MEEN 10060: Design & Materials

Course Introduction

Week 1, Lecture 1

Dr. James O'Donnell

Dr. Ken Stanton

School of Mechanical & Materials Engineering

All design material courtesy of David FitzPatrick

Logistics

Who is involved ?

- Module Coordinator (Design):
  - Dr. James O'Donnell james.odonnell@ucd.ie
    Rm 311, Engineering & Materials Science Centre
- Design Lab:
  - Instructor: Dr. James O'Donnell
  - TA: Mark Ruddy mark.ruddy@ucdconnect.ie
  - TA: Su Quanliang suquanliang@gmail.com
- CAD Lab:
  - Instructor: Mr. Abdollah Malekjafarian Abdollahmalekjafarian@ucdconnect.ie
  - TA: Dr James Barry james.barry@ucdconnect.ie
  - TA: Conor Dunne conordnn@yahoo.ie

Who is involved 2 ?

- Materials Lectures:
  - Dr. Kenneth Stanton Kenneth.Stanton@ucd.ie

MEEN10060: Lectures – When ?

Lectures: (Health Sciences Building)

- Mon & Weds: 10:00-10:50

NOTE: No lecture on Mon 21st April (**Easter Monday**)

Design Lab

Design/Materials Lab (Starts in week 3: w/c 4th Feb)

- Tue: **15:00-16:50** (Split Odd / Even weeks)
- Thu: **15:00-16:50** (Split Odd / Even weeks)

Offering 1 starts in Week 3 on **Tuesday**

(Newstead - G70; G87 & G88)

Offering 2 starts in Week 3 on **Thursday**

Newstead - G70; G87 & G88

NOTE: Lab Offerings will be redefined due to capacity

MEEN 10060: CAD Labs

CAD (Newstead – F15 (Tutorial); F20 & G80 (Lab))

- Tutorial – Thu: **14:00-14:50** (Split Odd / Even weeks)
- Lab - Thu: **15:00-16:50** (Split Odd / Even weeks)

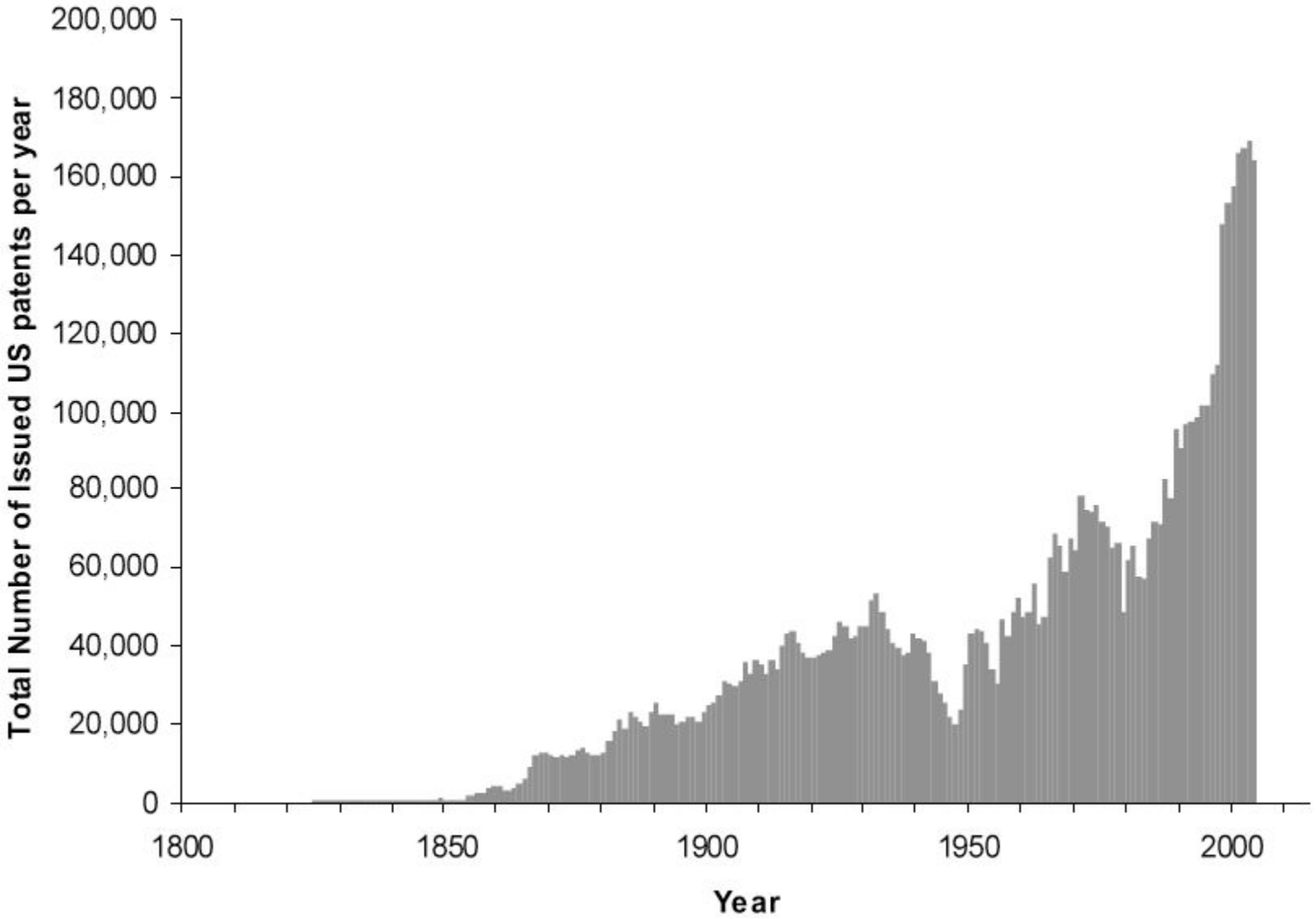
NOTE: Starts **Thurs 23rd** January for Offering 1

Starts **Thurs 30th** January for Offering 2

MEEN10060 - Why ?

- Provide experience in developing an Engineering design solution for a given problem.
- Build basic understanding of materials
- Foster the development of skills required in design:
  - Problem solving & Creative thinking
  - Application of theory and analytical tools
  - Project management – design, manufacture & test
  - Teamwork & communication skills
- Interdisciplinary – role of materials in design

Innovation is becoming increasingly important



Automatable human roles are in danger of disappearing

Google car for automated driving

Automated airport check in

Beam Master for semi-automated steel fabrication:
http://www.youtube.com/watch?v=vahEYCulVWM

What are your opinions on Amazon Drone?

10 most sought after jobs of 2013 (Forbes)

1. Software Developers (Apps & Systems Software)
2. Accountants and Auditors
3. Market Research Analysts and Marketing Specialists
4. Computer Systems Analysts
5. Human Resources, Training & Labor Relations Specialists
6. Network and Computer Systems Administrators
7. Sales Representatives (Wholesale and Manufacturing, Technical and Scientific)
8. Information Security Analysts, Web Developers and Computer Network Architects
9. Mechanical Engineer
10. Industrial engineer

MEEN10060 - What You'll Learn

On completion of this module, students will:

(a) Be familiar with the typical Engineering Design process.

(b) Be aware of the key characteristics and selection criteria for selected families of materials.

(c) Have developed capacity for problem solving and creative thinking.

(d) Have developed teamwork and communication skills.

Module Assessment

- No exam
- MCQ – Based on lecture content 30%
- Lab-based Activity 70%
  - CAD Lab (30%)
    - Individual - 6 exercises over the semester
  - Design, Build & Test (DBT) (30%)
    - Team based (random assignment to teams)
  - DBT Related Assignment (10%)
    - Individual
- NOTE: Attendance weighting will be applied to Team lab grade.

Key Resources

Text (Design):

- **Dieter & Schmidt – Engineering Design (4th Ed.) McGraw Hill International**

  (ISBN 978-007-127189-9)

  – Note: 1st, 2nd & 3rd Editions (1 copy ea.) currently in UCD Library: James Joyce Library – GEN 620.0042/DIE

Software (ArchiCAD):

- Will be used in CAD Lab
- Available for download from UCD IT Services for own laptop/PC.

Design – An Introduction

James O'Donnell

School of Mechanical & Materials Engineering

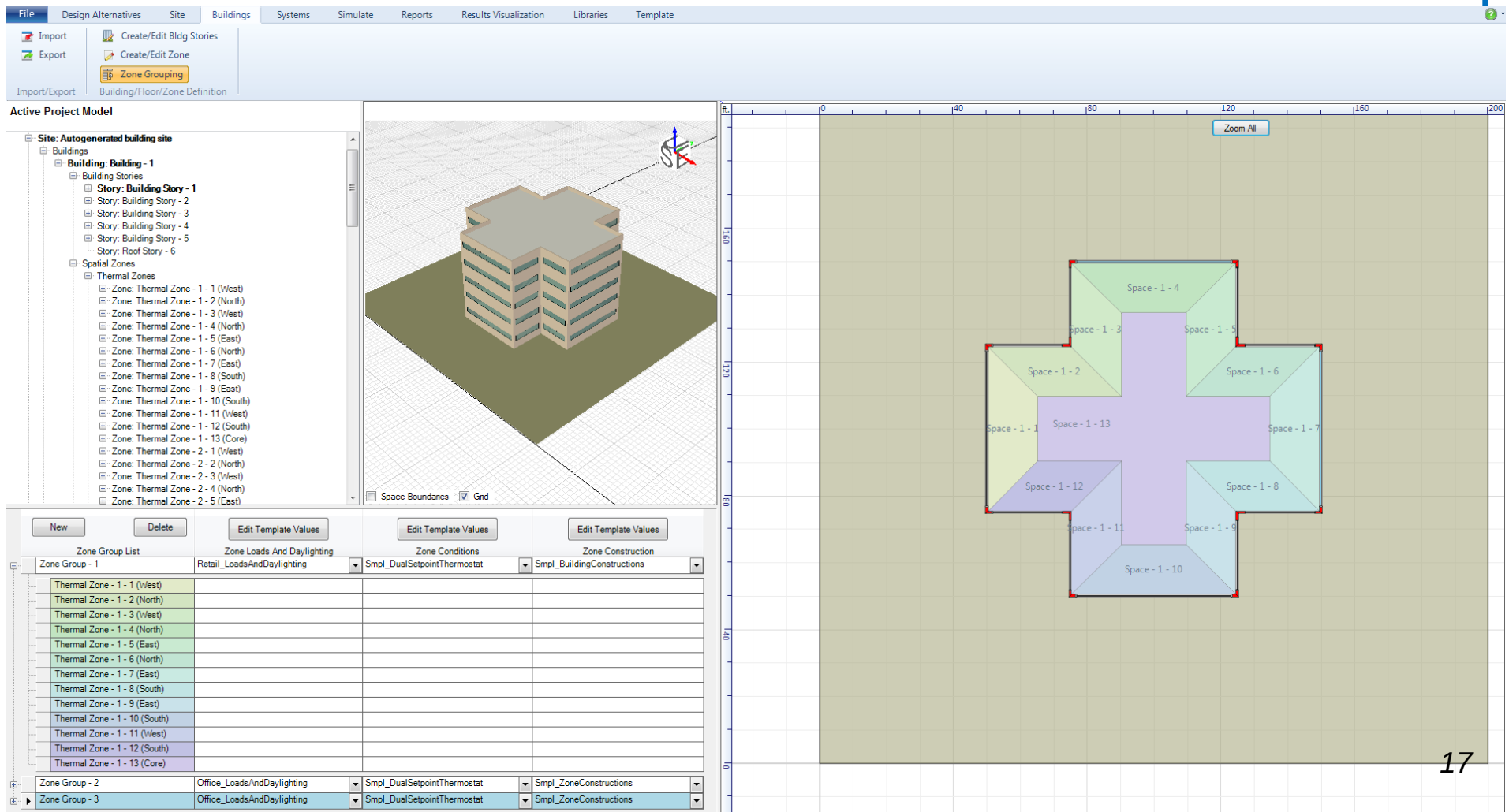
All design material courtesy of David FitzPatrick

James O'Donnell

- Subject Areas
  - Interoperability in the Architecture/Engineering/Construction/Facilities Management Domain
  - Building Performance Simulation (BPS) for design and retrofit design of buildings
- Summary Biography
  - Civil engineering primary degree
  - Energy performance of buildings based research degree
    - 'Holistic building performance appraisal'
  - Industrial Software Development
  - Academia

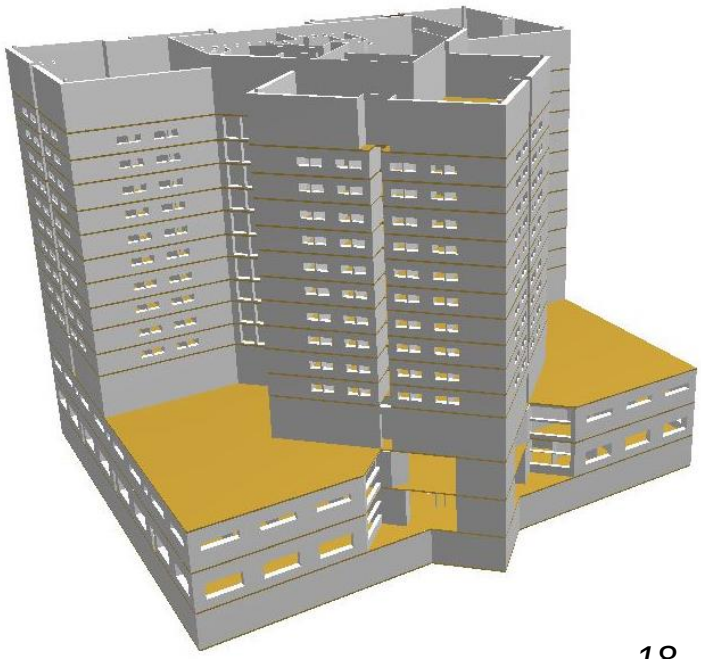
Design Background

- Graphical User Interface (GUI), Simergy, for Building Performance Simulation engine



Design Background

- Graphical User Interface (GUI), Simergy, for Building Performance Simulation engine
  - User workflows
  - Template development
  - Management of domain experts (beta tester)
  - Interface look and feel
- Design Experience
  - Building performance simulation models for numerous buildings
- Consultancy
  - Energy Modelling for Stanford University

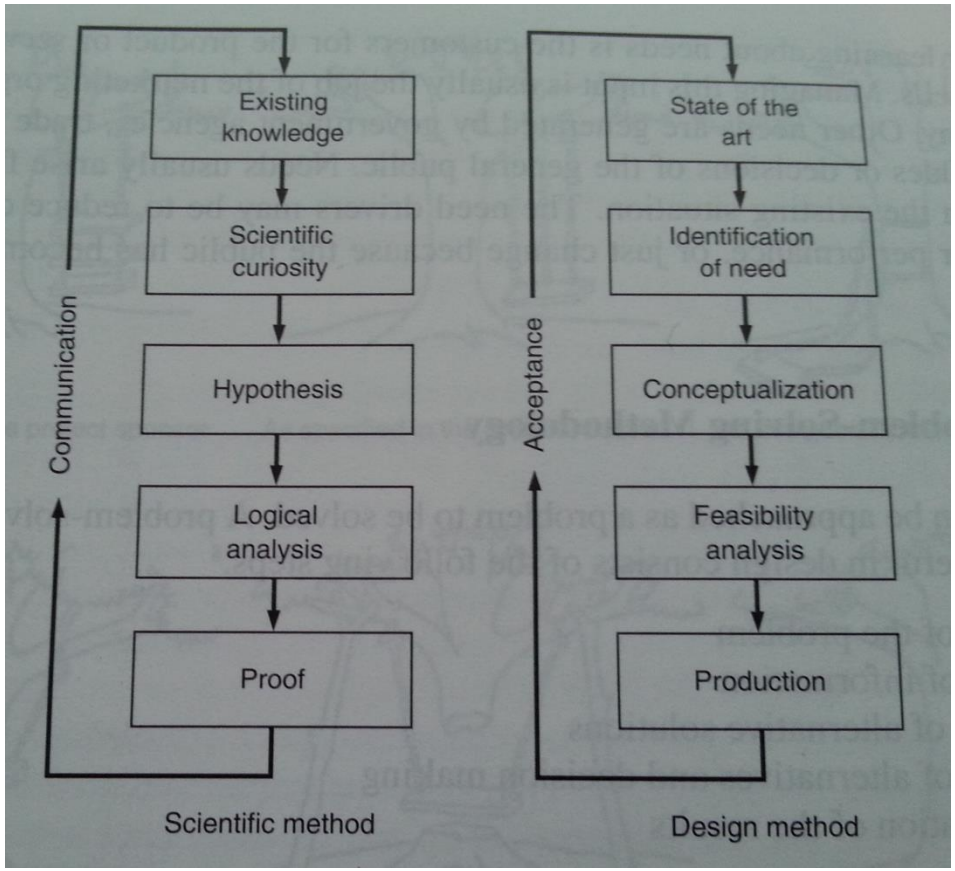


Big Idea for Today's Lecture

The fundamentals of the design process

What is 'Design' – Science & Technology?

- Providing solutions to a 'Need'
  - Development and application of technology
  - Same as Science?



What is 'Design' – Science & Technology?

"A scientist will be lucky if he makes one creative addition to human knowledge in his whole life, and many never do. A scientist can discover a new star but he cannot make one. He would have to ask an engineer to do it for him."

G.L. Glegg, "The Design of Design", Cambridge University Press, 1969.

Designing for end users

'human factors engineering' – *'…uses the sciences of biomechanics, ergonomics and engineering physchology to assure that the design can be operated efficiently by humans.'*

(Dieter & Schmidt, Ch1, pg 17)

What is 'Design' – Products ?

- Historical (Survival, Safety, Quality of Life):
  - Flint arrow heads
  - The wheel
  - Ceasar's bridge across the Rhine (400m long, 7-9m wide)
  - The steam engine
  - Light bulb
  - Electronic systems & Computer Technology

- Modern addn. - Creating a 'Need' (Marketing !):
  - Fashion & related products
  - Mobile phone upgrades
  - Short life-cycle products (Car < 7 years)
- Ultimately – the designed solution must meet a need.

Design - An Evolving Definition

- '**Design establishes and defines solutions** to and pertinent structures for problems not solved before, or new solutions to problems which have been solved in a different way' (Blumrich, 1970)

- '**Design is the** purposeful, human **means of realising a product or process** that satisfies acknowledged and stated criteria' (Gibson, 1993)

- '**Good design** is not simply about aesthetics or making a product easier to use. It **is a central part of business process**, adding value to products and creating new markets' (Tony Blair, UK PM, 1999)

4 C's of Design

Creativity

Complexity

Choice

Compromise

(Adapted from Dieter & Schmidt, Ch1)

3, 6, 3 - What is '*Good Design*' ?

- In class exercise 1

Characteristics of ‘good’ design

- You know it when you see it
- Minimalist — meets requirements in an efficient manner
- Wow factor — leaps out at you
- Robust — failure-resistant
- "Anticipatory" — easily modified to overcome unanticipated problems (this is subtle but important)
- Adaptable ; Expandable & Flexible
- Combines functions to increase efficiency — mounting bracket doubles as heat sink, etc.

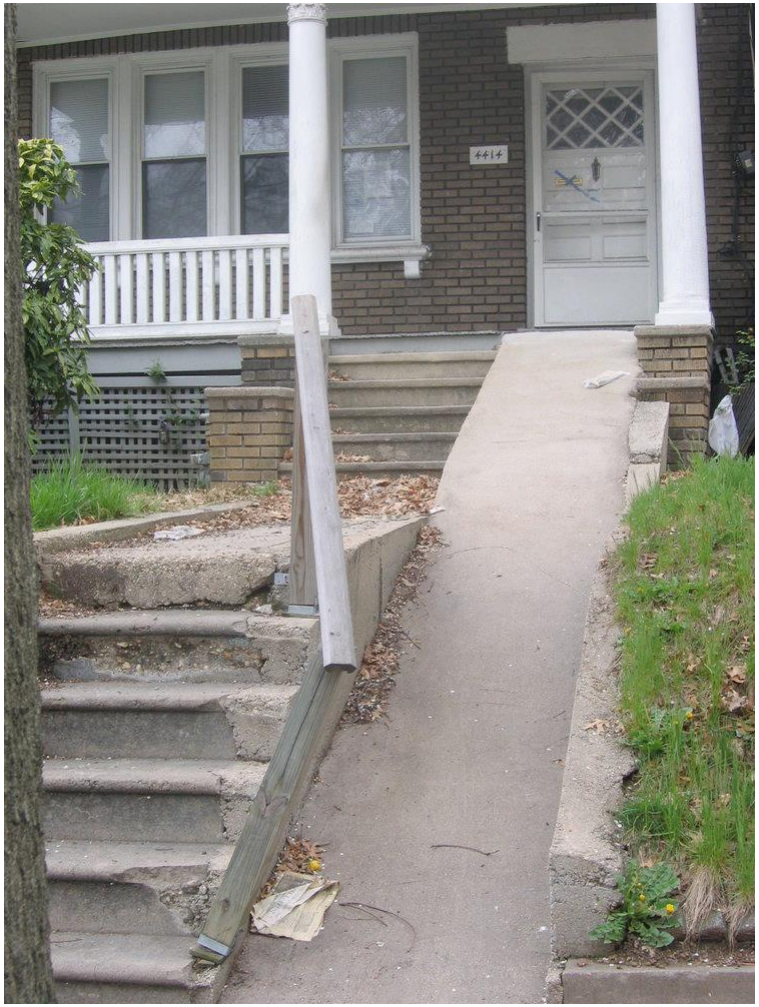
'Bad Design'

- http://www.baddesigns.com/
- **"*A scrapbook of illustrated examples of things that are hard to use because they do not follow human factors principles.*"**

- Definition - 'human factors engineering' – *'...uses the sciences of biomechanics, ergonomics and engineering physchology to assure that the design can be operated efficiently by humans.'*

(Dieter & Schmidt, Ch1, pg 17)

Poor Design examples



Design – Background Viewing

YouTube – Search for the following:

- Dieter Rams
  - ‘Cold War modern’
  - ‘Gestalten’
- Apple Design
  - Jonathan Ive interview
- Historical Engineering
  - Isambard Kingdom Brunel Clarkson
    - Look at Pt3 & Pt4 in particular

In class exercise 2

Conclusion

MEEN 10060 – Lab for Offering 1

- CAD – Starts this Thursday (23rd January)
  - Tutorial at **2pm**
  - 1st of 6 assignments from **3pm – 5pm**
  - Lab finished once assignment is complete and graded by Teaching Assistant.

- NOTE: It may be necessary to re-assign lab offerings due to lab capacity requirements. You will be advised by email if your lab offering has changed.