



كلية الهندسة  
جامعة الملك سعود



King Saud University  
College Of Engineering



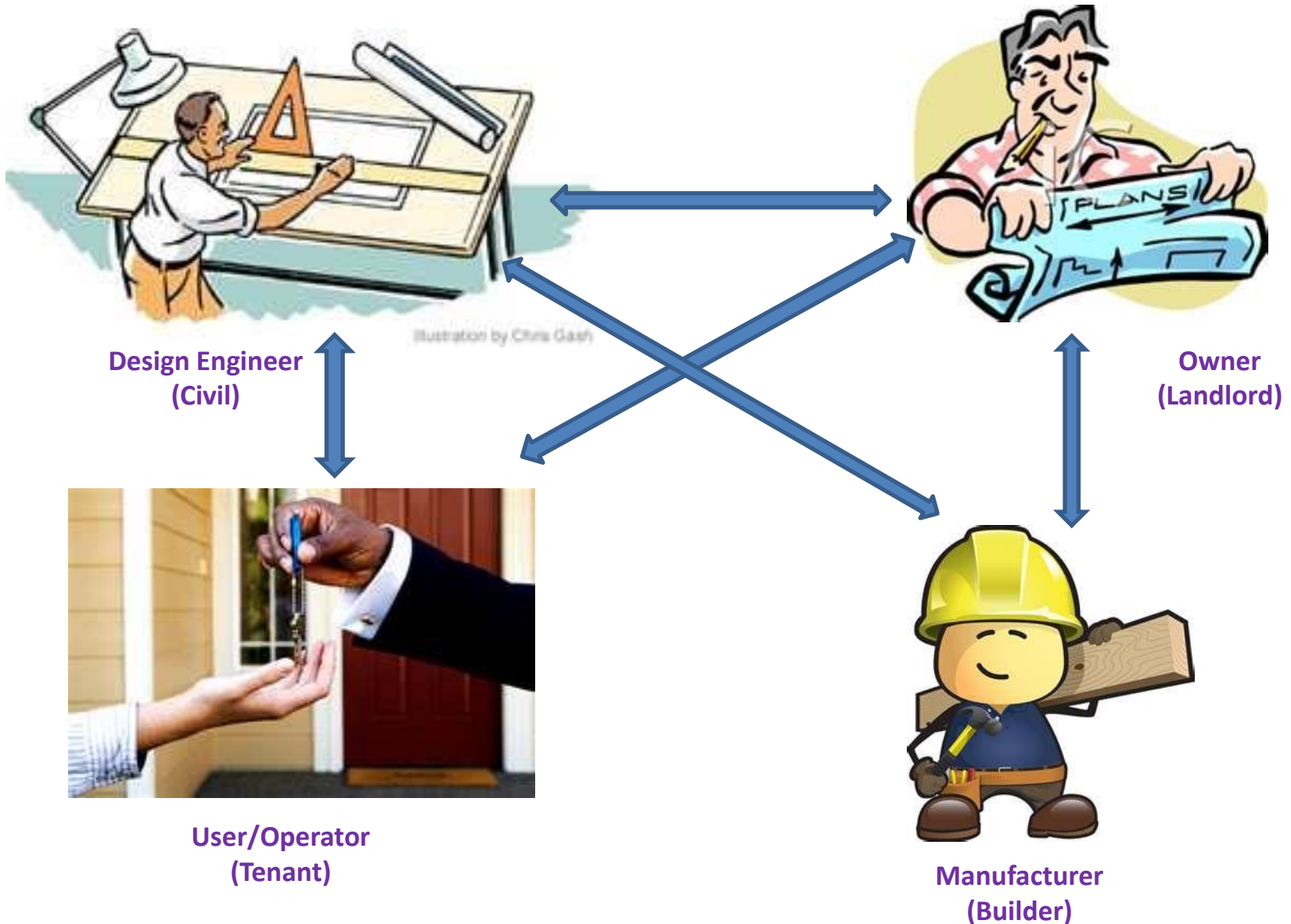
# GE105: Introduction to Engineering Design

## Need Analysis – 1/2

Dr. Mohammed A. Khamis

October 9, 2016

# The Role Of The Design Engineer *in a civil engineering context*



# 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

**Requirement Analysis is usually done by upper management**

Customer needs a solution to a problem

Assess needs

Statement of problem

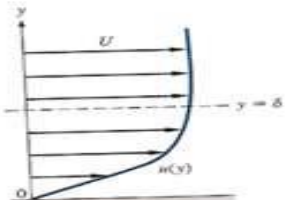
Specify design requirements

Requirement specifications

An approximation for the boundary-layer shape in Figs. 1.6b and P1.51 is the formula

$$u(y) = U \sin\left(\frac{\pi y}{2\delta}\right), \quad 0 \leq y \leq \delta$$

where  $U$  is the stream velocity far from the wall and  $\delta$  is the boundary layer thickness, as in Fig. P1.51. If the fluid is helium at 20°C and 1 atm, and if  $U = 10.8$  m/s and  $\delta = 3$  cm, use the formula to (a) estimate the wall shear stress  $\tau_w$  in Pa, and (b) find the position in the boundary layer where  $\tau$  is one-half of  $\tau_w$ .



P1.51

**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



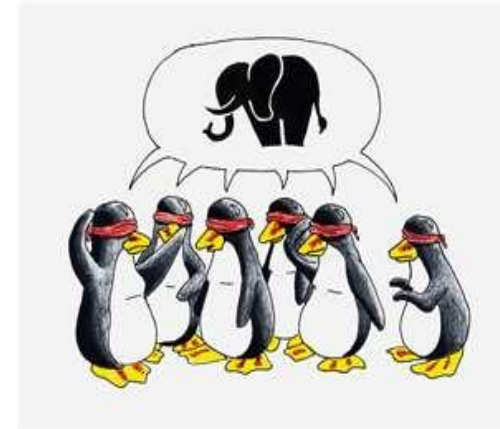
Requirement specifications



**What Do I Need?!**

# 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?!**



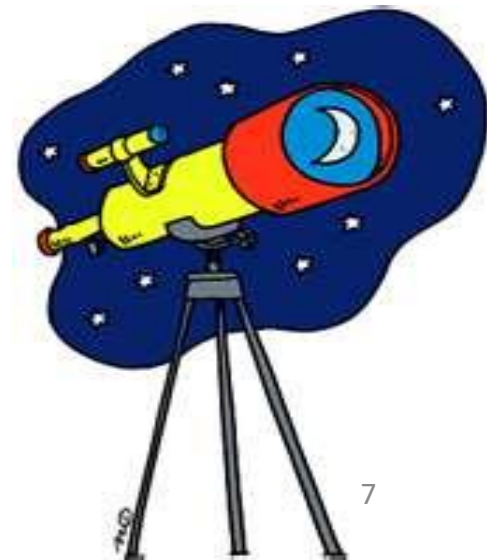
**Human Target!**



**Constraints!**<sup>6</sup>

# 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)

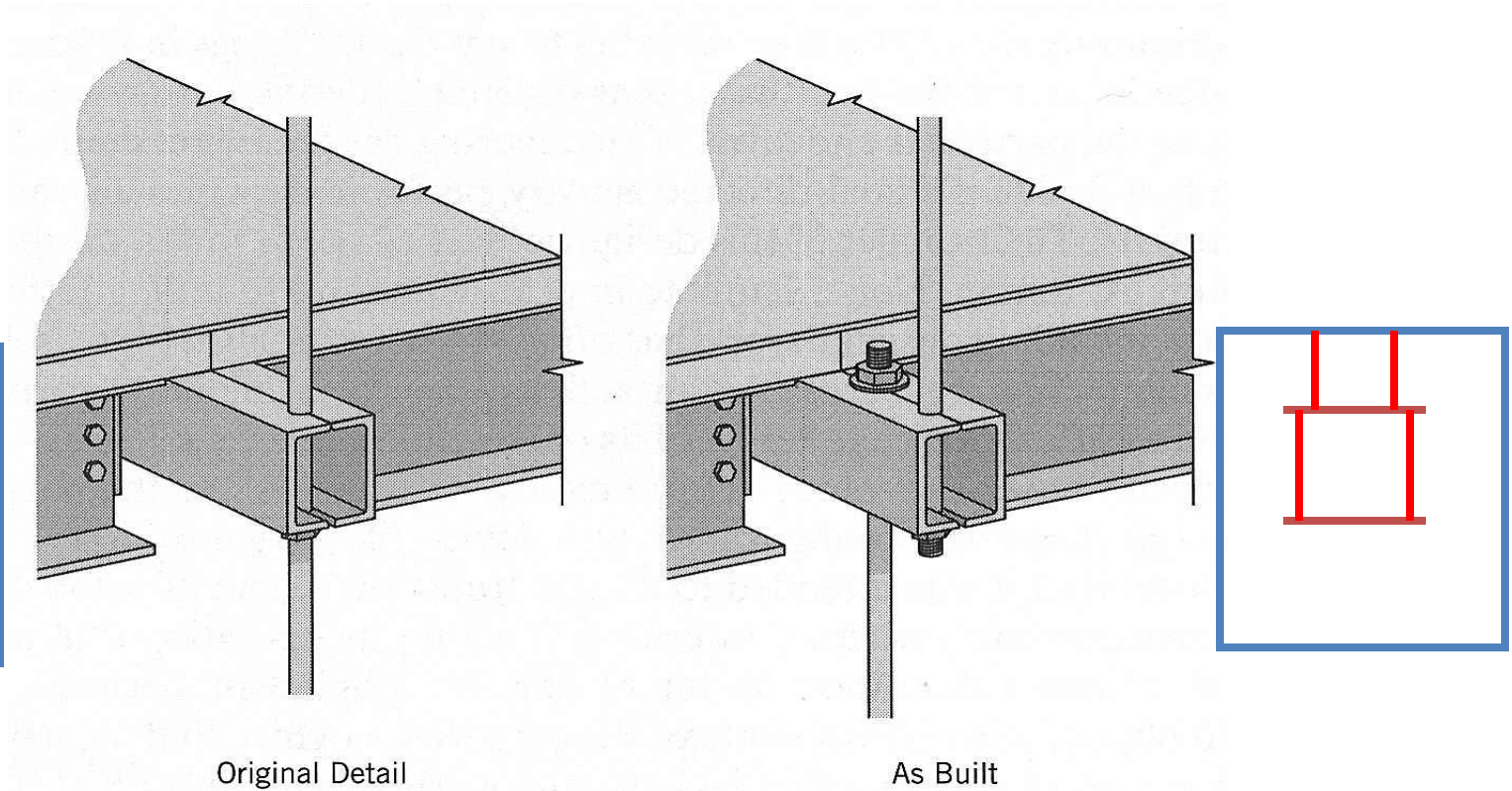
- Search legal and regulatory restrictions
  - Allocation of frequency bands
  - Restriction on tower heights
  - Environmental impacts
  - Safety
- Manufacturability issues





# Importance of Manufacturability and Communication

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



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)**

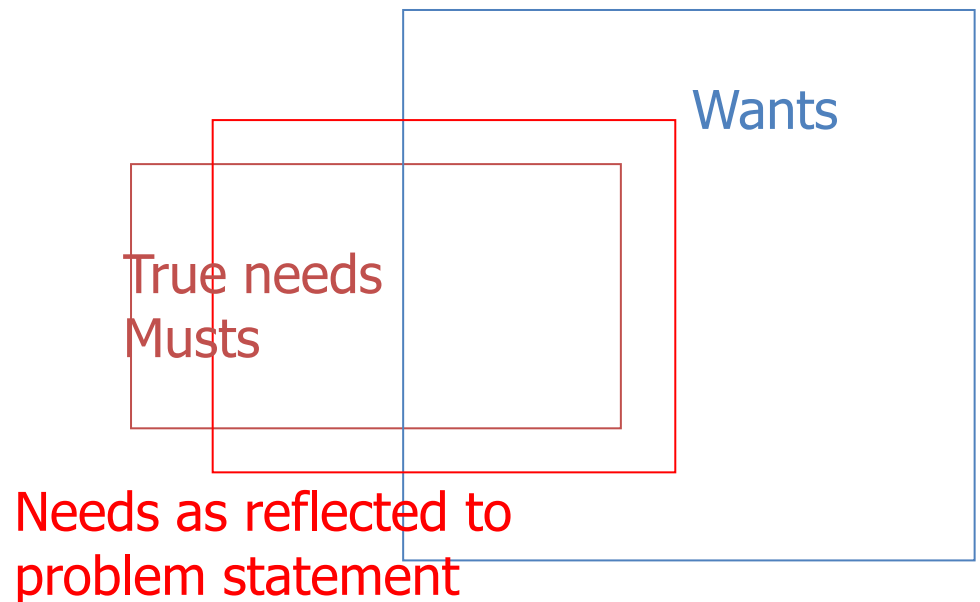
**The problem statement paragraph should be at least 3-5 lines long!**

# 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...

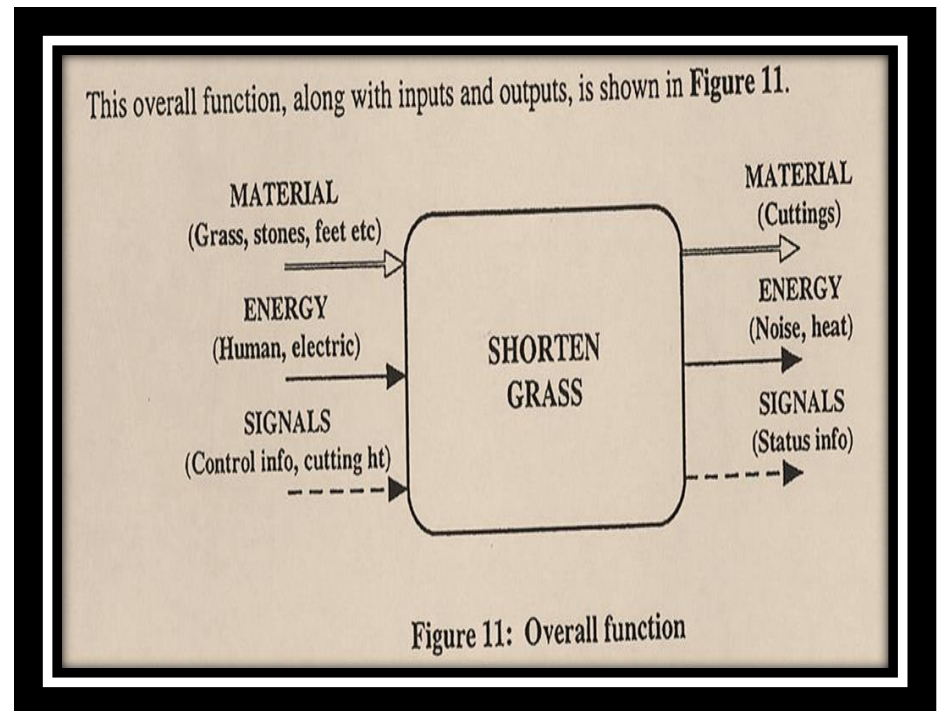


# Statement of the Problem (3/3)

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

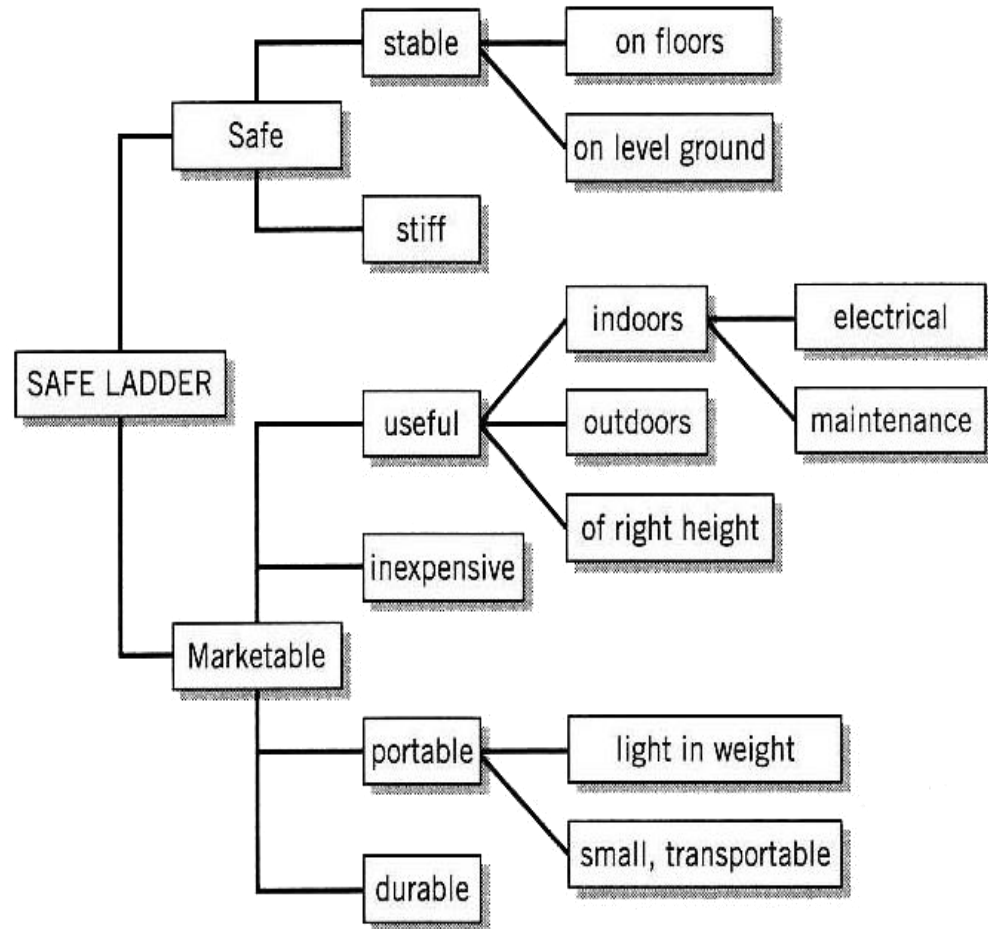


**Internet User Interface**



# 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**