ARCH 264 – Building Science

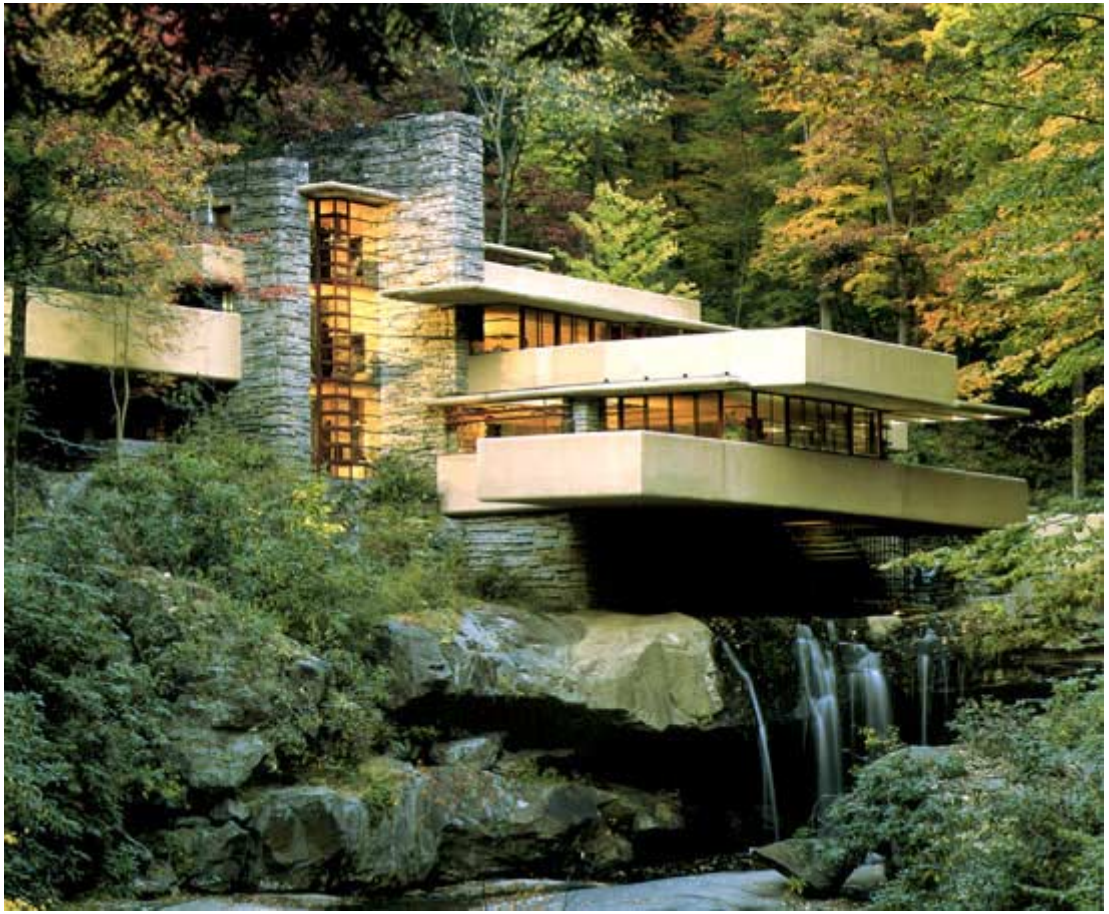
Lecture 1

Why worry about Building Science?

Historical Buildings and Landmarks

Santa Maria del Fiore, Florence

Monticello, Virginia



Falling Water, Pennsylvania

Campo Volantin, Spain

Homes

Utility Buildings

Plastic Garden Shed

Retail Price	$800.00 /unit
Annual sales	x 10,000 units
Revenue	= $8,000,000

Manufacturing Buildings

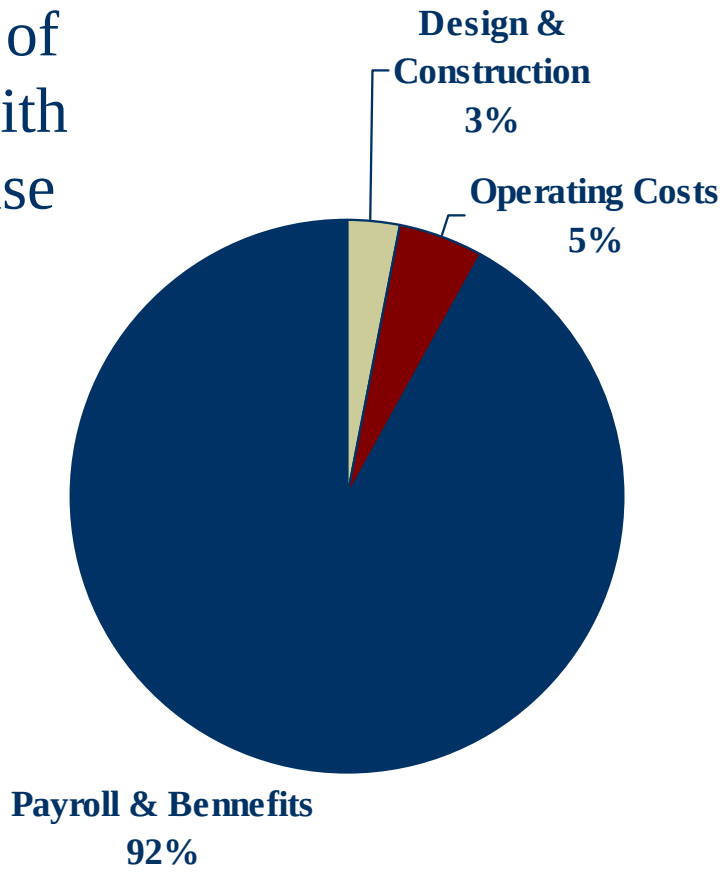
Toyota Assembly Plant, Cambridge

- 2.8 million sq. ft.
- $2.57 billion investment
- 2,800 employees
- $212 million payroll

Production	220,000 units/yr
Retail Value	x $20,000 /unit
Revenue	$4.4 billion

Office Buildings

Net present worth of costs associated with operating a high rise office building



The impact of buildings on Health & Productivity

- Typical North Americans spend 90% of their lives ***in*** buildings
- Building related illnesses account for $60 to $400 Billion of lost productivity in the US
- Lockheed & Boeing
  - Daylighting retrofit results in 15% drop in absenteeism and 15% productivity gain
  - Lighting retrofit results in reduction in defects an improved delivery time

- US post office, Reno
  - Lighting retrofit results in increased sorting speed and accuracy
- VeriFone
  - Building retrofit to add windows, non-toxic materials & improved ventilation system results in 45% decrease in absenteeism
- Wal-Mart's "Eco-Store"
  - Experimental building using conventional lighting in ½ and daylighting in other ½
  - Tracking indicates higher sales on daylit side

Medical costs associated with building related illnesses

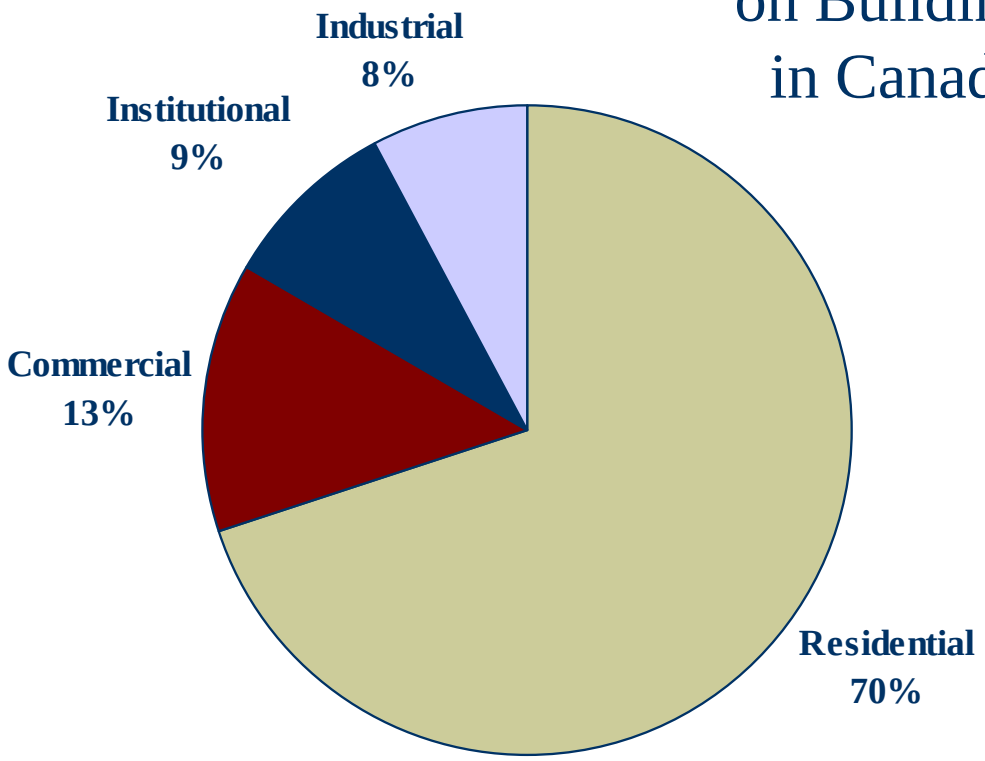
- Indoor Air Quality issues
  - Mould
  - Contaminants
  - Allergies
  - Headaches
  - Asthma

Medical costs associated with building related illnesses

- Cost to society
  - Treatment
  - Disability
  - Retraining

Buildings as Capital Investment

1997 Capital Expenditures on Building Construction in Canada = $55 Billion



Buildings as Capital Investment

Canadian Housing Stock Statistics - 2000	
Total Stock	11,908,049
Owned	7,491,208
Rented	4,416,837
Occupied	11,364,149
Owned	7,184,901
Rented	4,179,253
Vacant	543,896
For Sale	306,310
For Rent	237,586

Buildings as Capital Investment

Survey of Canadian renovation & repairs expenditures for 1999			
Total Expenditures	Total Homeowner Households	% Reporting Expenditures	Average Expenditure
Period of construction	7,516,620	65.2	$1,810
Before 1946	1,073,830	66.5	$2,250
1946-1960	1,067,590	68.6	$1,870
1961-1970	1,044,460	67.3	$1,900
1971-1980	1,686,290	67.9	$1,869
1981-1990	1,407,260	66.7	$1,695
1990 and after	1,082,630	55.1	$1,407
Not stated	154,560	44.4	$966

The impact of Buildings on the Environment

- N.A. construction waste accounts for 15-40% of the total materials sent to landfill

Typical Residential Construction Waste (lbs/sq. ft.)	
Wood	1.3 – 2.1
Drywall	1.0 – 1.2
Cardboard	0.1 – 0.5
Metals	0.02 – 0.13
Other (Plastics, shingles, etc)	0.5 – 1.3
Total	3.0 – 5.2

The impact of Buildings on the Environment

- North American buildings use over 30% of the energy produced – more (per capita) than any other continent
- Reducing building energy use can defer or even eliminate the need to construct additional power stations

Let someone else be the Judge

- ARCH 264 – Building Science
  - "How to make buildings that work" *or*
  - "How to practise architecture and not get sued"
- Approx. 30% of construction projects end up in litigation?
- The majority of these are related to problems with the building envelope and systems
  → Building Science

Summary

- The value of buildings
  - Historical
  - Sentimental
  - Revenue Protection / Generation

Summary

- Buildings represent great capital investment
- Buildings use significant resources & produce large amounts of waste

Summary

- Building deterioration, deficiency and inefficiency
  - Threatens that which we consider valuable
  - Increases resource use and waste production

Website

- University of Waterloo

  Building

  Engineering

  Group

www.civil.uwaterloo.ca/beg