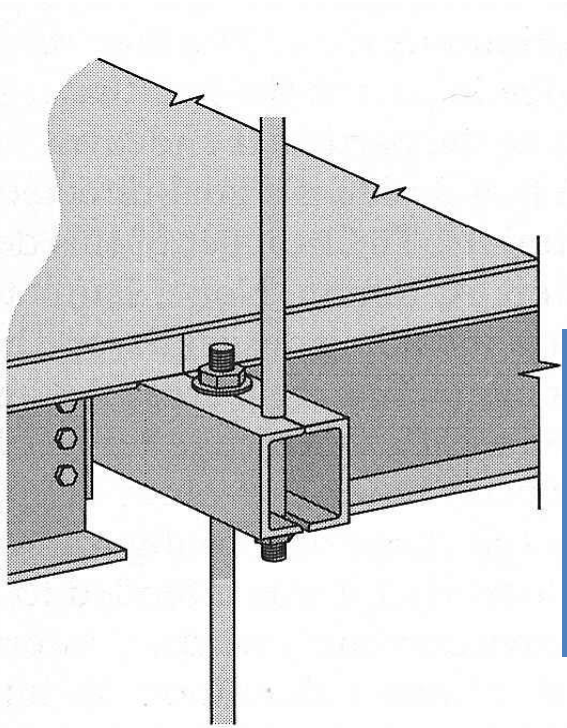
Importance of Manufacturability and Communication

A miscommunication within a building construction team lead to this accident due to the wrongful interpretation of the design.

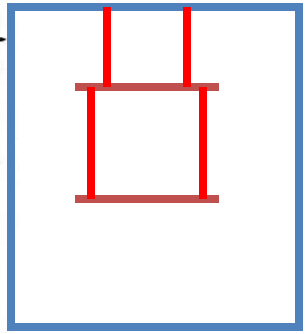




Original Detail



As Built



Second floor collapsed, 114 people died

Requirement Analysis

Homer: Oh my God, I'm gonna be eaten alive by a *SHARK*!

The SHAARK: Oh my God, Homer Simpson is gonna land on my head!!

Customer needs a solution to a problem

↓

Assess needs

↓

Statement of problem

↓

Specify design requirements

↓

Requirement specifications

Statement of the Problem (1/3)

- In the language of the customer, normally straightforward, non technical and non quantifiable (measurable).

When Asked to Write a Problem Statement, you should…

Problem Statement: Re-write the original problem in your own words without using highly technical terms.

(as if it's the language of the customer)

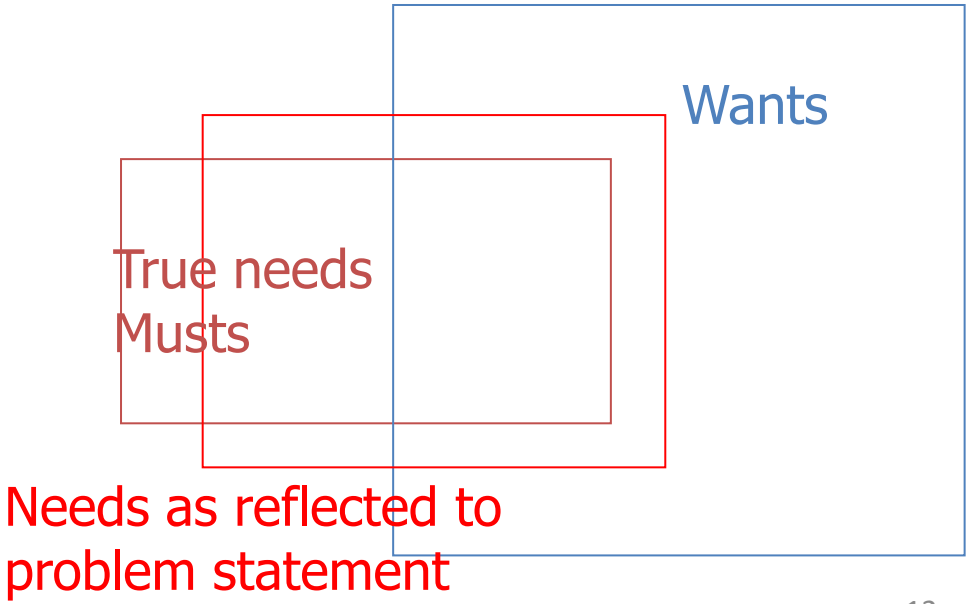
The problem statement paragraph should be at least 3-5 lines long!

Statement of the Problem (2/3)

- Tools that help
  - Question the customer
  - Differentiate Needs and Wants

Most times the customer himself does not know what he wants exactly nor what is tangible (realistic) in his case and

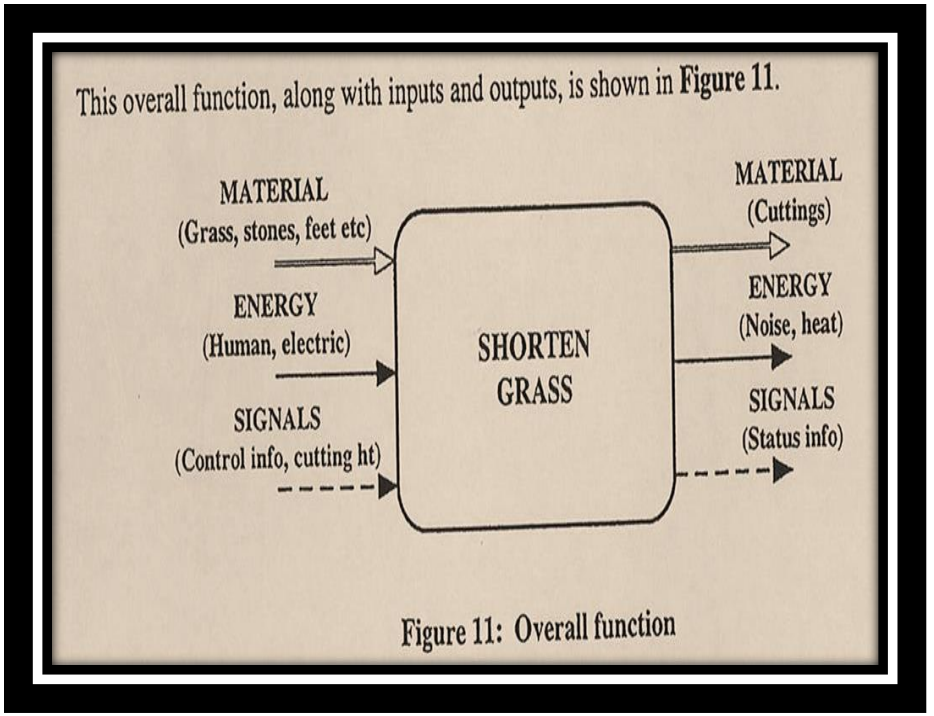
the engineer therefore needs to clarify the situation…



Statement of the Problem (3/3)

- Make Input/Output Analysis
- Preview the user interface and operation of the device

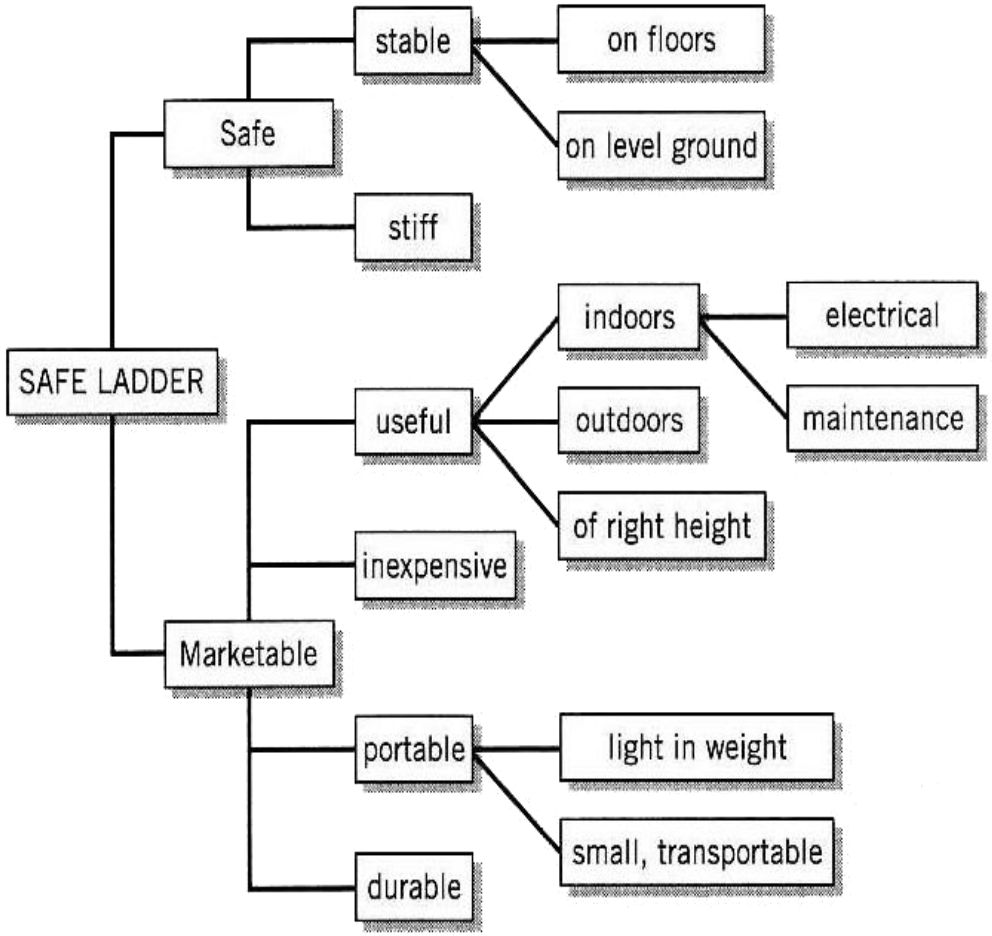
Internet User Interface



Input/Output Analyses for Lawnmower

Objective Trees

- Make a list of objectives according to the assessed needs and restrictions
- Group the relevant objectives
- Form a hierarchical tree structure



Example Objectives Tree for a Safe Ladder