Collaborative Engineering

Casting Cost Estimation

- Cost Estimation Methods
- Casting Cost Estimation
- Machining Cost Estimation

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Cost Estimation Methods

History Based
- Use data of previous estimations
- Quick and accurate method
- Can be used for only similar parts

Activity Based
- Estimate resources consumed by activities
- Comprehensive but laborious method
- Suitable for even new products

Parametric Approach
- Develop Cost Estimating Relationships
- Initial model development difficult
- Easy to apply even at design stage

Data for Cost Models

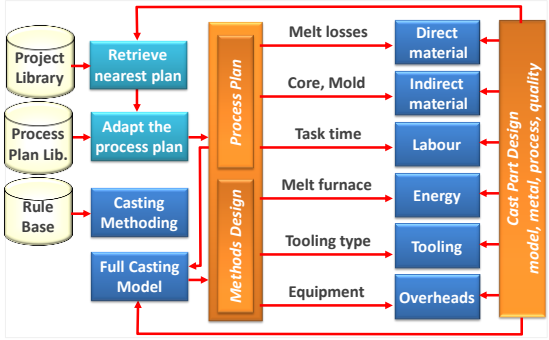
- Standard Cost Data:
  - Material rates (Rs. / kg)
  - Labour rates (Rs. / hour)
  - Energy rates (Rs. / kwh)
- Adjustments for:
  - Inflation (from baseline year)
  - New Technology (ex. efficient process)
- Normalization:
  - Weight (per kg basis)
  - Production rate (per piece basis)

Data Sources
- Accounting records
- Historical databases
- Functional specialist
- Other organizations
- Technical databases
- Contracts / PO's
- Project proposals

Product Cost Elements

Tooling	- Tool material : tooling volume - Tool manufacturing : shape complexity - Amortized based on order quantity
Material	- Direct material : part volume - Indirect material : needed for manufacture
Conversion	- Energy : equipment, process, etc. - Labour : hours per part as per process plan
Overheads	- Equipment, factory, other activities, per part
Modifiers	- Process yield, account for rejections - Material losses and recycling

Casting Cost Estimation



Casting Cost - Tooling

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

Tooling Weight (kg) = 89 Order Quantity (No) = 1000

Tool Material Rate (Rs./kg) = 200

Amortized Tool Cost (Rs.)

= Tooling Weight x Tool Material Rate / Order Quantity

= 89 x 200 / 1000 = 18

Casting Cost Estimation

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

Complexity = 40

Machining Volume (cm^3) = 3000

Machining Rate (Rs./cm^3) = 0.1

Tool Mfg Cost (Rs.)

= Complexity x Machining Rate x Machining Volume

= 40 x 0.1 x 3000 = 12,000

Amortized cost = 12,000 /1000 = 12

Casting Cost Estimation

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

Metal Weight (kg) = 50

Metal Loss (%) = 3

Casting Rejection (%) = 1

Metal Cost Rate (Rs.) = 120

Cost Metal (Rs.)

= Metal Weight x 100/ (100 – Casting Rejection) x 100 / (100 – Metal Loss) x Metal Cost Rate

= 50 x (100 / 99) x (100 / 97) x 120 = 6250

Casting Cost Estimation

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

Mold Material Weight (kg) = 350

Mold Recycling (%) = 80

Casting Rejection (%) = 1

Mold Mat Cost Rate (Rs/kg) = 10

Mold Rejection (%) = 2

Cost Mold Sand (Rs.)

= Mold Material Weight x 100 / (100 – Casting Rejection) x 100 / (100 – Mold Rejection) x (100 – Mold Recycling) / 100 x Mold Mat Cost Rate

= 350 x (100 / 99) x (100 / 98) x (20 / 100) x 10 = 730

Casting Cost Estimation

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

Metal Weight (kg) = 106

Tapping Temperature (°C) = 1640

Latent Heat (kJ/kgK) = 272

Furnace Efficiency (%) = 50

Specific Heat (kJ/kgK) = 0.448

Casting Rejection (%) = 1

Melting Energy (MJ)

= (Metal Weight x (Latent Heat + (Specific Heat x Tapping Temperature)) x 100 / (100 – Furnace Efficiency) x 100 / (100 – Casting Rejection))/1000

= (106 x (272 + (0.448 x 1640)) x 100 / 50 x 100 / 99)

= 215

Casting Cost Estimation

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

Melting Energy (kJ) = 14192

Energy Cost Rate (Rs/kWHr) = 8

Melting Energy Ratio = 2

Total Energy Cost (Rs.)

= Melting Energy x Melting Energy Ratio x Energy Cost Rate / 3600

= 215 x 1000 x 2 x 8 / 3600 = 950

Casting Cost Estimation

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

Pre-CastingTime = 60 hrs CastingTime = 40 hrs PostCastingTime = 50 hrs

Labour Cost Rate(Rs./hr) = 100 Casting Rejection = 1% BatchSize = 50

Labour Cost (Rs.)

= (Pre-CastingTime + CastingTime + Post-CastingTime) * LabourRate / (BatchSize (1 + Casting Rej Factor)

= (60 + 40 + 50) x 100 / 50 x 1.01 = 300

Casting Cost Estimation

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

Weight (kg) = 106 kg Volume (m^3) = 6375 cm^3 Complexity = 1.1
Heat Treatment = Rs 4/kg Rate Inspection = Rs 0.01/cm^3 Casting Class = 1.2

Other Process Cost (Rs.)

= Heat Treatment Cost + Inspection Cost

= Casting Weight x Rate Heat Treatment

+ InspectionRate

= 106 x 4 + 50 = 474

Casting Cost Estimation

TOOLING		MATERIAL		CONVERSION		OTHER	
Material	Mfg.	Direct	Indirect	Energy	Labour	Process	Overhead

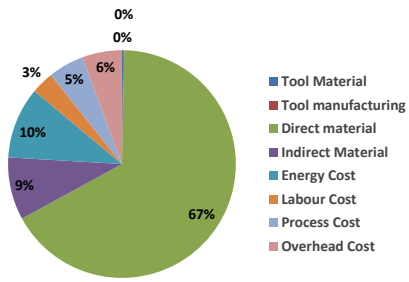
Overhead Cost (Rs.)

= CastingWeight x OverheadRate

= 106 x 5 = 530

Casting Cost Estimation – Total Cost

Total Cost (Rs.) = 9366



SUMMARY

- Correct cost estimation critical for frugal engineering
- Major cost elements: tooling, material, energy, labour
- Role of cost drivers and modifiers