



CE 203 Civil Engineering Synthesis I

Chapter 2

ENGINEERING COSTS AND COST ESTIMATING

Tim Ellis, Ph.D., P.E.

Department of Civil, Construction and Environmental
Engineering

Iowa State University

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Instructional Objectives

- **Be able to define**
 - fixed and variable costs,
 - marginal and average costs,
 - sunk and opportunity costs,
 - recurring and non-recurring costs.
 - Incremental , cash, book, and life-cycle costs
- **Be able to describe the various types of cost estimating (rough, semi-detailed and detailed)**
- **Be able to describe the general cost models**
- **Be able to draw a cash flow diagram**

Engineering Costs

Classifications of costs

- **Fixed - constant, unchanging**
 - Rent, car insurance
- **Variable - depends on activity level**
 - Food
- **Marginal - variable cost for the next unit**
 - Depends on the next unit
- **Average - total cost/number of units**

Fixed, Variable, and Total Costs

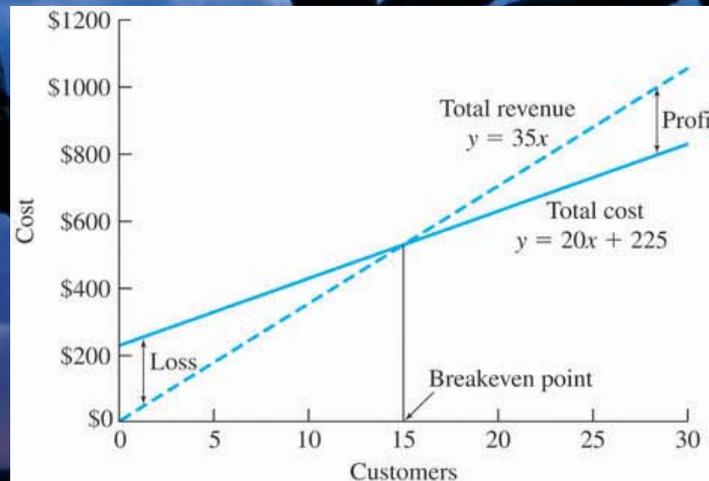
- Example 2-1:



Profit and Loss Terms

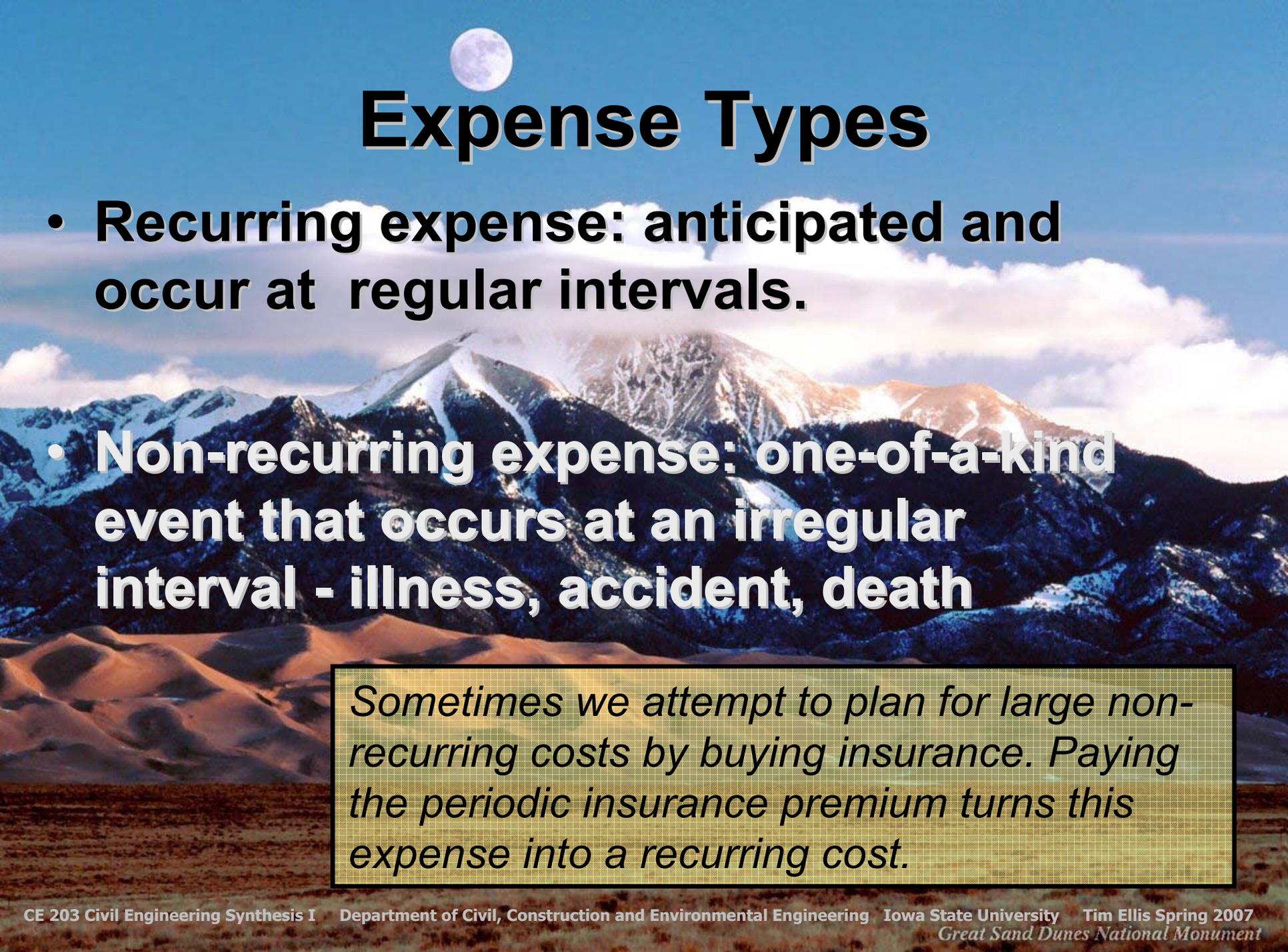
- **Breakeven: total revenue = total costs**
- **Profit region: total revenue > total costs**
- **Loss region: total revenue < total costs**

Example continued



Past (Sunk) Costs and Future (Opportunity) Costs

- **Sunk cost: money spent due to a past decision.**
- **Opportunity cost: a benefit that is foregone by engaging a resource in a chosen activity instead**



Expense Types

- **Recurring expense: anticipated and occur at regular intervals.**
- **Non-recurring expense: one-of-a-kind event that occurs at an irregular interval - illness, accident, death**

Sometimes we attempt to plan for large non-recurring costs by buying insurance. Paying the periodic insurance premium turns this expense into a recurring cost.

Incremental Costs

- An incremental cost is the difference between the costs of two alternatives.

Cash vs. Book Costs

- Cash costs:
 - Payment this month on an auto loan
- Book cost: cost of a past transaction
 - Down payment recorded in your checkbook from last year's automobile purchase

Life-cycle Costs

- **Life-cycle:** time from conception to death of a product (process).
- **Life-cycle costs:** sum total of all the costs incurred during the life cycle.
- **Life-cycle costing:** designing with an understanding of all the costs associated with a product during its life-cycle.

Cost Estimating

- **Economic analysis is future based.**
- **Costs and benefits in the future require estimating.**
- **Estimated costs are not known with certainty.**
- **The more accurate the estimate, the more reliable the decision.**

Types of Estimates

- **Rough: gut level, inaccurate**
 - -30% to +60%.
- **Semi-detailed: based on historical records, reasonably sophisticated and accurate**
 - -15% to +20%.
- **Detailed: based on detailed specifications and cost models, very accurate**
 - -3% to +5%.

Estimating Models

Model	Explanation
Per Unit	Uses a “per unit” factor \$/sq ft, Benefits/employee
Segmenting	Divide problem into items, estimate each & sum
Cost Indexes	Index number based on history
Power Sizing	Scaling previous known costs up or down
Triangulation	Looking at costs from several perspectives
Learning Curve	Tracking cost improvements

Cash Flow Diagrams

- **Summarizes the flow of money over time**
- **Can be represented using a spreadsheet**